

Project Final Report

Multiple risk behaviours and interventions to reduce multiple risk behaviours – what do we know?

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WHAT THIS STUDY ADDS

1. We conducted three systematic reviews on clustering and co-occurrence of risk behaviours (observational studies), effectiveness of non-pharmacological multiple risk behaviour interventions in the general population (RCTs), and experiences of making multiple risk behaviour changes (qualitative studies).

There are no existing reviews on clustering and co-occurrence of risk behaviours or on experiences of changing multiple risk behaviours. We found reviews of multiple risk behaviour interventions but none were focused on general populations and none included a comprehensive range of behaviours.

In addition, we found no previous reviews that integrated evidence from observational studies, RCTs, and qualitative studies to answer questions of direct relevance to policy makers and provide recommendations for future research in the UK.

2. We used a Social Ecological approach to categorise themes from the synthesis of qualitative studies and then examined the extent to which interventions took into account these themes. This enabled us to identify key gaps in both qualitative and intervention studies based on an established theoretical foundation. We found most intervention and qualitative studies used a Social Cognitive approach which focused on intrapersonal and interpersonal factors impacting on multiple risk behaviours. Most geographical and structural barriers identified in the qualitative literature were not addressed in intervention studies.
3. We also examined the most commonly targeted risk behaviour combinations in intervention studies and assessed whether there was strong evidence that these behaviours co-occurred or clustered. The aim was to aid researchers and policy makers when considering which risk behaviour combinations to target when planning interventions.

ABSTRACT

Introduction

Modifiable risk behaviours such as smoking, excessive alcohol use and unhealthy diet contribute significantly to global rates of disease and mortality. Existing evidence of clustering or co-occurrence of risk behaviours in individuals has increased interest in interventions that target more than one risk behaviour. It is also recognised that risk behaviours are influenced by social and economic contexts, but it is unknown how contextual factors may influence clustering of risk behaviours or individuals' attempts to change risk behaviours. Identification and exploration of the evidence would help to answer key policy questions.

Methods

We conducted three interlinked systematic reviews. Review 1 investigated the clustering and co-occurrence of risk behaviours, and predictors of risk clusters (e.g., gender, occupation) in general adult populations, young adults, students, and older adults in the UK. Review 2 evaluated the effects of non-pharmacological multiple risk behaviour interventions, again in general adult populations. Review 3 identified themes running through the qualitative studies related to contexts for, and perceptions and experiences of making behaviour changes. We also performed a scoping review to map characteristics of multiple risk behaviour interventions conducted worldwide. The three sets of findings from the systematic reviews were brought together to help address key policy questions.

Results

In Review 1, physical inactivity and smoking each co-occurred alongside low fruit and vegetable intake. Among general adult populations, alcohol misuse and low fruit and vegetable intake each clustered with smoking. In young adults, sexual risk behaviours strongly clustered with each of: smoking; alcohol misuse; and drug misuse. Socio-economic status was the strongest and only consistent predictor of risk clusters.

In Review 2, multiple risk behaviour interventions were associated with small improvements in dietary outcomes (e.g., fruit and vegetables intake) and physical activity levels. Evidence for all other behavioural outcomes was inconclusive or demonstrated ineffectiveness of the interventions. Improvements in outcomes attenuated as follow-up time increased. The use of enablement strategies (e.g., providing equipment and materials that could be used at home) alongside more common intervention content (e.g., education and training) was associated with greater effectiveness.

In Review 3, barriers to lifestyle change often related to psychological/physical factors, personal responsibilities, and geographical location and environment. Facilitators to lifestyle change most commonly related to psychological/physical factors and individuals' social networks.

In the integrated overview of the three systematic reviews, for most risk behaviour combinations targeted by interventions (Review 2) there was evidence of clustering (Review 1), although this was found less commonly with interventions that targeted more than two risk behaviours. Education and skills training, both identified as being important in qualitative studies (Review 3), were included in intervention studies (Review 2). Other intrapersonal (e.g., stress and negative emotions/mental states) and interpersonal factors (e.g., women acting as role models to families) discussed in qualitative studies were not adequately addressed by interventions. The greatest gaps in intervention content related to geographical and structural barriers to changing risk behaviours (e.g., access to healthy foods, personal safety, low or unstable income).

Discussion

There is a need for further research to evaluate the specific challenges of changing multiple risk behaviours, this includes qualitative studies to identify relevant barriers and facilitators and intervention studies to address these challenges. In particular, further clarity is needed regarding whether changes to multiple risk behaviours should be made simultaneously or sequentially. Future research should also include the impact of social and environmental factors on multiple risk behaviours; such findings need to be translated into intervention content aimed at reducing health inequalities.

EXECUTIVE SUMMARY

Background/introduction

Modifiable lifestyle risk behaviours such as smoking, excessive alcohol use, physical inactivity, and unhealthy diet contribute significantly to global rates of disease and mortality. Interest has grown in interventions targeting multiple risk behaviours because evidence suggests that risk behaviours often cluster or co-occur within individuals. Also, risk behaviours need to be viewed in the context of characteristics related to the social and economic environment (e.g., employment/income status), because these characteristics influence risk behaviour uptake and persistence, thereby affecting risk of disease and premature death.

A Cochrane review² evaluated the effects of behaviour change interventions on mortality and cardiovascular events but focused more on risk factors (e.g., blood pressure, total cholesterol) than behaviour change. The circumstances in which participants attempted to make lifestyle changes were not reported in detail. These contextual data are rarely reported in systematic reviews but their importance is increasingly being recognised. Systematic reviews of qualitative evidence can help to provide further information on the social and environmental context in which behaviour change is conducted and identify perceived barriers and facilitators.

Studies that report on risk behaviour clusters and predictors of clusters, evaluations of interventions targeting multiple risk behaviours, and contexts for and experiences of making lifestyle changes are vital for increasing our knowledge and understanding of multiple risk behaviours. Attempts to bring this evidence together in a way that is useful to policy makers are currently lacking. Individual sets of studies need to be synthesised and the synthesised evidence brought together to answer key policy questions.³

Aims

We aimed to identify, appraise and bring together research evidence on:

- Clustering and co-occurrence of lifestyle risk behaviours
- Predictors of risk clusters
- Effectiveness of multiple risk behaviour interventions (including consideration of process, outcomes, context, and implementation)
- Contexts for and perceptions/experiences of making lifestyle changes

Design and Methods

Three interlinked systematic reviews were conducted to address the project objectives:

1. A systematic review examining the clustering and co-occurrence of risk behaviours reported in observational studies. This review also examined predictive relationships between socio-demographic variables (e.g., gender, occupation) and risk clusters.
2. A systematic review evaluating the effectiveness of non-pharmacological interventions for reducing multiple risk behaviour interventions, as reported in randomised controlled trials. Overall effects on risk behaviour and weight/body mass index outcomes were considered alongside the influences of process, contextual and implementation characteristics.
3. A systematic review using thematic synthesis to explore the contexts for and perceptions/experiences of making lifestyle changes, as reported by qualitative studies.

Prior to conducting the systematic review of intervention studies we carried out a scoping review to map the characteristics of multiple risk behaviour interventions worldwide. Additionally, the findings from all three systematic reviews were brought together to answer key policy questions.

Main Findings/Conclusions

Summary of findings from the three systematic reviews

Starting with the systematic review of observational studies, the co-occurrence data showed a particularly high prevalence for the risk behaviour combination of low fruit and vegetable intake and low physical activity. Low fruit and vegetable intake concurrent with smoking also had a high prevalence. Most studies examined the association between alcohol misuse and smoking and found consistent evidence of clustering among adults. Additionally, low fruit and vegetable intake and smoking appeared to cluster. Among young adults, there was consistent and strong evidence of sexual risk behaviour clustering with smoking. There was also consistent evidence of clustering between sexual risk behaviour and alcohol misuse, and sexual risk behaviour and drug misuse. Socio-economic status (occupational group and educational status) was found to be the strongest and

most consistent factor associated with engaging in multiple risk behaviours. Evidence on the impact of gender and age on multiple risk behaviours was inconsistent.

The systematic review of intervention studies found that non-pharmacological interventions for multiple risk behaviours were associated with small improvements in diet outcomes (e.g., intervention participants on average ate 0.33 more portions of fruit and vegetables post-intervention compared with controls), and physical activity levels, but were not effective in reducing smoking. Evidence for effectiveness in reducing all other risk behaviours (e.g., alcohol misuse, sexual risk behaviour, drug misuse) was inconclusive. In terms of secondary outcomes, small reductions in weight and BMI were found (e.g., intervention participants on average reduced their weight by 0.85Kg compared with controls). Improvements in fruit and vegetable intake attenuated as follow up time increased. The use of enablement strategies alongside more commonly implemented intervention content (education and training) was associated with greater effectiveness.

The systematic review of qualitative studies found that most data related to factors at the intrapersonal (microsystem) and interpersonal (mesosystem) levels. Seven key themes (each with several subthemes) emerged from the review and generally, more barriers than facilitators to a healthy lifestyle were reported. Often barriers related to psychological/physical factors (e.g., stress, negative emotions and mental states, knowledge deficits), personal responsibilities (e.g., competing time demands), and geographical location and environment (e.g., access to healthy foods). Facilitators most commonly related to psychological/physical factors (e.g., perceived benefits of healthy behaviours) and social network (e.g., support from family and/or friends). These findings mostly related to diet and physical activity, although smoking and/or alcohol use were also discussed.

Summary of integrating findings from the three systematic reviews

The focus of integrating data from our three systematic reviews was, firstly to examine which risk behaviour combinations were targeted in intervention studies and then to examine the evidence for clustering and co-occurrence for these combinations based on the observational literature we reviewed. We also examined the extent to which the barriers and facilitators identified in our review of qualitative studies were addressed by the intervention studies included in our review.

For most risk behaviour combinations targeted in intervention studies there was evidence of clustering or co-occurrence (e.g., smoking and diet, alcohol and smoking, sexual risk and substance misuse). However, there were examples where studies targeting more than two risk behaviours included combinations of behaviours where there was no evidence of clustering or co-occurrence.

Most of the intrapersonal factors discussed by qualitative studies (e.g., knowledge and awareness about risk behaviours and disease, perceived benefits of behaviour change) were addressed in the educational content of intervention studies. However some intrapersonal factors (e.g., the role of negative emotions and stress) and interpersonal factors (e.g., women needing to act as a role model for their family) were not addressed adequately by intervention studies.

Perhaps the greatest gap in intervention content related to geographical (e.g., access to healthy foods, influence of the local environment on smoking and alcohol use, personal safety, weather) and structural barriers (e.g., influence of low or unstable income) to changing multiple risk behaviours. A potential explanation for this gap is that most intervention studies (subsection 2.3.2) and qualitative studies (subsection 2.3.3) had social cognitive theoretical foundations that emphasised intrapersonal and interpersonal factors.

Implications for future action in the UK context

Based on the three systematic reviews and the comparative synthesis we conducted, the following implications emerged from our findings:

- **Challenges of changing multiple risk behaviours:**
Many of the identified themes from qualitative studies concerned changing a single behaviour or behaviour in general. Further qualitative research is needed on the specific challenges of attempting to change multiple risk behaviours.
- **Multiple versus single behaviour change:**
Despite the plethora of research on multiple and single risk behaviour interventions it is inconclusive which approach is more effective as only one study in our review directly addressed this question. This is a key question for informing the best strategy for reducing risk behaviours.
- **Approaches to behaviour change:**
Most studies have evaluated educational approaches (often combined with skills training) which resulted in small reductions in risk behaviours. The focus on education and training meant that geographical and structural barriers to behaviour change were not addressed in most intervention studies
- **Clustering and co-occurrence of risk behaviours:**
Most of the observational studies investigated the clustering or co-occurrence of two risk behaviours. There was a lack of studies investigating the clustering and co-occurrence of three or more behaviours. In addition, there was a lack of data on the predictors of engaging in multiple risk behaviours.
- **Health inequalities:**
Socio-economic status was found to be the key predictor of engaging in multiple risk behaviours in our review of observational studies. However, there was insufficient data to conclude whether interventions were effective for people of low socio-economic status.
- **Further UK studies:**
There was a lack of UK intervention (n=5) and qualitative (n=4) studies. Therefore the results of our included UK studies were inconclusive.

1 INTRODUCTION/BACKGROUND

Modifiable lifestyle risk behaviours such as smoking, excessive alcohol use, physical inactivity, and unhealthy diet contribute significantly to the global burden of disease.⁴ In 2008, 36 million deaths (63% of all deaths worldwide) were attributed to diseases such as cancers, cardiovascular diseases, diabetes, and chronic respiratory diseases.⁵ Interventions to change risk behaviours have huge potential to alter current patterns of disease,⁶ however a large number of interventions targeting individual risk behaviours have failed to consistently achieve positive behavioural outcomes. Interest has grown in interventions that target multiple risk behaviours because they seem to be an efficient way of changing people's lifestyles⁷ and may lead to greater health benefits and reduction of health care costs.⁸ A growing evidence base suggests that risk behaviours often cluster or co-occur within individuals.⁹⁻¹⁴ Co-occurrence refers to concurrent (but independent) engagement in two or more risk behaviours; clustering refers to underlying associations between co-occurring risk behaviours.¹

Risk behaviours also need to be viewed in the context of the social and economic environment.^{15, 16} For example, living in a neighbourhood perceived to be unsafe has been reported as a barrier to regular physical activity,¹⁷ thereby limiting potential for effectiveness of exercise promotion strategies. Studies in high-income countries (e.g., UK, Republic of Ireland) have explored which psychological and socioeconomic factors may predict clustering of risk behaviours, and clusters have been especially identified in less advantaged groups (e.g., lower social class households, non-homeowners, the economically inactive).⁹⁻¹¹ Risk conditions (e.g., poor working environments, crowded housing) also tend to cluster and accumulate over time in less advantaged groups.¹⁸ It is important to consider the extent to which these conditions may interact with risk behaviours to increase or decrease risks of disease and/or premature death.

Recent NICE guidance¹⁹ reports a lack of evidence with which to identify the most effective approach for dealing with multiple risk behaviours. However, interventions that target more than one risk behaviour have been implemented and a systematic review² evaluating the effects of interventions (including education or counselling) to modify more than one risk factor is available. The authors reported a reduction in smoking prevalence (the only risk behaviour analysed), but no overall reduction in mortality. The studies were carried out across different countries and times and were likely implemented in varying social and economic contexts. Also, many of the interventions were individual- or family- focused and may not have considered the circumstances in which participants attempted lifestyle changes. These contextual data are rarely reported in systematic reviews but their importance is increasingly being recognised.^{20, 21} Systematic reviews of qualitative evidence can help to fill gaps in contextual knowledge, by collecting information from qualitative studies linked to quantitative evaluations or from studies exploring wider contexts surrounding risk behaviour change (e.g., perceptions/experiences of the behaviour change process, perceived barriers and facilitators).

There is an expanding evidence base on multiple risk behaviours with studies i) investigating risk behaviour clusters and predictors of clusters, ii) evaluating interventions targeting behaviour change, and iii) exploring contexts for and experiences of changing behaviours. The research evidence needs to be brought together, synthesised and interpreted to increase our knowledge and understanding of how to effectively intervene to change unhealthy behaviours. This can be achieved by synthesising individual sets of studies and then drawing together and interpreting findings from the synthesised evidence to answer questions of direct relevance to policy makers.³

2 PURPOSE OF THE PROJECT

Project aims:

We aimed to identify, appraise and synthesise evidence on:

- Clustering and co-occurrence of lifestyle risk behaviours
- Predictors of risk clusters
- The effectiveness of multiple risk behaviour interventions (including consideration of process, outcomes, context, and implementation)
- Contexts for and perceptions/experiences of making lifestyle changes

Project objectives:

1. To identify which lifestyle risk behaviours cluster or co-occur
2. To identify predictors of risk clusters
3. To identify and map existing multiple risk behaviour interventions
4. To evaluate the effectiveness of multiple risk behaviour interventions and to explore the content and context to better understand how, when and for whom they work

5. To investigate the contexts for and perceptions/experiences of making multiple lifestyle changes
6. To synthesise the findings from the individual systematic reviews in an overall comparative synthesis, allowing key policy questions to be answered.

Objectives 1 and 2 are addressed through a systematic review examining the co-occurrence and clustering of risk behaviours reported in observational studies (subsection 3.1); objective 3 is addressed through a scoping review (summarised in Appendix 9); objective 4 is addressed through a systematic review evaluating the effectiveness of multiple risk behaviour interventions (subsection 3.2); objective 5 is addressed through a systematic review of qualitative studies examining people's perceptions and experiences of making lifestyle changes (subsection 3.3); and objective 6 is addressed by a comparative synthesis drawing together and interpreting findings from the three systematic reviews (subsection 3.4).

3 DESIGN, METHODS AND FINDINGS

3.1 Review 1 - Clustering and co-occurrence of risk behaviours

3.1.1 Design and methods

The systematic review methods are described briefly below; full details are provided in the protocol (Appendix 1).

Box 1. Definitions for Review 1

Mapping exercise: An exercise performed to record characteristics of studies on a given topic. Characteristics recorded might include study design, country, population, outcomes, etc. The purpose is to increase understanding of the evidence base; it is particularly useful where a large volume of literature is available. Also called a scoping review.

Co-occurrence of risk behaviours: Concurrent engagement in two or more risk behaviours where the risk behaviours co-occur independently. This is assessed in two main ways: prevalence of specific risk behaviour combinations or prevalence of risk indices which sum the number of risk behaviours.¹

Clustering of risk behaviours: Concurrent engagement in two or more risk behaviours where associations exist between the co-occurring risk behaviours. This is assessed using standard statistical techniques for identifying associations (e.g. logistic regression, prevalence odds ratios) or more advanced techniques that identify clusters based on patterns of response to multiple items (e.g. latent class analysis, cluster analysis).¹

Risk behaviour threshold: A threshold used to define a health-related behaviour as being risky or hazardous to health, e.g., eating fewer than five portions of fruits and vegetables per day.

Eligibility criteria

We used an iterative approach for determining inclusion criteria. Firstly, a mapping exercise was carried out to determine the scope and size of the multiple risk behaviour literature before deciding on the inclusion criteria (see Appendix 2 for further details).

Based on the findings of the mapping exercise, we restricted the review to UK studies. This was to make the review feasible within available resources and because our primary aim was to inform public health policy in the UK. Mapping confirmed that restricting the review in this way did not limit the range of risk behaviours or predictors of risk clusters investigated.

The full inclusion criteria were:

Population: Non-clinical UK populations (aged 16 years or older).

Outcomes: Studies examining co-occurrence and/or clustering between two or more risk behaviours were eligible. We took an inclusive approach on which behaviours to include; this was to avoid identifying only predetermined clustering and co-occurrence of behaviours. We did not impose specific thresholds for risk behaviours but included studies where thresholds for risk behaviours were reported and justified.

Study design: Any quantitative study was eligible for inclusion.

Information sources

Four electronic databases (MEDLINE, EMBASE, PsycINFO, and Science Citation Index) were searched from January 1990 to December 2011/January 2012 with no language restrictions (see Appendix 3 for full search strategy). 1990 was selected as the start date as preliminary searches showed that most of the multiple risk behaviour literature is both time- and context-dependent.

Selection of studies and data collection process

Final selection of studies was conducted by one reviewer and checked by a second according to the inclusion criteria. Data extraction and quality assessment were conducted by one reviewer and checked by another.

We developed a data extraction template (Appendix 4) which we piloted on five studies to ensure consistency across the reviewers' ratings. Data from multiple publications of the same study (or dataset) were extracted and reported as a single study.

For co-occurrence data we extracted the proportion of two or more behaviours (either specific behaviour combinations or risk indices) and their 95% confidence intervals. For clustering data we extracted prevalence odds ratios (POR) and odds ratios (OR) from studies with their standard errors (SE) where these were reported. Where prevalence odds ratios were not reported in a study, but there were sufficient data to calculate these along with their standard errors, these were calculated and entered into Review Manager with the other prevalence odds ratios. For factors associated with multiple risk behaviours, odds ratios and their associated standard errors were extracted from studies.

Risk of bias in individual studies

We piloted the University of Wales College of Medicine tool²² for the critical appraisal of observational studies on five studies before using on all studies in the review. Adjustment for confounding was assessed for age, gender, socio-economic status, marital status, and ethnicity. Each of these factors was included as a potential predictor of multiple risk behaviours in our review (when the association between a particular factor and multiple risk behaviours was assessed we examined whether these other factors were adjusted for in the analysis).

Syntheses of results

The included studies were diverse in their design, settings, targeted behaviours, and methods of analysis. We decided that a narrative synthesis was the most appropriate approach after examination of the data suggested substantial conceptual and statistical heterogeneity. For example, outcome definitions for alcohol use and diet varied between studies, and high I^2 values were shown in most comparisons. Studies were grouped based on population characteristics (e.g.,

students, older adults) and whether studies aimed to examine co-occurrence or clustering of risk behaviours.

We constructed forest plots to graphically explore patterns of similarity or difference across the studies' findings. Log odds ratios and log prevalence odds ratios, each with their standard errors, were entered separately into Review Manager 5. Proportions with their standard errors were entered into STATA 12.

3.1.2 Findings

Our search identified 86,576 records from which 30 studies (27 cross-sectional studies, three prospective cohort studies) were included in the review (Figure 1). The main reason for study exclusion was a lack of investigation of co-occurrence or clustering between risk behaviours.

Study characteristics are presented in Table 1. Studies were mostly on general adult populations; a small proportion of the studies focused on young adults, students and older adults. Behaviours investigated were: alcohol misuse; smoking; physical inactivity; unhealthy diet (low fruit and vegetable intake, high fat intake, high calorie intake); illicit drug use; sexual risk behaviour; lack of seat belt use; lack of motorcycle or bicycle helmet use; lack of sunscreen use; gambling; poor oral hygiene; and drink driving.

Seven studies included only two risk behaviours, 12 studies included three risk behaviours and 11 studies included more than three risk behaviours. Figure 2 shows the most common combinations of risk behaviours investigated: alcohol and smoking (11 studies), physical activity and smoking (11 studies), and diet and smoking (10 studies). Risk behaviour combinations investigated appeared to some extent to depend on the target population.

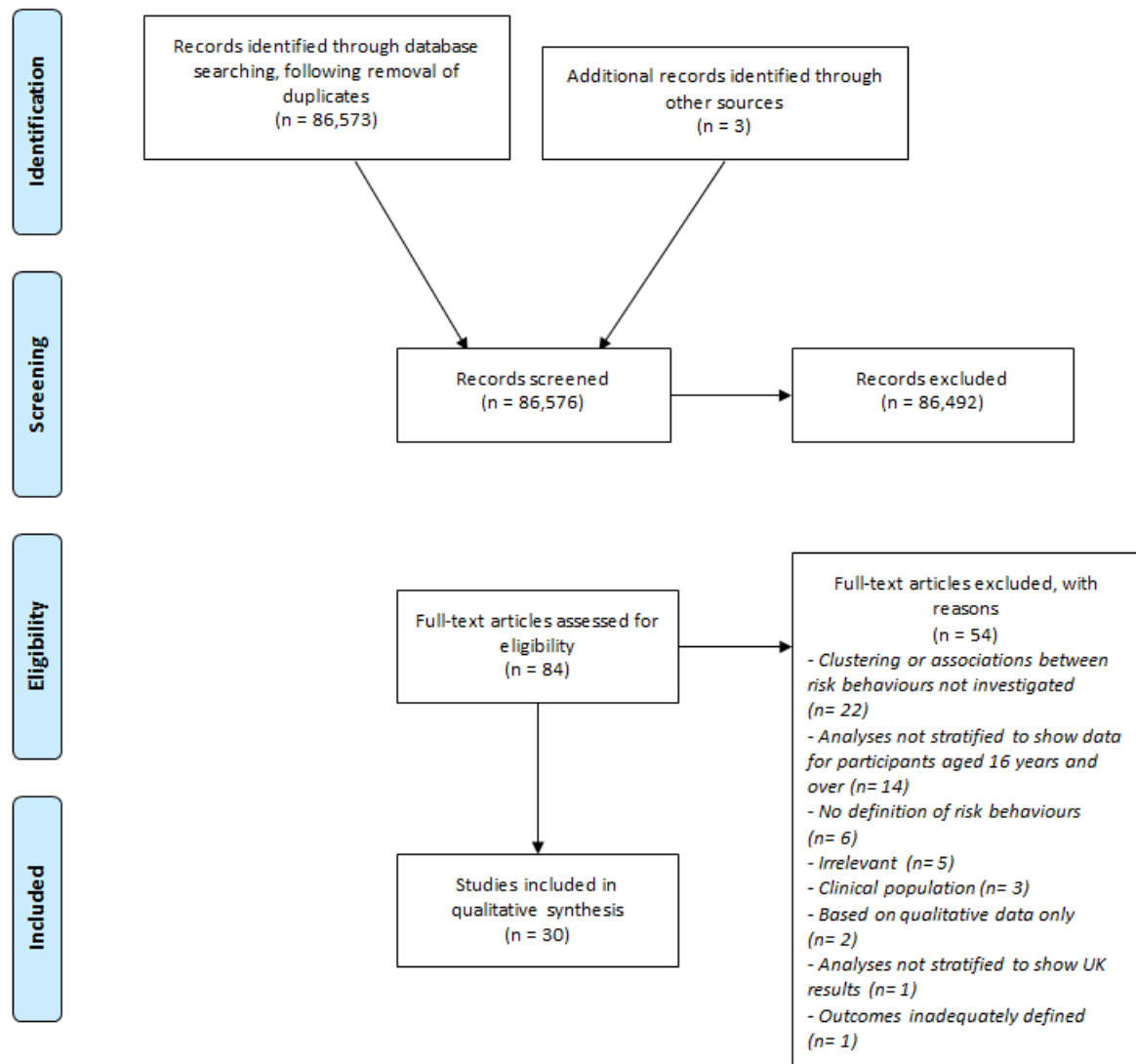


Figure 1. The review process

Table 1. Study characteristics of the included studies (30 in total)

Author/s (date of publication), location	Study population	Study Design	Date of data collection (and name of survey if available)	Risk behaviours investigated	Predictors of multiple risk behaviours investigated	Clustering or co-occurrence investigated
General adult population (study did not restrict inclusion criteria to specific at risk or age groups)						
Aicken <i>et al.</i> (2011) ²³ England, Scotland, Wales,	General population (N=24,296)	Cross-sectional	NATSAL 1: 1990-1991 NATSAL 2: 2000-2001	Alcohol misuse, sexual risk behaviour	-	Clustering
Buck & Frosini (2012) ¹⁴ England	General population (N=14,912)	Cross-sectional	HSE 2003 and 2008	Alcohol misuse, smoking, low levels of fruit and vegetable intake, low level of physical activity	Gender, age, occupational group, education, employment status	-
Griffiths <i>et al.</i> (2010, 2011) ^{24, 25} England, Scotland, Wales	General population (N=9,003)	Cross-sectional	British Gambling Prevalence Survey 2007	Alcohol misuse, gambling, smoking	-	Co-occurrence and clustering
Lawder <i>et al.</i> (2010) ¹⁰ Scotland	General population (N=6,574)	Cross-sectional	Scottish Health Survey 2003	Alcohol misuse, low level of physical activity/exercise, low level of fruit and vegetable intake, smoking	Gender, age, occupational group, deprivation of geographical area, education, employment status, ethnicity, marital status	Co-occurrence and clustering
Liao <i>et al.</i> (1995) ²⁶ England	45-year old women (N=106)	Cross-sectional	1991-1992	Alcohol misuse, low level of physical activity/exercise, smoking	-	Clustering
Plant <i>et al.</i> (2002) ²⁷ England, Scotland, and Wales	General population (N=2,027)	Cross-sectional	2000	Alcohol misuse, illicit drug misuse, smoking	-	Clustering
Poortinga (2007) ⁹ England	General population (N=11,492)	Cross-sectional	HSE 2003	Alcohol misuse, low level of physical activity/exercise, low level of fruit and vegetable intake, smoking	Gender, age, occupational group, education, employment status	Co-occurrence and clustering
Sabia <i>et al.</i> (2009) ²⁸ England	General population (N=5,123)	Prospective Cohort	Whitehall II study 1985-1988	Alcohol misuse, low level of physical activity/exercise, low level of fruit and vegetable intake, smoking	Age, gender, employment grade	-
Tang <i>et al.</i> (1997) ²⁹ England	General population (N=8,109)	Cross-sectional	OXCHECK 1989-1993	Alcohol misuse, other dietary intake, smoking	-	Clustering
Thompson <i>et al.</i> (1999) ³⁰ England	General population (N=5,553)	Cross-sectional	Health and Lifestyle Survey 1993	Low level of fruit and vegetable intake, smoking	-	Clustering

Thornton <i>et al.</i> (1994) ³¹ England, Scotland, and Wales Thompson & Warburton, (1992) ³² were the secondary reference here	General population (N=9,003)	Cross-sectional	Health and Lifestyle Survey 1987	Alcohol misuse, low level of physical activity/exercise, low level of fruit and vegetable intake, other dietary intake, smoking	-	Co-occurrence
Uitenbroek (1993) ³³ Scotland	General population (N=5,471)	Cross-sectional	1991	Alcohol misuse, low level of physical activity/exercise, other dietary intake, sexual risk behaviour, lack of seat belt use, smoking	-	Co-occurrence and Clustering
Uitenbroek (1994) ³⁴ England, Scotland	General population (N=7,717)	Cross-sectional	1990	Alcohol misuse, low level of physical activity/exercise, sexual risk behaviour, lack of seat belt use, drink driving, smoking	-	Co-occurrence
Underwood <i>et al.</i> (2007) ³⁵ UK	Vocational dental practitioners (N=767)	Cross-sectional	2005	Alcohol misuse, illicit drug misuse, smoking	-	Co-occurrence and Clustering
Wadsworth <i>et al.</i> (2004 a, b) ^{36, 37} Wales	General population (N=7,979)	Cross-sectional	2001	Alcohol misuse, illicit drug misuse, smoking	-	Co-occurrence and Clustering
Woodward <i>et al.</i> (1994) ³⁸ Scotland	General population (N=9,491)	Cross-sectional	Scottish Heart Health Study 1984-1986	Alcohol misuse, low level of physical activity/exercise, other dietary intake, smoking	-	Co-occurrence
Young adults (study inclusion criteria restricted to ages 16-21 years)						
Egginton <i>et al.</i> (2002) ³⁹ England	Young adults (N=815)	Cross-sectional	Northern Regional Longitudinal Study 2000	Alcohol misuse, illicit drug misuse, smoking	-	Co-occurrence
Jackson <i>et al.</i> (2012) ⁴⁰ Scotland	Young adults (Earlier cohort: N=908; later cohort: N=1258)	Prospective Cohort	Twenty-07 Study: Health in the community (Earlier cohort): 1990 11-16/16+ Study: Young People's Health (Later cohort): 2003	Alcohol misuse, illicit drug misuse, sexual risk behaviour, smoking	Socio-economic status	Clustering
McAloney <i>et al.</i> (2010) ⁴¹	Young adults (N=1,132)	Prospective Cohort	Belfast Youth	Illicit drug misuse, sexual	-	Clustering

Northern Ireland			Development Study	risk behaviour, smoking		
Parkes <i>et al.</i> (2007) ⁴² Scotland	Young adults (N=1,322)	Cross-sectional	1996-1999	Alcohol misuse, illicit drug misuse, sexual risk behaviour, smoking	-	Clustering
Sutherland & Willner (1998) ⁴³ England	Young adults (N=540)	Cross-sectional	1997	Alcohol misuse, illicit drug misuse, smoking	-	Co-occurrence
Student populations (study inclusion criteria restricted to undergraduate students)						
Balabanis (2002) ⁴⁴ England	Students (N=196)	Cross-sectional	Not reported	Alcohol misuse, gambling, smoking	-	Clustering
Dodd <i>et al.</i> (2010) ⁴⁵ England	Students (N=410)	Cross-sectional	2008	Alcohol misuse, low level of physical activity/exercise, low level of fruit and vegetable intake, smoking	Gender, age, ethnicity	Clustering
Underwood <i>et al.</i> (2010) ⁴⁶ England	Dental Students (N=258)	Cross-sectional	2008	Illicit drug misuse, smoking	-	Clustering
Older adult populations (study inclusion criteria restricted to ages 50 years and over)						
Shankar <i>et al.</i> (2010) ⁴⁷ England	Adults aged ≥50 years (N=11,214)	Cross-sectional	ELSA 2002-2003	Alcohol misuse, low level of physical activity/exercise, smoking	Education, subjective social status, income	Co-occurrence and Clustering
At-risk populations (study inclusion criteria restricted to specific groups at greater risk of engaging in multiple risk behaviours)						
Bolding <i>et al.</i> (2006) ⁴⁸ England	Homosexual men (N=1,307)	Cross-sectional	2002-2005	Illicit drug misuse, sexual risk behaviour	-	Co-occurrence
Fear <i>et al.</i> (2007) ⁴⁹ UK	UK Armed Forces (N=8,686)	Cross-sectional	2003	Alcohol misuse, smoking	-	Clustering
Plant <i>et al.</i> (1990) ⁵⁰ Scotland	Sex workers (N=205)	Cross-sectional	1988-1989	Alcohol misuse, sexual risk behaviour	-	Clustering
Singleton <i>et al.</i> (2003) ⁵¹ England, Wales	Prisoners (N=3,563)	Cross-sectional	Psychiatric Morbidity among Prisoners Survey 1998	Alcohol misuse, illicit drug misuse, smoking	-	Co-occurrence
Thomas <i>et al.</i> (1990) ⁵² Scotland	Clients (mainly male) of sex workers (N=209)	Cross-sectional	1988-1989	Alcohol misuse, illicit drug misuse, sexual risk behaviour, smoking	-	Co-occurrence

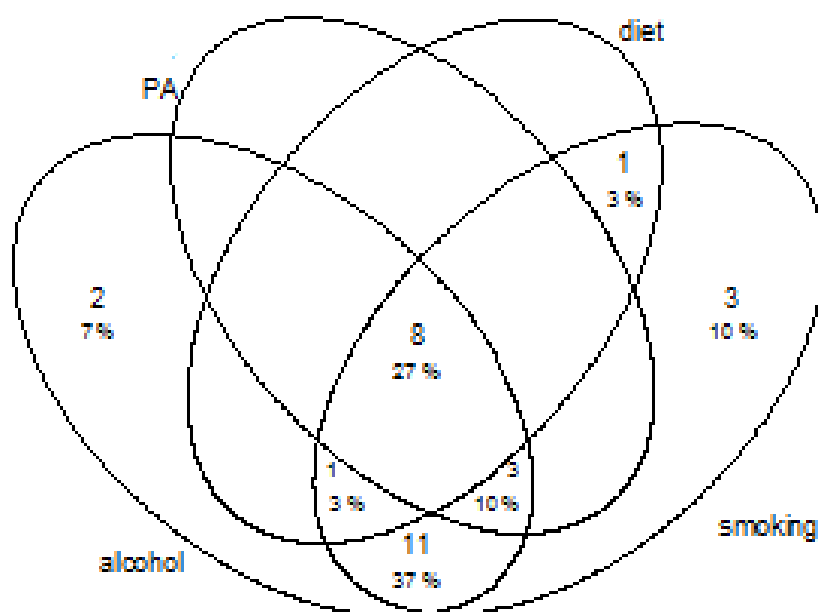


Figure 2. Venn diagram illustrating the combinations of risk behaviours examined in included studies for all populations. The numbers not representing a proportion (%) represent the total number of studies studying that behaviour combination.

Studies in general adult populations most commonly investigated alcohol use and smoking (seven studies), and physical inactivity and smoking (six studies). Almost all studies on young adults examined sexual risk behaviour combined with substance use: alcohol use (two studies, three datasets), illicit drug use (three studies, four datasets), or smoking (three studies, four datasets).

Risk of bias within studies

The main limitations of included studies were: 1) lack of prospective cohort studies examining clustering and co-occurrence of risk behaviours and factors associated with clustering and co-occurrence; and 2) the varying thresholds of risk behaviours. Appendix 5 provides an example of varying thresholds in relation to alcohol misuse. Together, these limitations make it more difficult to compare studies, and likely contribute to the observed heterogeneity in most of the data. The quality assessment results are reported fully in Appendix 6.

Co-occurrence results

Table 2 summarises the co-occurrence and clustering findings. Forest plots representing these data are presented in Appendix 7. Fifteen studies provided data on co-occurrence across general adult populations (nine studies), young adults (two studies), students (one study), older adults (one study), and at risk populations (two studies). A small number of studies with large sample sizes provided data on co-occurrence of the risk behaviours (Table 2).

For general adult populations, the highest prevalence (range 47-54%) for two risk behaviours was for low fruit and vegetable intake and low physical activity. This was based on two studies that included over 18,000 participants.^{9,10} Co-occurrence of low fruit and vegetable intake and smoking was also high (range 23-38%; three studies; more than 27,000 participants).^{9,10,31} These high levels of co-occurrence partly reflect the very high prevalence of these behaviours in the UK populations. For example, in Poortinga's study⁸ 79% of men had low fruit and vegetable intake, 59% were physically inactive, and 29% smoked.

It was not possible to draw conclusions about which behaviours were more likely to co-occur for young adults, older adults, students, and at risk populations due to a lack of studies.

Clustering results

Twenty studies provided data on clustering of risk behaviours in general adult populations (11 studies), students (two studies), young adults (three studies, four datasets), older adults (one study), and at risk populations (groups specifically targeted as being more likely to be engaging in risk behaviours than the general population; three studies). For most risk behaviours, there were few studies but their sample sizes were often large (>1,000 participants).

For general adult populations, the strongest evidence for clustering was found for alcohol misuse and smoking. A relatively large effect (PORs ranged from 1.81 to 2.89 and ORs ranged from 1.55 to 2.44) in the general adult population was found indicating consistent associations between smoking and alcohol use. This was based on three studies with a combined total of more than 20,000 participants.^{9, 10, 36}

For young adults, the strongest evidence for clustering was sexual risk behaviour and substance use. There was consistent evidence of a relatively moderate to strong association (ORs ranged from 1.38 to 3.22) between sexual risk behaviour and alcohol use based on two studies/three datasets with a combined total exceeding 3,000 participants.^{40, 42} Similar findings (ORs ranged from 1.71 to 4.71) were observed for sexual risk behaviour and illicit drug use (three studies/four datasets, combined total exceeding 4,000 participants),⁴⁰⁻⁴² and sexual risk behaviour and smoking (ORs ranged from 1.71 to 2.11) (three studies/four datasets, combined total exceeding 4,000 participants).⁴⁰⁻⁴²

It was not possible to draw conclusions concerning behaviours that cluster in older adults, students, and at risk populations due to a lack of studies.

Table 2. Summary table of co-occurrence, prevalence odds ratios and logistic regression analyses for combinations of two risk behaviours

Risk Behaviour combinations	Co-occurrence (prevalence range between studies)			Prevalence Odds Ratio (range between studies)			Odds Ratio from logistic regression analyses (range between studies)		
	Adults (16 years+)	Young adults (16-21 years)	Older adults (50 years +)	Adults (16 years+)	Young adults (16-21 years)	Older adults (50 years +)	Adults (16 years+)	Young adults (16-21 years)	Older adults (50 years +)
Low fruit and vegetables and low physical activity (2 studies)	47-54% 2 studies N = 18,066	-	-	1.19-1.67 2 studies N =18,066	-	-	-	-	-
Alcohol misuse and smoking (10 studies)	9-14% 3 studies N =26,045	13% 1 study N=815	3% 1 study N=11,214	1.81-2.89 3 studies N =26,045	-	1.32 1 study N=11,214	1.55-2.44 3 studies N=24,777	-	-
Low fruit and vegetables and Alcohol misuse (2 studies)	13-26% 2 studies N=18,066	-	-	1.09-1.63 2 studies N=18,066	-	-	-	-	-
Low Fruit and vegetables and Smoking (3 studies)	23-28% 3 studies N=27,048	-	-	2.02-2.55 2 studies N=18,066	-	-	1.77 1 study N=5,553	-	-
Physical activity and alcohol misuse (4 studies)	4-12% 3 studies N=23,537	-	3% 1 study N=11,214	0.65-0.79 2 studies N=18,066	-	0.58 1 study N=11,214	-	-	-
Physical activity and smoking (6 studies)	8-20% 5 studies N=42,010	-	7% 1 study N=11,214	0.81-1.01 2 studies N=18,066	-	1.16 1 study N=11,214	-	-	-
Sexual risk and alcohol misuse (4 studies and 6 datasets)	-	-	-	-	-	-	1.81-2.77 1 study/2 datasets N=24,926	1.38-3.22 2 studies/3 datasets N=3,119	-
Sexual risk and illicit drug use (3 studies and 4 datasets)	-	-	-	-	-	-	1.71-4.71 3 studies/4 datasets N=4,251	-	-
Sexual risk and smoking (3 studies and 4 datasets)	-	-	-	-	-	-	1.71-2.11 3 studies/4 datasets N=4,251	-	-

Factors associated with multiple risk behaviours

Seven studies (eight datasets) assessed factors associated with multiple risk behaviours. Four studies – three cross-sectional^{9, 10, 14} and one cohort study²⁸ – used an index of risk behaviours (e.g., any of two, three, or four risk behaviours) in general adult populations. One study used an index of risk behaviours in an older adult population.⁴⁷ One cross-sectional study⁴⁵ used cluster analytic techniques and examined factors associated with these clusters in a student population. One paper⁴⁰ reported on two cohort studies in young adults. In each study the analyses were stratified analyses by manual and non-manual occupations for clustering between sexual risk behaviour and substance use (smoking, excessive drinking, and illicit drug use).

It was unclear if two studies adjusted for potential confounding.^{9, 14} Lawder et al¹⁰ examined each of the potential factors associated with multiple risk behaviours adjusting for all other potential factors considered in their study (i.e. sex, age, deprivation, education, economic activity status, occupational social class). Shankar et al.⁴⁷ adjusted all analyses for age, gender, marital status, and limiting long-standing illness. Dodd et al.⁴⁵ did not adjust for potential confounding. Finally, for data relevant to our review, Sabia et al.²⁸ did not provide any adjustment for confounding. This seems to reflect that our particular research question was not central to the aim of their study.

Associations between gender, age, socio-economic status, and ethnicity and co-occurrence or clustering of risk behaviours are summarised below.

Gender

Studies of the general adult population^{9, 10, 14} suggested that gender is a weak predictor of multiple risk behaviours. Two studies^{9, 10} found that men were marginally more likely to engage in two, three or four risk behaviours, but another study¹⁴ found that gender was not associated with engaging in two risk behaviours and that women were more likely to engage in three or four risk behaviours. It should be noted that these studies did not examine the associations between gender and specific risk behaviour combinations (e.g., smoking and low fruit and vegetable consumption) but used an index of risk behaviours. Therefore it is unclear whether the impact of gender differs depending on risk behaviour combinations. One study⁴⁶ focused on students and found a higher percentage of women (61.5%) in the high risk behaviour cluster and a higher percentage of men (54.2%) in the low risk behaviour cluster.

Age

Three studies^{9, 10, 14} examined age as a predictor of multiple risk behaviours in general adult populations. Data relating to age as a predictor were inconsistent and it was unclear whether there was a difference between 16-24 and 25-44 year age groups. The two studies based on data collected in England^{9, 14} found that 45-64 year olds had lower odds of engaging in two, three or four risk behaviours but data from a national survey in Scotland¹⁰ found the opposite.

Across all three studies, those over the age of 65 years had greater odds of engaging in two risk behaviours compared with 16-24 year olds. For the two English data sets,^{9, 14} those over the age of 65 years had reduced odds of engaging in three or four risk behaviours. The Scottish data set¹⁰ showed increased odds of engaging in three risk behaviours and no difference for four risk behaviours.

Socio-economic status

The association between occupational group and multiple risk behaviours was assessed in four studies of general adult populations.^{9, 10, 14, 28} Data were mostly consistent across the four studies: skilled manual, skilled non-manual, partially skilled and unskilled occupational groups were more likely to engage in two, three or four risk behaviours compared with professionals (see Appendix 7 for the relevant forest plots). Sabia et al.²⁸ found that a much higher proportion of people who engaged in three (31.9%) or four (37%) risk behaviours were in a low employment grade, compared with only 9% of those who engaged in no risk behaviours.

Shankar et al.⁴⁷ found a similar pattern in older adults. For example, those who perceived themselves to have a high social status were much less likely to engage in two (OR 0.20; 95% CI 0.12 to 0.32) or three (OR 0.26; 95% CI 0.08 to 0.87) risk behaviours compared with those who perceived themselves to have low social status. The same pattern was found in relation to income, with the wealthiest less likely to engage in two (OR 0.32; 95% CI 0.26 to 0.39) or three (OR 0.22; 95% CI 0.12 to 0.41) risk behaviours compared with the poorest. However, two cohort datasets⁴⁰ in young adults did not find an increased risk for people from manual occupational backgrounds engaging in sexual risk behaviour and substance use compared with people from non-manual backgrounds.

The education data were also mostly consistent. Those with no qualifications or intermediate qualifications (e.g., below degree level) were more likely to engage in multiple risk behaviours compared with those who attended higher education. For those with no qualifications there were two fold or greater increased odds of two, three, or four risk behaviours in most studies.^{10, 14, 47}

Ethnicity

Two studies examined the association between ethnicity and multiple risk behaviours. One conducted multinomial regression analyses in a general population of adults¹⁰ and the other a cluster analysis in students.⁴⁵

Lawder et al.¹⁰ found that people from black and minority ethnic (BME) groups were less likely to engage in two (RR 0.44; 95% CI 0.23 to 0.83), three (RR 0.32; 95% CI 0.16 to 0.65) or four (RR 0.16; 95% CI 0.06 to 0.41) risk behaviours compared with white people. Similarly, Dodd et al.⁴⁵ found that white students were more likely to be in the moderate (91.6%) or high risk (86.6%) clusters. Asian or Asian British students were more likely to be in the low risk cluster (20.6%), as were black or black British students (10.6%).

3.2 Review 2 - Exploring the effectiveness of multiple risk behaviour interventions: a systematic review, meta-analysis and meta-regression

3.2.1 Design and methods

The methods of the systematic review are described briefly below, with full details provided in the protocol (Appendix 8).

Box 2. Definitions for Review 2

Mapping exercise: Definition provided in Box 1.

Non-targeted subgroup: A subgroup where no screening (e.g., anthropometric measurements) has taken place before enrolment to determine a person's eligibility for inclusion in a study. Examples of non-targeted subgroups include pregnant women, students, and older people.

Meta-regression: An exploratory statistical technique that examines the relationship between study characteristics and pooled results in a systematic review.

Robust variance estimation: A statistical method which estimates the covariance between correlated effect size estimates (e.g., effect sizes for two separate interventions each compared with the same control in the same study). This method provides more valid, robust estimates of variance than standard meta-analyses, because it does not assume that effect sizes are independent from each other.

Multivariate meta-analysis: A method of meta-analysis that provides pooled estimates for multiple dependent variables and takes into account correlations between these variables. For example, this type of analysis can simultaneously synthesise outcomes for physical activity and fruit and vegetable intake, provide a pooled estimate for each behaviour, and take into account correlations between these behaviours. Where two dependent variables (e.g., physical activity, fruit and vegetable intake) are included in this type of analysis, it may also be known as a bivariate meta-analysis.

Eligibility criteria

We used an iterative approach to determining inclusion criteria. We carried out a mapping exercise/scoping review to determine the size and scope of the literature on interventions that target multiple risk behaviours (see Appendix 9 for further details).

Based on the findings from the mapping exercise, we selected studies with the following characteristics for inclusion in the systematic review:

Population: General adult populations (aged 16 years or older) or non-targeted subgroups of general adult populations (e.g., pregnant women, older adults, students). Studies on targeted subgroups, where screening takes place to determine eligibility (e.g., to identify people who are obese/overweight, or at risk of long term conditions such as type 2 diabetes), were excluded as the findings from such studies may differ from those conducted with the general population.

Intervention: Any intervention (primarily non-pharmacological) that aimed to change at least two risk behaviours. Studies of school- or family-based interventions were excluded to avoid duplication with a registered protocol of a systematic review.⁵³

Outcomes: The primary outcome was any change in the risk behaviours targeted. Secondary outcomes were changes in weight and body mass index (BMI).

Study design: RCTs (randomised controlled trials) and any linked process evaluations or qualitative studies were eligible for inclusion. We included only RCTs in this review because the mapping exercise revealed no differences in the types of interventions evaluated and the risk behaviours targeted between RCTs and other evaluative study designs.

Information sources

Six electronic databases (MEDLINE, EMBASE, PsycINFO, Science Citation Index, Cochrane Central Register for Controlled Trials, Applied Social Sciences and Index and Abstracts) were searched from January 1990 to January 2013 with no language restrictions. The 1990 start date was used because preliminary searches showed that most of the multiple risk behaviour literature is both time- and context-dependent.

An abbreviated search of PubMed was undertaken to cover the period 2012 to May 2013, with the aim of ensuring up to date coverage of the literature. The full search strategy is provided in Appendix 10.

Once the screening of full articles had taken place and eligible studies had been selected for inclusion in the review, further searches were carried out. This involved identifying papers that cited for each included study using four databases (Google Scholar, Scopus, Web of Science, and OVIDSP MEDLINE) and assessing these for eligibility in our review. For further details on the methods see Wright et al.⁵⁴

Selection of studies and data collection process

The final selection of studies was conducted by one reviewer and checked by a second. This was also the case for data extraction and assessment of risk of bias.

We piloted a modified version of the Cochrane Public Health Group's data extraction template (Appendix 11) on five studies to ensure consistency. Extraction of implementation data was based on criteria adapted from the Oxford Implementation Index.⁵⁵ The Behaviour Change Wheel⁵⁶ was used to classify studies according to intervention content.

For dichotomous outcomes we calculated odds ratios and their 95% confidence intervals with values less than 1 in favour of the non-pharmacological intervention group. For continuous outcomes (e.g., change from baseline) we calculated standardised mean differences using Hedges' g ⁵⁷ with negative

effect sizes favouring the intervention/s. Where a sufficient number of studies were available we also calculated mean differences on original scales (e.g., portions of fruit and vegetables).

Risk of bias in individual studies

We used the Cochrane risk of bias tool ⁵⁸ to critically appraise included studies.

Syntheses of results

For all data syntheses we conducted random effects meta-analyses using Review Manager 5 software. Control conditions were subgrouped into three categories (minimal intervention, information provision, active control) to establish whether there were substantial differences in effect estimates when using these different control conditions. We also examined the impact of implementation factors on effectiveness using meta-regression with Stata 13.

We assessed heterogeneity based on visual inspection of forest plots (considering the variability of the effect estimates and overlap of confidence intervals). In addition we examined the I^2 statistic.⁵⁹ A Q-value (approximating χ^2 distribution) of $p < 0.1$ indicated statistically significant heterogeneity.

Where data were deemed unsuitable for meta-analysis, we synthesised the findings narratively.

Additional analyses

One of the major challenges of the data syntheses were the multiple dependencies within the data. For example, each study reported different risk behaviour outcomes and studies often had more than one intervention group and more than one follow-up time period.

In the standard meta-analyses we used various techniques to reduce the risk of double counting while trying to take into account the complexity of the data (see Appendix 12 for further details).

In sensitivity analyses we examined the impact of using robust variance estimation to include more than one data point from each study where dependencies occurred. We also assessed the impact of using a bivariate meta-analysis of correlated outcomes rather than analysing these outcomes separately (assuming the outcomes are independent) using standard univariate meta-analysis. To assess the impact of length of follow-up we removed studies with less than 12 months follow-up from the meta-analyses and examined any change in overall effect.

3.2.2 Findings

Study selection

The searches identified 21,853 records and 50 RCTs were included in the review (Figure 3). In addition to process and implementation data reported in the primary papers, we identified four process evaluations⁶⁰⁻⁶³ and a qualitative study⁶⁴ published separately but linked to the 50 included studies. Reasons for exclusions of full texts are presented in Appendix 13.

Study characteristics

A summary table of the study characteristics is presented below (Table 3); further details of the studies are presented in Appendix 14. Most studies targeted two risk behaviours (31 studies). Eleven studies targeted three risk behaviours, seven studies targeted four behaviours, one study targeted five behaviours, and one study targeted six behaviours.

Figure 4 illustrates the most common risk behaviours targeted in the included studies. Eighty-two per cent of all studies targeted both diet and physical activity with 56% exclusively targeting these behaviours. Thirty per cent targeted diet and smoking but only 2% exclusively targeted these behaviours. Twenty-two per cent targeted alcohol and smoking but only 7% targeted these behaviours exclusively.

Nineteen studies targeted general adult populations, 11 studies targeted students, seven studies specifically targeted low income populations, five studies targeted black and minority ethnic groups in the United States, four studies targeted older adults, four studies targeted pregnant women, and one study targeted prisoners.

Most studies were conducted in the USA (27 studies), followed by UK (five studies), Australia (five studies) and the Netherlands (four studies). Two studies were conducted in Belgium and two in Canada. One study was conducted in each of Germany, Spain, New Zealand, Mexico, and China.

Almost all studies included an educational function in the intervention; only three studies did not mention education explicitly. Twenty-seven studies included education and training intervention content. This focus on education and training content is consistent with the most commonly reported theoretical approaches used in the studies, such as Social Cognitive Theory, the Health Belief Model, and the Theory of Planned Behaviour (reported by 27 out of 36 studies which reported a theoretical foundation).

Risk of bias within studies

Study quality was variable (for a full breakdown see Appendix 15). Most of the ratings for blinding of participants and personnel were unclear because given the nature of the interventions it did not seem feasible that participants or personnel could be blinded. In this context, giving a high risk of bias rating was judged to be overly conservative (as there are limited means to reduce this bias) and a low risk rating would also be overly permissive (as the presence of such bias cannot be ruled out). Just over half of the studies (28 in total) had a high risk of bias for at least one of domains: incomplete outcome data (attrition bias) (20 studies); other bias (eight studies); blinding of outcome assessors (four studies); selective reporting (three studies); and allocation concealment (two studies).

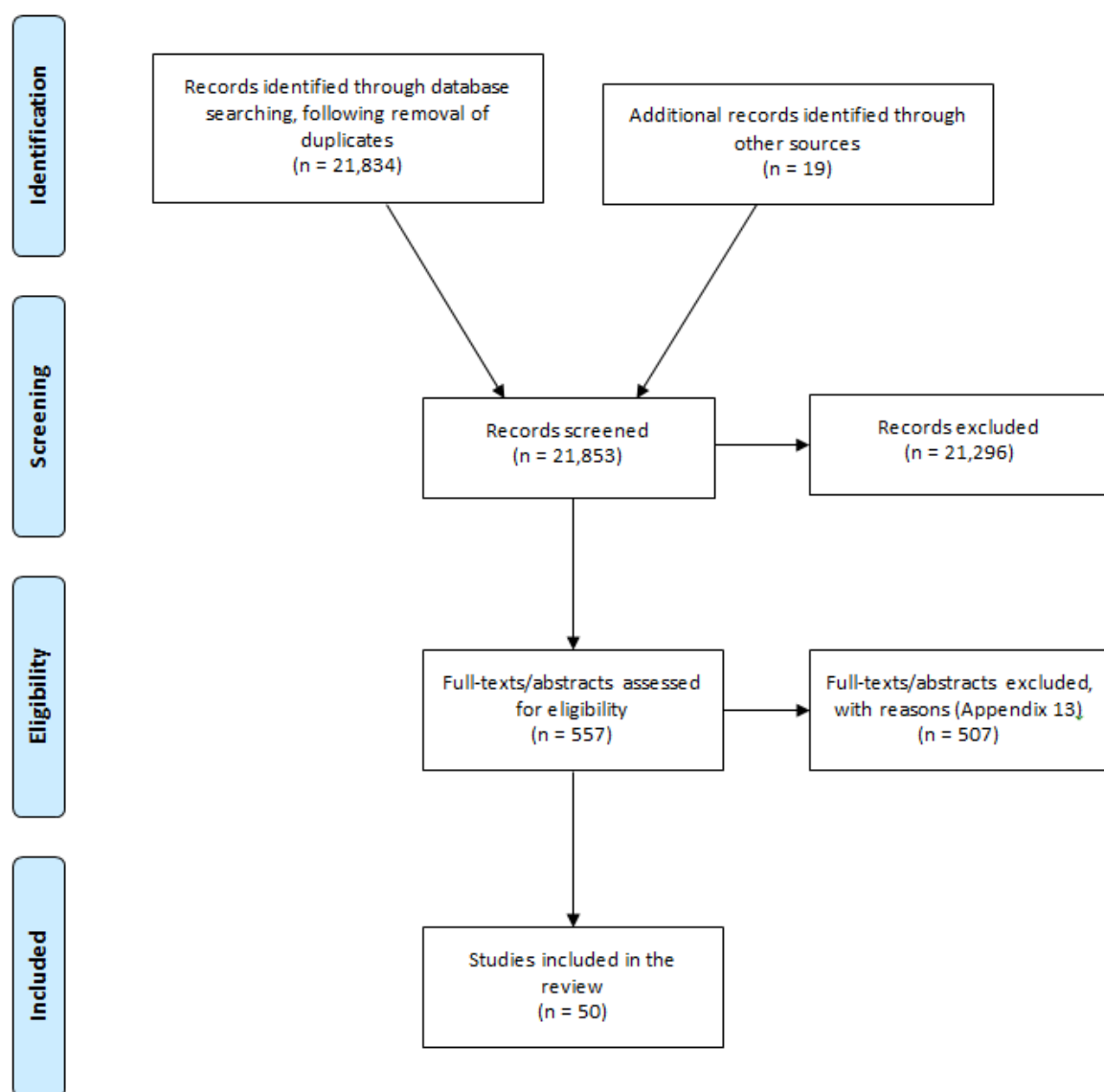


Figure 3. The review process

Table 3. Study characteristics of the included studies (50 in total)

First author (year of publication), country	Sample size, setting	Population	Intervention function/s (Behaviour Change Wheel definitions)	Intervention duration and length of follow-up	Risk behaviours targeted	Secondary outcomes
Aldana et al. (2006) ⁶⁵ USA	N=348 Community	General adult population	Education, training	Duration: 4 weeks Length of follow-up: 6 months	Diet, Physical activity	Weight (kg), BMI*
Braithwaite et al. (2005) ⁶⁶ USA	N=114 Prison	Prison inmates	Education, training, modelling	Duration: 6 weeks Length of follow-up: 3 and 6 months following release from prison.	Sexual risk behaviour, illicit drug use, alcohol use, smoking	None
Burke et al. (2013) ⁶⁷ Australia	N=478 Mailed materials to homes.	Older adults with low to middle income	Enablement, education	Duration: 6 months Length of follow-up: Endpoint	Diet, physical activity, sedentary behaviour	None
Burton et al. (1995) ⁶⁸ USA	N=4,195 Primary care settings	Older adults	Enablement, education	Duration: 2 years Length of follow-up: Endpoint	Smoking , alcohol use, sedentary behaviour	None
Campbell et al. (2004) ⁶⁹ USA	N=850 African American churches	Members of African American churches	Education, training, modelling, persuasion, environmental restructuring, enablement	Duration: 9 months Length of follow-up: 3 months	Diet, physical activity	None
Campo et al. (2012) ⁷⁰ Spain	N=169 Community health centres	General adult population	Education, training, enablement	Duration: 8 weeks Length of follow-up: 6 months	Diet, physical activity	None
de Vries et al. (2008) ⁷¹ Netherlands	N=1,331 Mailed materials to homes.	General adult population	Persuasion	Duration: 9 months Length of follow-up: endpoint	Smoking, diet, physical activity	None
Diez et al. (2012) ⁷² Mexico	N=134 University	University students	Education, training	Duration: 1 week Length of follow-up: 3 months	Diet , physical activity	None
Emmons et al. (2005) ⁷³ USA	N=2,219 Health centre	General adult population.	Education, persuasion, enablement	Duration: Not reported Length of follow-up: 8 months	Diet, physical activity	None
Franko et al. (2008) ⁷⁴ USA	N=606 University	University students.	Education	Duration: 2 weeks plus a booster 3 weeks later Length of follow-up: 6 months	Diet, physical activity	None
Gow et al. (2010) ⁷⁵ USA	N=159 University	University students.	Education, persuasion, training	Duration: 6 weeks Length of follow-up: 3 months	Smoking, diet, physical activity	Weight (lbs), BMI.
Greene et al. (2012) ⁷⁶ USA	N=1,689 University	University students.	Education, training	Duration: 10 weeks Length of follow-up: Endpoint and 15 months	Diet, physical activity	Weight (lbs), BMI,
Hillier et al. (2012) ⁷⁷	N=128	Adults with low-socio-	Persuasion, training,	Duration: 30-45 minutes	Diet, physical activity	Weight (kg), BMI

UK	Community	economic status	modelling	Length of follow-up: 12 months.		
Hivert et al. (2007) ⁷⁸ Canada	N=115 University	University students.	Education, training, modelling	Duration: 2 years Length of follow-up: Endpoint	Diet, physical activity	Weight (kg), BMI.
Hui et al. (2012) ⁷⁹ Canada	N=224 Community gyms	Pregnant women.	Education, training, enablement	Duration: 2 months Length of follow-up: Endpoint	Diet, physical activity	Excessive weight gain, BMI
Jackson et al. (2011) ⁸⁰ USA	N=321 Pre-natal care practices.	Pregnant women with low socio-economic status.	Education, persuasion	Duration: One 10-15 minute session. Length of follow-up: 4 weeks	Diet, physical activity	None
Jacobs et al. (2011) ⁸¹ Belgium	N=314 Online intervention	General adult population.	Education, persuasion, training	Duration not reported. Length of follow-up: 6 and 12 months	Diet, physical activity	Weight (kg), BMI.
Jeffery et al. (1999) ⁸² USA	N=1,226 Participants' homes	General adult population.	Education, enablement, incentivisation	Duration: 3 years Length of follow-up: Endpoint	Diet, physical activity	Weight (kg)
Keyserling et al. (2008) ⁸³ USA	N=236 Health centre	Women from lower- income populations.	Education, persuasion, training, enablement	Duration: 6 months (2 individual counselling sessions, 3 group sessions, 3 phone calls from a peer counsellor, and 6 months maintenance) Length of follow-up: 6 and 12 months	Diet, physical activity	None
Kreuter et al. (1996) ⁸⁴ USA	N=1,317 Mailed materials to homes.	General adult population.	Education, training	Duration: 4 weeks Length of follow-up: 6 months	Smoking, diet, physical activity, seat belt use, screening examinations	None
Kypri et al. (2005) ⁸⁵ New Zealand	N=218 University health centre	University students.	Education	Duration: single internet session Length of follow-up: 6 weeks	Smoking, alcohol use, diet, physical activity	None
Lachausse et al. (2012) ⁸⁶ USA	N=358 University campus, or online	University students.	Education, training	Duration: 12 weeks Length of follow-up: 2 weeks	Diet, physical activity	BMI
Lee et al. (2011) ⁸⁷ Australia	N=248 Participants' homes	Older adults.	Education, persuasion, training	Duration: 12 weeks Length of follow-up: Endpoint	Diet, physical activity	None
Leigh et al. (1992) ⁸⁸ USA	N=2,106 Mailed materials to homes.	Older adults.	Education	Duration: 12 months Length of follow-up: Endpoint	Smoking, alcohol use, diet, physical activity, regular seat belt use	Weight (lbs),
Leslie et al. (2012) ⁸⁹ UK	N=83 Community	Smoking cessation clinic	Education, Enablement, Modelling	Duration: 5 weeks Length of follow up: 6 months	Smoking, diet	Changes in body weight (kg), and BMI.
Lombard et al. (2009) ⁹⁰ Australia	N=250 Meetings held in	Parents with children.	Education, training, enablement	Duration: 4 months Length of follow-up: Endpoint	Diet, physical activity	Weight (kg)

	primary schools					
McCambridge et al. (2011) ⁹¹ UK	N=416 Further education colleges	University students.	Persuasion	Duration: 1 hour Length of follow-up: 12 months	Smoking, alcohol use, illicit drug use	None
Oenema et al. (2008) ⁹² Netherlands	N=2,159 Online intervention	General adult population.	Education, training, persuasion	Duration: 1 month Length of follow-up: Endpoint	Diet, physical activity, smoking	None
OXCHECK study group (1995) ⁹³ UK	N=5,559 Primary care practices	Patients from primary care practices.	Education	Duration: 4 years Length of follow-up: Endpoint	Smoking, alcohol use, diet, physical activity	BMI,
Parekh et al. (2012) ⁹⁴ Australia	N=1,711 Received mailed information (home-based)	Patients from primary care practices.	Education	Duration: 10 days Length of follow-up: 3 months	Smoking, alcohol use, diet, physical activity	Weight (unit not reported)
Peragallo et al. (2012) ⁹⁵ USA	N=548 Community	Hispanic Women in USA	Education, training, enablement	Duration: 10 hours altogether Length of follow-up: 12 months	Alcohol use, sexual risk behaviour	None
Rauh et al. (2013) ⁹⁶ Germany	N=250 Gynaecological practices.	Pregnant women.	Education, training	Duration: Delivered at 20 th and 30 th weeks of gestation Length of follow-up: Up to the 38 th week of gestation	Diet, physical activity	Gestational weight gain (kg)
Resnicow et al. (2005) ⁹⁷ USA	N=906 Church community and participants' homes	African-American church members.	Education, persuasion, training, environmental restructuring, modelling	Duration: not reported. Length of follow-up: 1 year from baseline.	Diet, physical activity	None
Ruffin et al. (2011) ⁹⁸ USA	N=3,786 Healthcare practices.	Patients from primary care practices.	Education	Duration: One session Length of follow-up: 6 months	Smoking, diet, physical activity	None
Sallit et al. (2008) ⁹⁹ USA	N=216	Women only.	Education, persuasion, training	Duration: 12 weeks Length of follow-up: 9 months	Smoking, diet	Weight (lbs), BMI
Sikkema et al. (1995) ¹⁰⁰ USA	N=55	University students.	Education, training, modelling	Duration: 4 weeks Length of follow-up: 4 weeks	Alcohol use, sexual risk behaviour, illicit drug use	None
Simkin-Silverman et al. (1998) ¹⁰¹ USA	N=535 University clinics.	Women only.	Education, persuasion, training, modelling, enablement.	Duration: 54 months Length of follow-up: Endpoint	Diet, physical activity	Weight (lbs),
Spring et al. (2012) ¹⁰² USA	N=204	General adult population.	Education, incentivisation, training, enablement	Duration: 3 weeks Length of follow-up: 20 weeks	Diet, physical activity, sedentary behaviour	None
Staten et al. (2004) ¹⁰³	N=361	General adult population.	Education, enablement,	Duration: 12 months	Diet, physical activity	Weight (kg), BMI,

USA			environmental restructuring	Length of follow-up: Endpoint		
Ussher et al. (2003) ¹⁰⁴ UK	N=299 Community-based stop smoking clinic	General adult population	Education, training, enablement	Duration: 7 weeks Length of follow-up: 2 weeks	Smoking, physical activity	Weight (kg)
van Assema et al. (1994) ¹⁰⁵ Netherlands	N=1,506 Community	General adult population	Education, environmental restructuring, enablement	Duration: 12 months Length of follow-up: 6 months	Smoking, alcohol use, diet, use of sunbeds	None
van Keulen et al. (2011) ¹⁰⁶ Netherlands	N=1,629 Participants' homes	Patients recruited from primary care practices	Education persuasion	Duration: 43 weeks Length of follow-up: Up to 73 weeks.	Diet, physical activity	None
Vandelanotte et al. (2005 and 2008) ^{107, 108} Belgium	N=567 University	General adult population.	Education	Duration: Two 50-minute sessions (over a 6 month period) Length of follow-up: Endpoint	Diet, physical activity	None
Walker et al. (2009) ¹⁰⁹ USA	N=225 Community	Women aged 50-69 years, residing in rural areas.	Education, training, enablement	Duration: 12 months Length of follow-up: 12 months	Diet, physical activity	BMI,
Weisman et al. (2011) ¹¹⁰ USA	N=292 Community	Women with low socio- economic status	Education, incentivisation, training	Duration: 12 weeks Length of follow-up: Up to 12 months	Diet, physical activity	Weight (lbs), BMI
Werch et al. (2010) ¹¹¹ USA	N=303 University	University students	Education, persuasion, training	Duration: 25 minutes Length of follow-up: 3 months and 12 months	Alcohol use, physical activity, illicit drug use, drink driving	None
Wilcox et al. (2013) ¹¹² USA	N=1,257 Church	African Americans	Education, environmental restructuring, modelling, enablement	Duration: 15 months Length of follow-up: Endpoint	Diet, physical activity	Blood pressure
Wilkinson et al. (2012) ¹¹³ Australia	N=360 A maternity hospital in Queensland	Pregnant women	Education, training, enablement	Duration: one 60-minute session Length of follow-up: 12 weeks post- service entry (around 26 weeks of pregnancy)	Smoking, diet, physical activity	None
Yanek et al. (2001) ¹¹⁴ USA	N=267 Churches	African American women aged 40 years and over	Education, training, environmental re- structuring, modelling, enablement	Duration: 20 weeks Length of follow-up: 12 months	Diet, physical activity	Weight (lbs) and BMI.
Zhou et al. (2010) ¹¹⁵ China	Cluster RCT N=2,441 Home visits by a village doctor.	Older adults	Education, persuasion, enablement	Duration: 9 months Length of follow-up: Endpoint	Smoking, alcohol use, diet, physical activity	None



Figure 4. Venn diagram illustrating the most commonly targeted behaviours (alcohol, smoking, diet and physical activity) in included studies. The numbers not representing a proportion (%) represent the total number of studies targeting that behaviour combination.

Results of individual studies

We examined the effectiveness of non-pharmacological interventions for each of the targeted behaviours. Subgroup analyses according to control group types (minimal intervention/information provision/active control) did not substantially change the pooled results and are not discussed further.

Summary estimates from the meta-analyses are presented in Table 4. Also presented are summary estimates from some of the sensitivity analyses, which involved removal of studies with less than 12 months follow-up. Forest plots for these meta-analyses are presented in Appendix 16. For most outcomes there were some studies that could not be included in the meta-analysis; the rationales for these decisions are discussed in more detail in Appendix 17.

Compared with control groups the intervention groups demonstrated small increases in fruit and vegetable intake (-0.33 portions; 95% CI -0.51 to -0.19), small reductions in fat intake (SMD -0.19; 95% CI -0.25 to -0.14), and small increases in physical activity (SMD -0.16; 95% CI -0.24 to -0.09). Small-to-medium benefits of the interventions were observed for improvements in overall diet score, fibre intake, calorie intake and sodium intake but few studies were available for these analyses and some of the results lacked precision. The interventions did not appear to have any benefits over control conditions for smoking cessation (OR 0.95; 95% CI 0.88 to 1.03). Small benefits of the interventions were observed for alcohol use and reduction of sexual risk behaviours but few studies were available for these analyses and the results lacked precision. Minimal reductions in weight (-0.85Kg; 95% CI -1.34 to -0.37) and BMI (-0.24 points; 95% CI -0.44 to -0.04) were found, compared with control conditions.

It was not possible to draw conclusions on the effectiveness of non-pharmacological interventions for people of low socio-economic status and black and minority ethnic groups due to a lack of studies.

All studies compared interventions to reduce multiple risk behaviours versus controls. Only one study⁸⁹ compared an intervention targeting multiple behaviours (smoking and unhealthy diet) with an intervention that targeted a single behaviour (smoking). No statistically significant differences were found between groups for either smoking or unhealthy diet.

All studies examined the simultaneous change of multiple risk behaviours. One study^{107, 108} compared interventions aiming to simultaneously reduce fat intake and increase physical activity against interventions that aimed to change these behaviours sequentially. Comparisons were inconclusive as to whether simultaneous or sequential change of behaviours was more effective (e.g., for changing both behaviours: simultaneous vs sequential physical activity first: OR 1.39; 95% CI 0.69 to 2.83; simultaneous vs sequential fat intake first: OR 0.78; 95% CI 0.39 to 1.53).

Sensitivity analyses showed minor differences between results obtained in the main analyses compared with using robust variance estimation. Although it appears that our main analyses may have been a little conservative, none of the differences had any impact on interpretation of findings (for comparison data, see Appendix 18).

Comparisons of our main (univariate) analyses with the multivariate analyses did not reveal any substantial differences for any outcomes (for further details, see Appendix 19). There were moderate sized correlations between all of the behaviours included in the multivariate meta-analyses. Changes in diet (fruit and vegetable intake) appeared to be more strongly associated with weight loss than physical activity. A further interesting finding was that beneficial changes in diet (fruit and vegetable intake) and in physical activity were associated with deterioration of smoking behaviour (reduced odds of smoking cessation). This may have been the result of participants paying less attention to their smoking behaviour while they focused on changes in diet and physical activity.

Table 4. Summary point estimates from the meta-analyses

Risk behaviour outcome	Summary point estimate			Results from sensitivity analyses (removing studies with <12 months follow-up): all studies
	All	Low SES	BME	
Dichotomous data				
Fruit and vegetable intake	OR 0.59 (95% CI 0.49 to 0.72) I ² =70% K=9	OR 0.65 (95% CI 0.44 to 0.83) I ² =48% K=3	OR 0.65 (95% CI 0.38 to 1.12) I ² =N/A K=1	OR 0.58 (95% CI 0.31 to 1.09) I ² =85% K=2
Intake of fat/meat/dairy	OR 0.70 (95% CI 0.61 to 0.81) I ² =0% K=3	OR 0.73 (95% CI 0.61 to 0.88) I ² =N/A K=1	N/A	N/A
Physical activity	All: OR 0.82 (95% CI 0.73 to 0.92) I ² =37% K=13	Low SES: OR 0.85 (95% CI 0.72 to 1.00) I ² =0% K=4	BME: OR 0.58 (95% CI 0.38 to 0.87) I ² =N/A K=1	OR 0.79 (95% CI 0.51 to 1.23) I ² =21% K=2
Smoking	OR 0.95 (95% CI 0.88 to 1.03) I ² =0 K=10	N/A	N/A	N/A
Alcohol misuse	OR 0.84 (95% CI 0.65 to 1.08) I ² =60% K=5	N/A	OR 0.59 (95% CI 0.20 to 1.76) I ² =N/A K=1	N/A
Continuous data				
Calorie intake (cals/day)	MD -114.93 (95% CI -186.38 to -43.48) I ² =73% K=7	N/A	N/A	N/A
Fruit and vegetable intake (post-intervention values)	SMD -0.19 (95% CI -0.25 to -0.14) I ² =11% K=13 Portions of fruit and vegetables: MD -0.33 (95% CI -0.51 to -0.19)	SMD -0.22 (95% CI -0.31 to -0.13) I ² =0% K=2 Portions of fruit and vegetables: MD -0.48 (95% CI -0.64 to -0.32)	SMD -0.14 (95% CI -0.22 to -0.06) I ² =0% K=3 Portions of fruit and vegetables: MD -0.37 (95% CI -0.59 to -0.15)	SMD -0.20 (95% CI -0.27 to -0.12) I ² =0% K=2

	I ² =56% K=8	I ² =0% K=3	I ² =0% K=2	
Intake of fat/meat/dairy (post-intervention values)	SMD -0.21 (95% CI -0.31 to -0.11) I ² =69% K=13	SMD -0.14 (95% CI -0.22 to -0.06) I ² =0% K=3	SMD -0.04 (95% CI -0.15 to 0.08) I ² =0% K=2	SMD -0.43 (95% CI -0.76 to -0.20) I ² =0% K=2
Fibre intake	SMD -0.17 (95% CI -0.29 to -0.05) I ² =26% K=5	SMD -0.23 (95% CI -0.44 to -0.03) I ² =N/A K=1	SMD -0.04 (95% CI -0.15 to 0.08) I ² =N/A K=1	N/A
Sodium intake (mg/day)	MD -138.89 (95% CI -221.39 to -56.39) I ² =0% K=2	N/A	MD -137.00 (95% CI -224.52 to -49.48) I ² =N/A K=1	N/A
Overall diet score	SMD -0.63 (95% CI -0.80 to -0.46) I ² =0% K=4	SMD -0.55 (95% CI -0.85 to -0.25) I ² =N/A K=1	N/A	N/A
Physical activity (post-intervention values)	SMD -0.16 (95% CI -0.24 to -0.09) I ² =59% K=18	SMD -0.05 (95% CI -0.29 to 0.18) I ² =56% K=3	SMD -0.12 (-0.23 to -0.01) I ² =32% K=3	SMD -0.12 (95% CI -0.21 to -0.02) I ² =32% K=3
Smoking	SMD 0.32 (95% CI -0.35 to 0.99) I ² =79% K=2	N/A	N/A	N/A
Sexual risk behaviours	SMD -0.12 (95% CI -0.49 to 0.24) I ² =32% K=3	N/A	N/A	N/A
Non-behavioural outcomes (continuous data)				
Weight (kg)	MD -0.85 (95% CI -1.34 to -0.37) I ² =63% K=13	MD -0.76 (95% CI -2.30 to 0.79) I ² =41% K=3	MD -0.88 (-1.47 to -0.29) I ² =N/A K=1	MD -0.76 (95% CI -2.30 to 0.79) I ² =41% K=3
BMI (kg/m ²)	MD -0.24 (95% CI -0.44 to -0.04) I ² =54% K=11	MD -0.58 (95% CI -1.45 to 0.29) I ² =7% K=2	MD -0.31 (95% CI -0.53 to -0.09) I ² =N/A K=1	MD 0.17 (95% CI -1.30 to 1.63) I ² =59% K=3

Note: OR=odds ratio, MD=mean difference, SMD=standardised mean difference, CI=confidence intervals, SES= socio-economic status, BME=Black and Minority Ethnic (all studies were conducted in US), N/A= not applicable, K=number of trials.

Impact of implementation factors on effectiveness of non-pharmacological interventions

Summary of intervention content and theoretical approaches

Here, we focus on intervention content and theoretical approaches used in the included studies. Full details on extracted implementation factors are presented in Appendix 20. Table 5 summarises the intervention functions of the studies classified using the Behaviour Change Wheel,⁵⁶ the theoretical approaches used, and the risk behaviours targeted.

Studies varied substantially in the number of functions included in their intervention. Seven studies included only one intervention function, eight studies included two intervention functions, 21 studies used three functions, three studies included four functions and four studies included five functions. There did not appear to be any evidence that studies targeting a wider range of behaviours used more intervention functions. For example, many of the studies that included four or more intervention functions targeted only diet and physical activity.

Almost all studies included an educational function in the intervention; only three studies did not explicitly mention education. Twenty-seven studies included education and training functions. Education and training functions are consistent with the mostly commonly reported theoretical approaches used in the studies, such as Social Cognitive Theory, the Health Belief Model, and the Theory of Planned Behaviour. Other combinations of intervention functions consistent with these theoretical approaches were commonly reported and included: education, training, and enablement (10 studies); education and modelling (eight studies); and education, training and modelling (six studies). Persuasion was another commonly reported function (15 studies). Combinations included: education and persuasion (13 studies); and education, training, and persuasion (eight studies). No

clear patterns appeared to emerge concerning the use of particular intervention functions for particular risk behaviour combinations.

The most common theoretical approach was Social Cognitive Theory, which was used in 16 studies. Most of these studies included education and training, as well as enablement or modelling intervention functions. The next most commonly reported theories were the Transtheoretical Model (six studies), the Health Belief Model (four studies), and the Theory of Planned Behaviour (three studies). Many of these studies drew on other theoretical approaches such as Social Cognitive Theory. There was a less clear pattern of intervention functions used in the studies drawing upon the Transtheoretical Model, the Health Belief Model, and the Theory of Planned Behaviour compared with those using Social Cognitive Theory. Three studies identified motivational interviewing as a key theoretical approach. Not surprisingly, persuasion (through motivational interviewing) was the main goal of these interventions.

Five studies included environmental re-structuring as part of their intervention; four of these explicitly adapted their intervention to take into account social or cultural factors (e.g., black and minority ethnic groups in the USA), and one study developed interventions to produce a health promoting social environment on a larger scale (i.e., within a city in the Netherlands). These five studies tended to have more intervention functions than most other studies and often included attempts to restructure the social environment through networks, and also modelling and enablement. Sixteen studies did not report the theoretical foundation of their intervention. Further, most studies did not explicitly examine the link between intervention effectiveness and mediators of change (such as attitudes, beliefs, knowledge) as predicted by the theoretical approach used. Only one study⁹⁵ specifically examined the link between theory and intermediate outcomes; this study found that the intervention increased knowledge about HIV and that this in turn resulted in an increase in condom use as predicted by Social Cognitive Theory.

Table 5. Intervention functions, theoretical approaches and risk behaviours targeted

Study authors	Education	Training	Enablement	Modelling	Persuasion	Environmental restructuring	Incentivisation	Coercion	Restrictions	Theoretical approach	Risk behaviours targeted
Braithwaite <i>et al.</i> (2005) ⁶⁶ USA										Social cognitive theory	Sexual risk behaviour Illicit drug use Alcohol misuse Smoking
Gow <i>et al.</i> (2010) ⁷⁵ USA										Social cognitive theory	Smoking Diet (fruit and veg, fat, fibre) Physical activity
Hivert <i>et al.</i> (2007) ⁷⁸ Canada										Social cognitive theory	Diet (calories) Physical activity
Lombard <i>et al.</i> (2009) ⁹⁰ Australia										Social cognitive theory	Diet (fat) Physical activity
Sallit <i>et al.</i> (2008) ⁹⁹ USA										Social cognitive theory	Smoking Diet
Weisman <i>et al.</i> (2011) ¹¹⁰ USA										Social cognitive theory	Diet (fruit and veg) Physical activity

Yanek <i>et al.</i> (2001) ¹¹⁴ USA									Social cognitive theory	Diet (fat, calories) Physical activity
Ussher <i>et al.</i> (2003) ¹⁰⁴ UK									Social cognitive theory	Smoking Physical activity
Peragallo <i>et al.</i> (2012) ⁹⁵ USA									Social cognitive theory Freire's pedagogy	Alcohol misuse Sexual risk behaviour
Hillier <i>et al.</i> (2012) ⁷⁷ UK									Social cognitive theory Theory of planned behaviour	Diet (fruit and veg, fat) Physical activity
Burke <i>et al.</i> (2013) ⁶⁷ Australia									Social cognitive theory Precede-proceed model	Diet (fruit and veg, fibre, fat) Physical activity Sedentary behaviour
Campbell <i>et al.</i> (2004) ⁶⁹ USA									Social cognitive theory Trans-theoretical model Health belief model Social support models	Diet (fruit and veg, calories, fat) Physical activity
de Vries <i>et al.</i> (2008) ⁷¹ Netherlands									Social cognitive theory Health belief model Transtheoretical model Precaution adoption model Goal setting theories	Diet (fruit and veg, fat) Smoking Physical activity
van Assema <i>et al.</i> (1994) ¹⁰⁵ Netherlands									Transtheoretical model Model of behavioural change	Diet (fat) Smoking Alcohol misuse Sunbed use
Zhou <i>et al.</i> (2010) ¹¹⁵ China									Transtheoretical model	Diet (fruit and veg, salt) Physical activity Alcohol use Smoking
Aldana <i>et al.</i> (2006) ⁶⁵ USA									Health belief model Transtheoretical model	Diet (calories, fruit and veg, fat, sodium) Physical activity
Werch <i>et al.</i> (2010) ¹¹¹ USA									Behavior Image model	Diet (fruit and veg) Physical activity Smoking Alcohol use
Walker <i>et al.</i> (2009) ¹⁰⁹ USA									Health promotion model	Diet (fruit and veg, fibre, fat) Physical activity
Jacobs <i>et al.</i> (2011) ⁸¹ Belgium									Theory of planned behaviour Self-determination theory	Diet (fruit and veg, fat) Physical activity
Wilkinson <i>et al.</i> (2012) ¹¹³ Australia									5As (assess, advise, agree, assist, arrange)	Diet (fruit and veg, fat, fibre) Physical activity Smoking
Greene <i>et al.</i> (2012) ⁷⁶ USA									Dick and Carey's Instructional Design model Keller's Instructional Motivational model	Diet (fruit and veg) Physical activity

Parekh <i>et al.</i> (2012) ⁹⁴ Australia									Events of instruction framework	Diet (fruit and veg, fat intake) Physical activity Smoking Alcohol misuse
Emmons <i>et al.</i> (2005) ⁷³ USA									Social-contextual approach (adaptation for low literacy and ethnicity)	Diet (fruit and veg, red meat) Physical activity
Resnicow <i>et al.</i> (2005) ⁹⁷ USA									Culturally tailored approach based on a theoretical approach developed by the authors	Diet (fruit and veg) Physical activity
Jackson <i>et al.</i> (2011) ⁸⁰ USA									Motivational interviewing	Diet (fruit and veg, high fat meat) Physical activity
McCambridge <i>et al.</i> (2011) ⁹¹ UK									Motivational interviewing	Smoking Alcohol use Illicit drug use
Oenema <i>et al.</i> (2008) ⁹² Netherlands									Precaution adoption process model	Diet (fat) Physical activity Smoking
Lee <i>et al.</i> (2011) ⁸⁷ Australia									Participatory action research approach	Diet(fat, fibre) Physical activity
van Keulen <i>et al.</i> (2011) ¹⁰⁶ Netherlands									I-Change model control theory	Diet (fruit and veg) Physical activity
Campo <i>et al.</i> (2012) ⁷⁰ Spain									Virginia nursing model	Diet (Mediterranean) Physical activity
Burton <i>et al.</i> (1995) ⁶⁸ USA									Not reported	Smoking Alcohol use Sedentary behaviour
OXCHECK study group (1995) ⁹³ UK									Not reported	Diet (fat) Physical activity Smoking Alcohol misuse
Wilcox <i>et al.</i> (2013) ¹¹² USA									Not reported	Diet (fruit and veg, fat, fibre) Physical activity
Jeffery <i>et al.</i> (1999) ⁸² USA									Not reported	Diet (calories, fat) Physical activity
Keyserling <i>et al.</i> (2008) ⁸³ USA									Not reported	Diet (overall) Physical activity
Kreuter <i>et al.</i> (1996) ⁸⁴ USA									Not reported	Diet (fat) Physical activity Smoking Seat belt use
Kypri <i>et al.</i> (2005) ⁸⁵ New Zealand									Not reported	Diet (fruit and veg) Physical activity Smoking Alcohol misuse

Lachausse <i>et al.</i> (2012) ⁸⁶ USA									Not reported	Diet (fruit and veg) Physical activity
Franko <i>et al.</i> (2008) ⁷⁴ USA									Not reported	Diet (fruit and veg) Physical activity
Hui <i>et al.</i> (2012) ⁷⁹ Canada									Not reported	Diet (fruit and veg, fat, carbohydrates, protein) Physical activity
Leigh <i>et al.</i> (1992) ⁸⁸ USA									Not reported	Diet (fruit and veg, fat, salt, fibre) Physical activity Smoking Alcohol use Seat belt use
Sikkema <i>et al.</i> (1995) ¹⁰⁰ USA									Not reported	Alcohol misuse Illicit drug use Sexual risk behaviour
Simkin-Silverman <i>et al.</i> (1998) ¹⁰¹ USA									Not reported	Diet (calories, calcium, fat) Physical activity
Rauh <i>et al.</i> (2013) ⁹⁶ Germany									Not reported	Diet (calories) Physical activity
Ruffin <i>et al.</i> (2011) ⁹⁸ USA									Not reported	Diet (fruit and veg) Physical activity Smoking
Leslie <i>et al.</i> (2012) ⁸⁹ UK									Not reported	Diet (fruit and veg) Smoking

Note: shaded areas represent where a study intervention has been classified as having a particular function, as defined by Michie *et al.*'s Behaviour Change Wheel.⁵⁶

Meta-regression analyses

Mixed-effects meta-regression analyses were performed to explore the influence of implementation factors on heterogeneity observed from the univariate meta-analyses. The covariates entered into the analyses related to intervention characteristics or contextual factors. Covariates related to intervention characteristics included combinations of intervention functions (classified using the Behaviour Change Wheel by Michie *et al.*),⁵⁶ methods of delivery, intervention duration, and characteristics of those delivering the interventions. Covariates related to contextual factors included participant (population) characteristics, the study setting, follow-up duration, and the publication period of the study (1990s versus 2000s). Full definitions of these covariates are provided in Appendix 21. We conducted meta-regression analyses only for outcomes where high heterogeneity was identified and where there were at least 10 studies in the previous meta-analysis. The risk behaviour outcomes examined included: post-intervention data for fat intake, physical activity, weight (kg), and BMI; and dichotomous data for fruit/vegetable intake and physical activity.

For the analysis of dichotomous data on fruit and vegetable intake, length of follow-up explained all of the heterogeneity (adjusted $r^2=100\%$) and was found to be a statistically significant predictor of effect ($p=0.002$). Longer follow-up periods were associated with a reduced estimate of effect. Studies with follow-up periods of less than six months (slope=1.62; 95% CI 1.14 to 2.29; adjusted $p=0.076$), and 6-12 months (slope=1.54; 95% CI 1.26 to 1.89; adjusted $p=0.020$) had substantially lower effect estimates than studies that reported results at endpoint. The influence of follow-up in

studies with less than 6 months follow-up was less conclusive (i.e., the adjusted p-value was only approaching statistical significance). Fewer studies could be included in this meta-regression analysis resulting in less precision in the estimate. There was insufficient evidence to examine the impact of studies with beyond 12 months follow-up as only one study met this criterion. We examined whether the impact of follow-up time may be confounded by duration of intervention. Entering this variable into the meta-regression had negligible impact on the parameter estimate for follow-up time and it remained statistically significant.

For continuous outcome measures of physical activity, studies that included a combination of education, training, and enablement found that participants were more physically active (slope -0.39; adjusted p value=0.001) than studies that used other intervention content. This also explained a substantial magnitude of the heterogeneity (adjusted r^2 =66.25%).

For dichotomous outcome measures of physical activity, interventions with a combination of education, training, and persuasion were associated with reduced likelihood of meeting physical activity recommendations (slope 1.26; adjusted p value=0.14). This covariate was not statistically significant but it explained a substantial magnitude of the heterogeneity (r^2 =68.99%).

For a continuous outcome measure of change in weight, interventions that included education and training were associated with greater reductions in weight (slope -1.19, adjusted p value=0.04). This explained 50.29% of the heterogeneity.

3.3 Review 3 - Perceptions and experiences of multiple risk behaviour change in non-clinical adult populations, and the contexts in which changes occur: a thematic synthesis

3.3.1 Design and methods

The findings of this systematic review are reported with reference to a framework for reporting syntheses of qualitative health research.¹¹⁶ The following is a brief description of our methods; full details are in the protocol (Appendix 22).

The review focused on qualitative studies investigating multiple behaviour change including in the context of multiple risk behaviour interventions.

Box 3. Definitions for Review 3

Thematic synthesis: This approach is similar to thematic analysis (used in primary qualitative research) and involves identification of important or recurrent themes across a number of qualitative studies. It includes three progressive stages: 1) line-by-line coding of text; 2) development of overarching codes; and 3) generation of analytical themes.

Analytical theme: These themes are generated during the final stage of thematic synthesis; they are based on interpretations of the reviewers and are used to develop new interpretive constructs, explanations, and hypotheses.

Bioecological Model of Human Development: In this model individuals are considered to be at the centre of a system with four layers each of which represents a different aspect of the environment. These layers interact with the individual (their biological being) and impact the individual's development throughout their lifetime. They include: the microsystem (direct interactions in immediate settings); the mesosystem (relationships between different microsystems); the exosystem (aspects of structures within the microsystem which indirectly affect individuals); and the macrosystem (overarching cultural/societal values, customs, regulations and laws).

Eligibility criteria

Eligible studies reported use of qualitative methods to investigate people's perceptions and experiences of multiple risk behaviour change. The contexts in which any multiple risk behaviour changes had been successfully made were also of interest. We included studies of adult populations (aged 16 years and over). Studies that included at-risk populations were excluded as we did not want to duplicate a recent systematic review focusing on this group.¹¹⁷ There were no restrictions on the country where the study was performed.

Information sources

CINAHL, Embase, MEDLINE, PsycINFO, and Science Citation Index databases were searched from 1990 to November 2013 for articles published in English. The 1990 start date was used because preliminary searches showed that most of the multiple risk behaviour literature is both time- and context-dependent. The full search strategy is presented in Appendix 23. Electronic searches were supplemented by examination of the bibliographies of included studies. This manual search was conducted by one reviewer and checked by a second.

Selection of studies and data collection process

Two reviewers independently assessed full texts for inclusion. Data were extracted by one reviewer and checked by a second. There was no need to contact study authors for any missing data, because all data were sufficiently reported.

Data consisted of direct quotes from participants and/or statements (interpretations or descriptions) made by study authors about the participant data. The findings presented in subsection 3.3.2 combine both data types.

A standard data extraction form was used (Appendix 24); this was piloted on a selection of studies beforehand to ensure consistency across reviewers. Data were extracted using an inductive, line-by-line coding technique to assign relevant text of articles to initial codes. A full description of the process has been published by Thomas & Harden¹¹⁸ (further details reported below).

Risk of bias in individual studies

Two reviewers independently used Hawker et al.'s framework¹¹⁹ to critically appraise the included studies.

Synthesis of results

A large number of distinct methods of synthesis exist within secondary qualitative research.¹²⁰ Examples include meta-ethnography,¹²¹ meta-narrative,¹²² critical interpretive synthesis,¹²³ meta-study,¹²⁴ grounded theory,¹²⁵⁻¹²⁷ thematic synthesis,¹¹⁸ textual narrative synthesis,¹²⁸ and framework synthesis.^{129, 130}

In line with guidance on selecting qualitative synthesis methods,¹³¹ we chose to perform thematic synthesis. This is an inductive, aggregative method which is useful for addressing questions relating to a specific intervention review. It is seen to be more relevant to policymakers and designers of interventions than methods with a more constructivist orientation, such as meta-study, meta-narrative, meta-ethnography, and grounded theory.¹²⁰ Moreover, it is appropriate to apply thematic synthesis when only thin data (i.e., data that will not sustain interpretive approaches like meta-ethnography or grounded theory) are mostly available, as was the case in the current review. A definition of this method is provided in Box 3; further details of these methods are provided in the protocol (Appendix 22).

Initial codes identified during the data extraction process were combined where there was overlap (e.g., data relating to the impacts of depression, sadness, and fear combined with data on the impact of stress on lifestyle behaviours), into overarching codes (e.g., stress, emotions, and mental states).

Overarching codes were then examined and where there was overlap they were combined into analytical themes. During this process, codes and themes were progressively amended to fit the data.

In order to ensure the analytical themes were theoretically grounded, we categorised them using an adaptation of the Bioecological Model of Human Development.¹³² This also provided a framework for comparing the findings of this qualitative review with the findings of our other review of multiple risk behaviour interventions (see subsection 3.2.2).

One reviewer identified the overarching codes and analytical themes, and categorised the themes. Data, codes, and themes were then checked by multiple reviewers. The analytical themes were used to answer the research questions of the review; the overarching codes are presented as subthemes of the analytical themes (see subsection 3.3.2 and appendices 26 and 27).

3.3.2 Findings

Study selection

The searches identified 21,312 records, resulting in 14 studies (described by 15 articles) being included in the review (Figure 5).

Overview of the evidence

The included study articles were published between 2000 and 2013. Studies were conducted in the USA,¹³³⁻¹⁴² the USA and Canada,¹⁴³ and the UK.^{64, 89, 144, 145} A summary table of the study characteristics is presented below (Table 6); further details of the studies are presented in Appendix 25.

Participants in the three UK studies included prisoners,¹⁴⁴ South Asians aged 40 years or older,¹⁴⁵ and smokers taking part in a smoking cessation and weight management programme.^{64, 89} Among the 11 studies conducted in the USA and Canada, the populations of nine studies^{133-138, 140-142} were wholly or mostly women (72% to 100% per study) with varying contextual circumstances.

All of the studies reported participants' perceptions or experiences of making changes to more than one risk behaviour. Although all studies discussed barriers or facilitators of changing these behaviours, only two studies^{64, 141} reported how making changes in one risk behaviour affected changes in other risk behaviours.

Three studies discussed participants' experiences of previous multiple risk behaviour (lifestyle) interventions,^{64, 137, 141} one of which was linked to an RCT included in the effectiveness review.⁸⁹

The remaining studies explored participants' perspectives concerning past or future attempts to change risk behaviours and/or maintain healthy behaviours. Most studies discussed diet and physical activity. Six studies^{136-138, 140, 141, 143} relied on existing behaviour change theories or frameworks to interpret their findings.

Two studies were rated medium quality;^{134, 144} the others were rated high quality. A full breakdown of the results is provided in Appendix 26.

Thematic synthesis

Seven analytical themes were identified. Figure 6 presents these themes according to categorisations adapted from the Bioecological Model of Human Development.¹³²

Very little data relevant to the mesosystem level was found and the vast majority of data related to the microsystem level. As a result, no analytical themes were categorised at the mesosystem level.

Issues such as low incomes and poor conditions were categorised within the structural (macrosystem) level of the model, as their origins and remedies lie in the wider structure of society (e.g., the labour market and welfare system).

Each of the analytical themes had several subthemes. Sometimes study papers reported both types of data (participant quotes and authors' statements) for a particular finding. In other instances, they only reported one of these types of data.

To ensure brevity not all of the participant quotes and authors' statements can be presented. Instead, data that most clearly illustrate the overall findings are presented. Where no participant data were available for a subtheme, this has been stated in the relevant subsection. All extracted participant quotes and authors' descriptions/interpretations are presented in full in Appendix 27. Appendix 28 provides a more concise overview of the themes and subthemes identified.

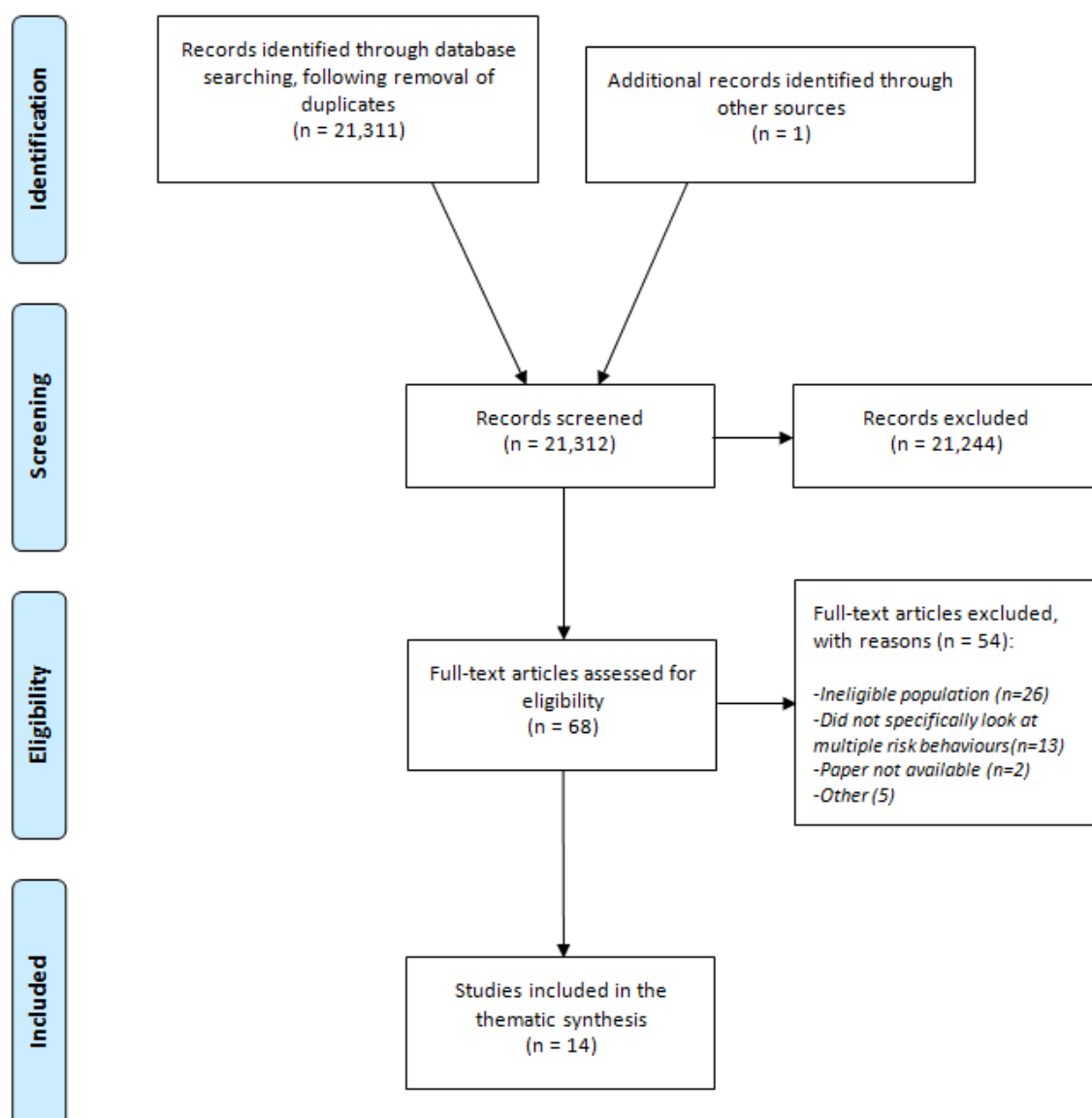


Figure 5. The review process.

Table 6. Study characteristics of the included studies (14 in total)

Study author/s, (year of publication) and country	Study aim	Participant characteristics	Sample size; setting	Risk behaviours discussed and details of any previous multiple behaviour change interventions received by participants	Contextual reason/s for discussing multiple risk behaviours	Data collection method; Method of analysis used; Theoretical model/s used to interpret findings
Bove & Olson (2008) ¹³³ USA	To identify factors contributing to overweight and obesity in deprived rural areas	Low-income mothers	N=28; Various (rural areas)	Diet, physical activity No intervention previously received	See study aim	Interviews; Grounded theory analysis; No theoretical model reported
Condon et al. (2008) ¹⁴⁴ UK (England)	To explore views on making healthy choices in prison	Prisoners	N=111; twelve prisons	Diet, physical activity, smoking, alcohol use No intervention previously received	To explore opportunities prisoners have and use for healthy choices in areas identified in the 2004 white paper, entitled 'Choosing Health'	Interviews; Thematic analysis; No theoretical model reported
Doldren & Webb (2013) ¹³⁴ USA	To identify whether knowledge or attitudes were related to motivations for healthy behaviour	Black women of working age	N=40; No setting details reported	Diet, physical activity No intervention previously received	USA obesity rates are higher in black women compared with white women	Focus groups; Thematic analysis; No theoretical model reported
Farooqi et al. (2000) ¹⁴⁵ UK (England)	To explore knowledge and attitudes to lifestyle risk factors for coronary heart disease	South Asians aged over 40 years	N=44; GP practices and community centres (urban area)	Diet, physical activity, smoking, alcohol use. No intervention previously received	South Asians have a higher risk of coronary heart disease in the UK than the general population	Focus groups; Content and thematic analyses; No theoretical model reported
Folta et al. (2008) ¹³⁵ USA	To explore knowledge and awareness of cardiovascular disease risks, identify barriers to healthy behaviours and develop intervention strategies	Sedentary women aged 40 years or more	N=38; Various (rural and urban areas)	Diet, physical activity No intervention previously received	Cardiovascular disease is the leading cause of death in women in the USA	Mostly focus groups; Framework analysis; No theoretical model reported
Gettleman & Winkleby (2000) ¹³⁶ USA	To generate ideas for designs of future cardiovascular disease interventions	Low-income women of African-American, Hispanic or White ethnicity	N=51; Various (rural and urban areas)	Diet, physical activity, smoking No intervention previously received	These groups are at high risk for cardiovascular disease. Few heart disease programs have effectively been implemented.	Focus groups; Thematic analysis; Social learning and empowerment theories
Greaney et al. (2004) ¹³⁷ USA	To explore motivations for fruit/vegetable intake and/or exercise, and strategies used to adopt or maintain these behaviours.	Adults aged 60 years and over	N=29; Various	Diet, physical activity SENIOR program; included behaviour-based manuals, newsletters, tailored reports and counsellor phone calls. Duration: 12 months	To better understand processes of change so that future interventions might be more effective.	Focus groups; Thematic analysis; Transtheoretical model used
Greaney et al. (2009) ¹³⁸	To identify barriers and facilitators for healthy weight management in college students.	University students	N=115; Online	Diet, physical activity, alcohol use No intervention previously received	Rapid weight gain commonly occurs in adults during their twenties.	Focus groups; Framework analysis; Social ecological model (Keller's ARCS model also

USA						used to guide focus group questions)
Higgins et al. (2006) ¹⁴³ USA and Canada	To identify social and economic contexts that shape behaviours related to heart health	Low income, lone mothers living on social assistance	N=38; No setting details reported	Diet, physical activity, smoking No intervention previously received	Low income, poor education, etc, predispose women to heart disease	Mostly focus groups; Framework analysis; McKinlay and Marceau's upstream-midstream-downstream framework
Kegler et al. (2008) ¹³⁹ USA	To explore how home and neighbourhood environments may affect healthy eating and physical activity	Adults aged 50 years or over	N=60; Participants' homes (rural areas)	Diet, physical activity No intervention previously received	See study aim	Interviews; Content and thematic analyses; No theoretical model reported
Koshy et al. (2012) ⁶⁴ Leslie et al. (2012) ⁸⁹ was the secondary paper for this UK (Scotland)	To explore whether participants of a multiple risk behaviour intervention perceived behavioural changes as being linked or discrete processes	Participants of smoking cessation classes	N=30; Venues of classes (urban area)	Diet, smoking, physical activity Previous intervention; included standard smoking cessation classes, nutritional advice and review sessions. Duration: 24 weeks	See study aim	Interviews; Thematic analysis; No theoretical model reported
Peterson et al. (2013) ¹⁴⁰ USA	To describe perceptions of healthy eating, physical activity and weight management.	Women residing in Midwestern rural areas	N=65; Community (rural area, no further details reported)	Diet, physical activity No intervention previously received	To improve the design and implementation of physical activity and weight management interventions	Focus groups; Framework analysis; Theory of planned behaviour
Russell et al. (2013) ¹⁴¹ USA	To identify facilitators and barriers to behavioural change during a healthy lifestyle intervention	Patients with inadequate access to healthcare	N=23; Community health centre (urban area)	Diet, physical activity, smoking The Healthy Living Program; included group support, health education, and organised group exercise. Duration: 11 months	See study aim	Focus groups; Framework analysis; Social ecological model
Thornton et al. (2006) ¹⁴² USA	To explore influence of social support on weight, diet, and physical activity-related beliefs and behaviours	Spanish-speaking Latino pregnant and post-partum women	N=10 dyads (one family member per woman also interviewed) Settings allowing for confidentiality (urban area)	Diet, physical activity No intervention previously received	Results were going to be used to help plan diabetes and obesity prevention interventions	Interviews; Thematic analysis; No theoretical model reported

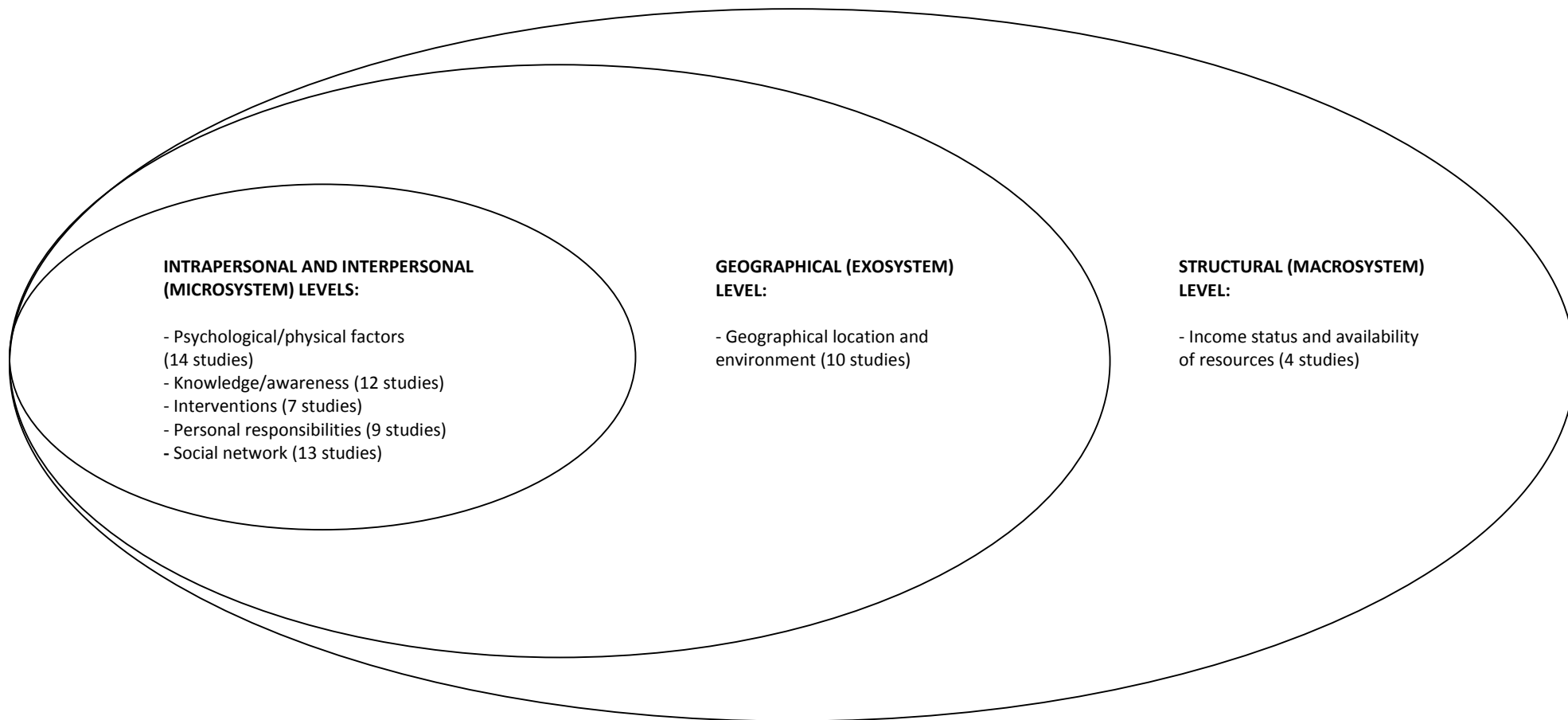


Figure 6. Analytical themes identified during the thematic synthesis, categorised afterwards (i.e., post hoc) according to the Bioecological Model of Human Development.¹³² Very little data relevant to the mesosystem level was found, and the vast majority of data related to the microsystem level. As a result, no analytical themes were categorised at the mesosystem level.

Intrapersonal (microsystem level)

- Psychological and physical factors (14 studies)

Perceived risk of future events (e.g., disease, death) (four studies)

Participants in two studies^{134, 141} had witnessed health-related events in friends or relatives and believed they should change their own lifestyles to reduce their risks for these events. One study also reported that participants felt dramatic relief (intense feelings towards a specific behaviour) *"watching relatives or friends die at a young age"* (Adult aged 60 years or older, p.29, Greaney et al., 2004 - USA).¹³⁷

Authors of another study¹³⁵ claimed that women expressed fatalism regarding risk for heart disease, due to family history. The seriousness of health-related events was not always realised.

"I've been there, and done that, been through two major heart surgeries, and I'm invincible." (Sedentary woman aged 40 years or older, p.4, Folta et al., 2008 - USA).¹³⁵

Perceived outcomes of healthy lifestyle behaviours (eight studies)

Perceived outcomes of adopting healthy behaviours were often positive. Psychological benefits included adjustment to new circumstances, feeling good, and improved self-esteem.^{137, 140, 141}

"Moving to a new house can cause adjustment problems. Exercise can help you through the adjustment." (Older adult aged 60 years or older, p.30, Greaney et al., 2004 - USA).¹³⁷

Many physical benefits were described; these included improvements in appearance, energy, general wellbeing, heart health, and health status.^{64, 134, 135, 137, 140, 142} Among participants of previous lifestyle interventions,^{137, 141} adopting a healthy lifestyle was perceived as being associated with longer life expectancy.

"...knowing that I need this at this time in my life...It's going to allow me probably to stay on this Earth a little bit longer to enjoy my family and stuff." (Patient from an underserved health centre, p.453, Russell et al., 2013 - USA).¹⁴¹

Some participants did not associate healthy behaviours with health benefits.^{140, 145} One USA-based study¹⁴⁰ claimed that a lack of immediate gratification associated with lifestyle changes resulted in a defeatist attitude among women.

Motivation for lifestyle behaviours (10 studies)

Lack of motivation sometimes prevented initiation and/or maintenance of healthy lifestyle behaviours.^{89, 133, 134} Among participant groups who had previously taken part in lifestyle interventions, motivational factors included wanting to be healthier for other people (e.g., children), fear of illness and incapacity, a strong sense of self-efficacy (to persevere with healthy behaviours), physical and psychological benefits following healthy behaviour change, or a medical event (e.g., a new diagnosis).^{64, 137, 141}

Among groups who had not received interventions,^{136, 142} motivational factors included perceived physical benefits of healthy behaviours and the behavioural preferences of a spouse.

"What is my motivation?...feeling good...feeling healthy. It's my first motivation. And my second motivation...is my husband...because he likes athletics so much." (Latino pregnant or postpartum woman, p.101, Thornton et al., 2006 - USA).¹⁴²

De-motivating factors among groups who had not received interventions included: laziness; procrastination; lack of perceived benefits of healthy behaviours; rebelliousness against being told what to do; boredom; and lack of enjoyment associated with healthy behaviours.^{134-136, 139, 140}

Caring about what other people and society think (three studies)

In two USA-based studies,^{135, 140} perceptions of what others might think discouraged women from attending gyms or fitness centres. At the same time, eating healthily to please others could facilitate a healthy lifestyle.¹⁴²

"Yes, he likes it if I eat more healthy...it makes me feel good that he's happy." (Latino pregnant or postpartum woman, p.100, Thornton et al., 2006 - USA).¹⁴²

Authors of one study¹⁴⁰ reported that residing in a rural community had influenced women's perceptions of weight and being overweight was considered normal.

"I am no different than any other woman in the area...I may be overweight, but I am not self-conscious about it in town. I am normal." (Midwestern rural woman, p.77, Peterson et al., 2013 – USA).¹⁴⁰

Will power and discipline (seven studies)

Some participants believed that will power and discipline are needed in the maintenance of healthy lifestyle behaviours.^{134, 137, 139} Studies also demonstrated that a lack of will power and discipline could hinder healthy behaviours.^{135, 136, 138, 141}

"And the healthy foods are always there. You know, you can lead a horse to water but can't make him drink. I try to cook healthy and try to have healthy things...but I like fried foods too, so it's hard." (Sedentary woman aged 40 years or older, p.5, Folta et al, 2008 - USA).¹³⁵

Stress, emotions, and mental states (seven studies)

Among six USA-based studies,^{133, 137, 138, 140, 141, 143} stress, negative emotions and mental states hindered healthy behaviours. These emotions/mental states included depression and frustration.

"I believe being depressed resulted in being unmotivated to exercise, or do much besides eat and watch TV..." (Midwestern rural woman, p.78, Peterson et al., 2013 - USA).¹⁴⁰

"If you become frustrated or if you lose your job...or if there is a downsize or your hours are cut, that affects you...So now you're at, damn, now okay, what am I gonna do. And it sure in hell ain't exercising." (Patient from an underserved health centre, p.456, Russell et al., 2013 - USA).¹⁴¹

University students reported *"being bored"* as a barrier to healthful weight management.^{138 (p.283)} Stress, emotions, and mental states could lead to an increase in risk behaviours; this was reported by UK prisoners,¹⁴⁴ and among university students and low-income women in the USA and Canada.^{138, 143}

"The emotions that affect my health are sadness, fear, and overwhelmness... they created an unhealthy lifestyle, such as eating poorly, not exercising..." (Low-income lone mother, p.225, Higgins et al., 2006 – USA and Canada).¹⁴³

Authors of another UK-based study¹⁴⁴ reported that some prisoners said using the gym was a coping strategy. Other study authors¹⁴³ reported that low-income lone mothers found that smoking and eating junk food helped them to cope with stress and anxiety.

Two studies^{143, 144} reported that perceptions of prejudice or discrimination can negatively influence people's lifestyles and self-feeling.

*"Looking down on people on welfare. Of their being disgraced – embarrassed by their life situation that's what [contributes to patterns of risky behaviour]." (Low-income lone mother living on social assistance, p.229, Higgins et al., 2006 – USA and Canada).*¹⁴³

In UK prisons, authors reported that older prisoners said they were prevented from using the gym because they were not considered adequately fit to do so.¹⁴⁴ According to the authors, these prisoners felt that this was an unfair exclusion stemming from a fear of litigation.

Impact of health status and physiological factors (three studies)

Authors of one USA-based study¹⁴⁰ reported that health conditions hindered healthy behaviours among women. These conditions related to both physical and mental health.

*"...I have arthritis, which makes it impossible to exercise. That resulted in becoming depressed...which added to the weight and inability to exercise." (Midwestern rural woman, p.78, Peterson et al., 2013 - USA).*¹⁴⁰

Physiological factors could hinder or facilitate healthy behaviours. Among women in a USA-based study,¹³⁵ barriers included hunger when trying to cut down on portion sizes, and not liking fruit and vegetables. A physiological barrier was also described by a participant in a UK-based study.

*"When I first stopped the smoking I couldn't stop eating sweet things..." (Smoking cessation class participant, p.8, Leslie et al., 2012 - UK).*⁸⁹

Another paper on the same UK study⁶⁴ described physiological benefits from smoking cessation during a lifestyle change intervention. These included improved breathing which encouraged physical activity and better taste perception which increased appreciation of subtler tastes (e.g., fruits and vegetables).

- Knowledge/awareness (12 studies)

Knowledge/awareness about risk behaviours and disease (seven studies)

Knowledge deficits sometimes prevented participants from practicing healthy behaviours.^{135, 136, 138, 142, 145} None of these participants had previously taken part in lifestyle interventions.

Studies also examined people's knowledge and awareness about cardiovascular disease risk, weight status, and associated lifestyle behaviours.^{133, 135, 136, 143, 145} One USA-based study reported that during times of food shortages, low-income women would save nutritious foods for their children and subsist on *"just liquids"* or *"coffee and water."*^{133 (p.67)} These liquids were reported by the authors as being sugar-sweetened, and the unseen calories seemed to confuse people.

*"I don't know why she has weight problems 'cause she starves herself half the time." (Low-income mother, p.71, Bove & Olsen, 2008 - USA).*¹³³

Among groups at higher risk of cardiovascular disease, most were aware of their risks.^{135, 136, 143, 145} However, two studies of South Asians in the UK¹⁴⁵ and sedentary women in the USA¹³⁵

demonstrated that participant groups did not always have accurate knowledge regarding the effects of behaviours on disease risk.

"Is alcohol bad for the health?" (South Asian aged 40 years or older, p.296, Farooqi et al., 2000 - UK).¹⁴⁵

Authors of the USA-based study also reported that sedentary women had misconceptions about the effects of foods on heart health (e.g., garlic, spices, coffee).¹³⁵

Perceived importance of healthy lifestyle behaviours (three studies)

Two USA-based studies showed that university students¹³⁸ and patients with inadequate healthcare access¹⁴¹ felt that it was important to prioritise healthy eating and be aware of unhealthy habits. In another study,⁶⁴ participants discussed the importance of maintaining multiple healthy behaviours.

"It's one thing cutting out the cigarettes to cut out heart disease, but you're just going to kill yourself anyway if you're eating all those fatty foods." (Smoking cessation class participant, p.5, Koshy et al., 2012 - UK).⁶⁴

"Everything works in as one thing, you know, you're not smoking, you're eating healthy food, you're on a control diet or whatever it is and you're exercising – it's not just four different things." (Smoking cessation class participant, p.5, Koshy et al., 2012 - UK).⁶⁴

Communication with health professionals/instructors and welfare staff (five studies)

Authors of one rural USA-based study¹⁴⁰ stated that communication with health professionals was insufficient and left people with a knowledge deficit regarding weight or the consequences of unhealthy behaviours. In another study based in the USA and Canada,¹⁴³ authors reported that welfare staff provided conflicting information to low income, lone mothers regarding their right to access services (e.g., financial assistance, food).

Other, urban USA-based studies^{141, 142} reported that communication with health professionals or instructors encouraged uptake of healthy lifestyle behaviours.

"The doctor told her...look Isabel, if you get pregnant again, please walk. Otherwise, you are going to struggle again." (Husband of Latino pregnant or postpartum woman, p.101, Thornton et al., 2006 - USA).¹⁴²

Authors of one study¹⁴¹ reported that during a previous lifestyle intervention, facilitators to behaviour change included the skills, personal care, and attention provided by the instructor and coordinator. Similarly, encouragement from intervention staff was reported in a UK-based study.

"...still smoking and you're a failure...there's not that negativity at all, whereas it's always, 'Yea, you are but you can still do this'..." (Smoking cessation class participant, p.8, Leslie et al., 2012 - UK).⁸⁹

Strategies used to maintain healthy lifestyle behaviours (five studies)

Diet-related strategies helped various participants refrain from overeating and/or eating unhealthily.^{134, 137, 138, 145} These strategies included preplanning meals, not buying unhealthy foods, using healthy food substitutions, healthier cooking methods, and portion control. Participants from only one of these studies¹³⁷ had previously taken part in a lifestyle intervention.

"We now grill our food rather than fry." (South Asian aged 40 years or older, p.295, Farooqi et al., 2000 - UK).¹⁴⁵

Study authors reported that sedentary women in the USA mentioned parking farther away from stores and taking stairs as strategies for carrying out physical activity.¹³⁵

Impact of culture and religion on knowledge/awareness, beliefs, and lifestyle behaviours (four studies)

Cultural background could limit knowledge/awareness of participants for what was considered healthy or unhealthy behaviour-wise.^{134, 145} Cultural traditions encouraged consumption of unhealthy foods^{141, 145} and hindered physical activity.¹⁴⁵ Participants' awareness of this and their perceptions of the benefits of changing these traditions differed.

"That was a great change for us. Especially for us African Americans...It was bacon for breakfast, so you know we were raised that way. Fried everything..." (Participant with inadequate healthcare access, p.456, Russell et al., 2013 - USA).¹⁴¹

"Our diet is in fact better than some, it is the worries in a foreign country that is the main reason for ill health." (South Asian aged 40 years or older, p.295, Farooqi et al., 2000 - UK).¹⁴⁵

Additionally, study authors reported that participants mentioned faith or spirituality as a facilitator for behaviour change during a previous lifestyle intervention.¹⁴¹ Others demonstrated that beliefs can hinder healthy behaviours.^{142, 145}

"They say when one eats watermelon, jicama, beans, it's real bad after the pregnancy, the birth...the womb gets cold...they tell me that you shouldn't even eat avocado...it's very bad because it's too cold." (Latino pregnant or postpartum woman, p.99, Thornton et al., 2006 - USA).¹⁴²

- Interventions (seven studies)

Perceptions and ideas relating to lifestyle interventions (seven studies)

In this subset of studies, only two^{89, 141} included participants who had previously participated in a lifestyle intervention. Among the five other studies participants wished to perform healthy behaviours, but felt they lacked the skills/strategies to do so. This was reported by female university students,¹³⁸ low-income women,¹³⁶ sedentary women,¹³⁵ (all based in the USA) and South Asians in the UK (Farooqi et al., 2000).¹⁴⁵

"Lots have no idea (on how to cook differently)." (South Asian aged 40 years or older, p.295, Farooqi et al., 2000 - UK).¹⁴⁵

Studies also reported participants' suggestions for future interventions.^{135, 136, 138} Suggestions included presentation of health information in a group/workshop format and use of visual components and images.¹³⁶ Study authors also reported that low-income women wanted to see testimonials from "normal women" describing how they had changed their behaviour, alongside factual commentaries by physicians.^{136 (p.447)}

Among low-income women,¹³⁶ suggested incentives included free child care and meals, and financial incentives (e.g., cash, food vouchers). Authors of another study¹³⁸ reported that university students thought that additional opportunities (e.g., group events), resources (e.g., free gym membership), and social support would facilitate physical activity.

Several programmes were described as being helpful to local community groups in the USA and Canada.¹⁴³ According to the authors, these programmes provided instrumental support,

companionship and mentoring, and opportunities to improve health-related knowledge and life skills. During a previous intervention, health centre patients learned specific nutrition information and skills; the study authors reported that one of these (reading nutrition labels) facilitated lifestyle changes among participants.¹⁴¹ In another study, a participant noted the benefits of using a pedometer in a previous intervention.

"It's quite nice to see how many steps you've done each day..." (Smoking cessation class participant, p.8, Leslie et al., 2012 - UK).⁸⁹

The process of changing multiple risk behaviours (two studies)

Most data on the process of changing behaviours came from a UK-based study⁶⁴ where participants received a smoking cessation course and a weight management intervention. The other study¹⁴¹ included people with inadequate healthcare access in the USA who received an intervention for diet, physical activity and smoking.

In the UK-based study, some participants reported that the change processes for multiple behaviours were discrete. The authors explained that changes were perceived to be easier to make when broken down into manageable chunks and when different behavioural changes were perceived as being separate tasks.

"Smoking was the last thing to deal with, I've dealt with the drinking, dealt with the weight, dealt with the smoking." (Smoking cessation class participant, p.5, Koshy et al., 2012 - UK).⁶⁴

Most participants in this study claimed that smoking, diet, and physical activity were inextricably linked. According to the authors, participants felt that a multiple behaviour change focus was beneficial because it diluted attention from each individual difficult shift.

"My daughter says 'you don't think it's a bit much to focus on the two at the same time' but I find it's actually quite good because it takes my mind [off]. If I'm thinking about one, I'm not thinking about the other." (Smoking cessation class participant, p.5, Koshy et al., 2012 - UK).⁶⁴

Additionally, study authors reported that participants felt that psychological benefits (e.g., improved confidence, increased self-efficacy) perceived while making one behavioural change encouraged them to make other healthy behavioural changes. Similarly, the other study¹⁴¹ claimed that participants described pride and self-esteem from reaching goals; this was said to lead to a sense of competence that encouraged maintenance of healthy changes. The UK-based study⁶⁴ reported a similar effect with physiological benefits from smoking cessation.

- Personal responsibilities (nine studies)

Being a role model and responsible for others (five studies)

In the five USA-based studies^{134, 136, 137, 140, 141} discussing role modelling and responsibility for others 72% to 100% of the participants were women. Thus, most of the data on this theme derives from and relates to women and their roles within the family.

Four studies demonstrated that participants felt responsible for their families and considered themselves as playing a central, key role within family life.^{134, 137, 140, 141} One study¹⁴⁰ claimed that this caretaker role puts unique demands on Midwestern rural women to ensure that their families ate healthily.

“My husband’s 40. I have to show him. My kids see me prepare stuff. I don’t fry anything. And I told them why and they see it. They’re learning it. They’re being raised that way...” (Black woman of working age, p. 36, Doldren & Webb, 2013 - USA).¹³⁴

“I am a strong woman and I am the glue that holds my family together.” (Participant with inadequate healthcare access, p.455, Russell et al., 2013 - USA).¹⁴¹

With some participants, this sense of responsibility encouraged them to improve their own lifestyle behaviours.^{137, 141} However, one study¹³⁶ suggested that low-income women might prefer to change their behaviours for their own sake rather than their children’s, because they already focused a lot of their energy and time on their children.

Competing time demands (seven studies)

A very common finding was that participants had busy schedules and sometimes they felt they did not have enough time to carry out healthy lifestyle behaviours.^{135, 136, 138-141, 145} This related mostly to mothers with children living at home.

“There is no time for exercise. Home life is too busy.” (South Asian aged 40 years or older, p.296, Farooqi et al., 2000 - UK).¹⁴⁵

“...being a single parent, I am always on the go...It is hard for me to say I am going to the gym today because she may have something at the school...” (Participant with inadequate healthcare access, p.456, Russell et al., 2013 - USA).¹⁴¹

Competing time demands also made it difficult for university students to obtain or prepare healthy meals or to exercise,¹³⁸ or for families to be physically active together.¹³⁹

Disruption to routine (two studies)

Two studies^{137, 141} reported how disruptions to routine prevented people from fully participating in lifestyle interventions in the USA. Positive reasons for adults aged 60 years or over not performing healthy behaviours included babysitting, having company, and travelling.^{137 (p.29)} A negative perception was reported in the other study.¹⁴¹

“I was going regularly [to the Healthy Living Program] with my daughter...then I get this call from my work, are you interested [in taking on a new case as a home health aide]?...then for the family to just take him away...I didn’t finish the Healthy Living Program...” (Participant with inadequate healthcare access, p.456, Russell et al., 2013 - USA).¹⁴¹

- Social network (13 studies)

Family habits during childhood and adolescence (five studies)

Four studies demonstrated that family habits during childhood and adolescence could encourage people to learn healthy lifestyle habits.^{134, 137, 141, 145}

“We grew up eating a lot of vegetables, so that has a lot to do with it too. Whatever your family grows up eating...” (Participant with inadequate healthcare access, p.455, Russell et al., 2013 - USA).¹⁴¹

Authors of one USA-based study¹³⁷ reported that older adults frequently said they had always consumed a diet high in fruits and vegetables and been active, and mentioned parents as role models.

Unhealthy lifestyle habits could also be learned from family members during childhood/adolescence.^{135, 141, 142, 145}

"...I quit smoking. I come from a family where we all smoke...I think a lot of us have backgrounds where what we eat is part of our culture and part of our way of life." (Participant with inadequate healthcare access p.456, Russell et al., 2013 - USA).¹⁴¹

In one USA-based study,¹³⁵ authors reported that sedentary women found it difficult to change eating patterns they had developed during childhood. Others claimed that family traditions surrounding food could act as a barrier or a facilitator to healthy lifestyle change during a previous intervention.¹⁴¹

Influence from family and/or friends in adulthood (nine studies)

Family and/or friends positively influenced lifestyle behaviours through encouragement and companionship for healthy eating and physical activities.^{137, 138, 140-143}

"Let's go walk, get some exercise...my husband is the one that motivates me the most." (Latino pregnant or postpartum woman, p.101, Thornton et al., 2006 - USA).¹⁴²

"...my sister came over and asked me if I wanted to go [to the HLP] and I said no. My legs ache a little bit. And she said well that's why you need to go. And they don't ache anymore." (Participant with inadequate healthcare access, p.455, Russell et al., 2013 - USA).¹⁴¹

Study authors reported that university students said they more likely to go to the gym if they went with a friend and female students said their friends provided social support to eat healthfully.¹³⁸

Studies also demonstrated that a lack of encouragement and companionship from family and/or friends acted as a barrier to healthy lifestyle behaviours (Kegler et al., 2008; Peterson et al., 2013; Russell et al., 2013; Thornton et al., 2006).¹³⁹⁻¹⁴² These studies mostly included women in the USA.

"My husband says I look just fine. He does not think I should spend time away from the family to take a walk...and he will not go with me." (Midwestern rural woman, p.78, Peterson et al., 2013 - USA).¹⁴⁰

One study¹³⁹ reported that family physical activities were hindered by laziness, reduced motivation since the children had grown, differing exercise preferences, spouses refusing when asked, physical limitations, and caretaking responsibilities.

Family and/or friends also influenced eating behaviours by dictating food choices and meal times.^{133, 135, 139-142} This had both positive and negative effects.

"I have a wife who does the shopping and cooking. She is health conscious." (Adult aged 60 years or older, p.29, Greaney et al., 2004 - USA).¹³⁷

"Sometimes it's hard that there are other things in your house that you don't need to eat or whatever. Like I would say to my partner why don't you just hide that?...And she wouldn't do that." (Participant with inadequate healthcare access, p.456, Russell et al., 2013 - USA).¹⁴¹

One study¹⁴² reported that being alone or worrying about husbands when they were not at home led Latino pregnant or postpartum women to under- or overeat, or have irregular eating patterns.

"She worries a lot about me...if I don't eat before leaving the house, she will not eat either." (Husband of Latino pregnant or postpartum woman, p.100, Thornton et al., 2006 - USA).¹⁴²

Support groups (three studies)

Studies reporting on the effects of support groups emphasised that advice, knowledge, and social support gained at these groups helped participants to initiate and/or maintain healthier lifestyle behaviours.^{89, 136, 141}

"...once I talked to a lady-we have a group, and she told me what is good to eat and what things are bad...how many times you eat at McDonalds a week....Now I drink a lot of water so I fill up. And then I eat some salad and buy a little hamburger." (Low-income woman, p.447, Gettleman & Winkleby, 2000 - USA).¹³⁶

In one study, group members' strategies for overcoming common barriers were cited as being more beneficial than those provided by health care professionals because they were given by people who had "been there."^{141 (p.455)} The authors of this study reported that some participants felt a sense of accountability to the group; this was also reported by a participant in another study.

"Meeting other individuals I think has been a bit of a challenge as well you don't want to let the rest of the group down." (Smoking cessation class participant, p.8, Leslie et al., 2012 - UK).⁸⁹

Social occasions (four studies)

Among USA-based studies, social occasions were associated with unhealthy behaviours such as overeating, consumption of unhealthy foods, and smoking in various groups of women^{135, 136, 142} and university students.¹³⁸

"You don't just quit smoking, you also quit your whole social life. You miss a lot of things besides the smoke." (Low-income woman, p.444, Gettleman & Winkleby, 2000 - USA).¹³⁶

Studies reported that participants (e.g., Latino pregnant/postpartum women, sedentary women, university students) felt under pressure to overeat or eat unhealthily on social occasions, and this sometimes related to pleasing others.^{135, 138, 142} In one study,¹³⁸ authors reported that university students spoke of weight gain resulting from calories in alcohol and "drunk eating" (when fattening foods are eaten in excess during intoxication).

Geographical (exosystem) level

- Geographical location and environment (10 studies)

Access to physical activity spaces and equipment (six studies)

Among USA-based studies in rural areas, low-income mothers,¹³³ Midwestern women,¹⁴⁰ and adults aged 50 years or older¹³⁹ felt that walking was restricted by a lack of access to sidewalks and few streetlights. Study authors also reported that the conditions of roads during spring and winter made walking difficult for low-income mothers with young children and strollers, or with health problems that inhibited mobility.¹³³

One study conveyed that rural areas could facilitate physical activities.

"I live in the country, and I have all the room in the world to walk, get around." (White woman aged 50 years or older, p.5, Kegler et al., 2008 - USA).¹³⁹

Similarly, authors of another study¹³⁸ reported that students said the geographic layout of their university campus made it easy to maintain a healthful weight and that parking shortages forced them to walk or cycle more.

Access to facilities and fitness equipment was discussed.^{138, 141, 144} Although no participant data were provided, authors' interpretations revealed the differences in access that can occur across different environments and contexts. Male university students reportedly said that commitments to athletic teams resulted in them being physically active.¹³⁸ In UK prisons, some inmates were able to go outside and walk every day; other prisons' exercise times were regularly cancelled or generally limited (particularly in high security prisons).¹⁴⁴ People with inadequate healthcare access in the USA claimed that costs of athletic footwear and gym membership acted as barriers to physical activity during a previous lifestyle intervention.¹⁴¹

Access to healthy foods (nine studies)

In six USA-based studies^{133, 135, 138-141} barriers to healthy food access were reported in relation to availability and costs of healthy foods within stores.

"Because of the price of them we don't...I like apples and bananas, and what not...but we don't eat them all the time." (Black man aged 50 years or older, p.7, Kegler et al., 2008 - USA).¹³⁹

Among these studies, those conducted in rural areas mentioned long distances from discount grocery stores, a lack of health food stores, and costs associated with transportation.^{133, 135, 139, 140}

"The grocery store is about 15 miles away. I shop once a week. Between the time and the gas it would take to go more often, I simply cannot." (Midwestern rural woman, p.78, Peterson et al., 2013 - USA).¹⁴⁰

Two studies^{135, 139} also suggested that rural areas had easy access to healthy foods.

"I don't think it's hard to get healthy foods, especially in an area where, a rural area where a lot of farming go...It's easy to get fruit or, you know, than less healthy foods." (Black man aged 50 years or older, p.6, Kegler et al., 2008 - USA).¹³⁹

Authors from one of these two studies reported results from an audit, which showed that most heart-healthy foods (e.g., wholegrain products, fruits and vegetables) are readily available in major supermarkets in rural areas (Kansas and Arkansas).¹³⁵ The authors reported that women in this study felt that fresh produce was not as readily available in the winter.

In addition to characteristics related to grocery stores, studies reported other environmental characteristics that influenced participants' food intake (e.g., when in prison, regularly eating at university cafeterias, or visiting food banks).^{138, 142-144} Sometimes this was beneficial, because it made it possible to eat healthily (e.g., on university campuses)¹³⁸ and have regular meal times (e.g., in UK prisons).¹⁴⁴ However, sometimes healthy foods could be difficult to obtain, were provided in inadequate amounts, or foods provided were unhealthy.^{138, 142-144}

"If you have ever checked out what the [food banks] give in their bags of groceries to the poor... high fat, highly processed, high in sugar and chemicals – high risk foods!" (Low-income lone mother living on social assistance, p.225-226, Higgins et al., 2006 – USA and Canada).¹⁴³

Influence of local environment on smoking and alcohol use (four studies)

Passive smoking was highlighted as an issue, both in UK prisons¹⁴⁴ and within homes in the USA.¹⁴¹

"...You grew up smoking cigarettes even before you put one to your mouth because it was going on so heavily..." (Participant with inadequate healthcare access, p.456, Russell et al., 2013 - USA).¹⁴¹

In the UK-based study,¹⁴⁴ the authors reported that non-smoking prisoners said that passive smoking was a problem, and some thought it should be banned in prisons. According to the authors, when a Young Offender's institution imposed a smoking ban, some prisoners felt that stopping smoking was easier than previously thought. Others felt that stress levels increased as a result.

The authors of the UK-based study reported that prisoners' described access to smoking cessation courses and nicotine patches varied. Barriers for access included long waiting lists and unavailability of staff in charge of the courses. Prisoners who were drug and alcohol misusers were reported as having described a lack of help for alcohol addiction in prison and difficulties adjusting to life outside prison following release.

"There's no help for people that's got a problem with drink detox pack and that's it." (Prisoner, p.161, Condon et al., 2008 – UK).¹⁴⁴

Similarly, authors of a USA-based study including low-income women¹³⁶ reported that smoking cessation was difficult; reported barriers included loss of the social outlet that smoking provided and a lack of interventions and resources for smoking cessation.

Personal safety (three studies)

One study based in the USA and Canada¹⁴³ reported that low-income lone mothers felt that the issue of neighbourhood safety was a barrier to outdoor walking. Other studies were more specific and reported that loose dogs, other people, and speeding traffic hindered walking in rural areas of the USA.^{139, 140} However, traffic was not always perceived as a safety issue in these areas.

"It's in a rural area, so we can get out and walk on the street and not be worried about vehicles because we don't have them, the traffic is very slow." (White woman aged 50 years or older, p.5, Kegler et al., 2008 - USA).¹³⁹

Weather (three studies)

Among USA-based studies, authors reported that weather was a barrier to physical activity among women in rural areas,^{135, 140} and among participants with inadequate healthcare access in an urban area.¹⁴¹

"No matter how much I try to stay active, you simply cannot walk outside during the winter. The roads are icy and the snow is seldom removed efficiently..." (Midwestern rural woman, p.78, Peterson et al., 2013 - USA).¹⁴⁰

During a previous lifestyle intervention, authors reported that weather prevented participants from carrying out outdoor activity and travelling to-and from the intervention.

"We had Rochester WalkFit, but that only lasted 3 weeks, we kept having to postpone because of bad weather." (Participant with inadequate healthcare access, p.454, Russell et al., 2013 - USA).¹⁴¹

Structural (macrosystem) level

- Income status and availability of resources (four studies)

Influence of low or unstable income on lifestyle behaviours (four studies)

One USA-based study¹³³ explored the impact of food insecurity on low-income mothers' eating behaviours. This occurs when there are limitations or uncertainty regarding the availability of nutritionally adequate, safe foods, or a person's ability to acquire these foods in socially acceptable ways.¹⁴⁶ The authors of this study claimed that during food shortages, women gave the nutritious food to their children and on days they did not eat, they relied on "just liquid" or "coffee and water."^{133 (p.67)} Food insecurity sometimes led to erratic eating patterns.

"Therica: I go hungry for like two days and then I'll eat...then when I do eat it's big meals that I eat.

Interviewer: Okay, so you're like making, feel like you're making up for lost meals.

Therica: Yeah. 'Cause I do it a lot, so...Like once a week maybe." (Low-income mother, p.67, Bove & Olsen, 2008 - USA).¹³³

Although other studies did not refer to food insecurity, other USA- and Canada-based studies suggested that mothers might not always have sufficient resources to eat healthily.^{142, 143} For example, authors of one study¹⁴³ reported that low-income lone mothers regularly sacrificed fruits and vegetable for their children's consumption.

A further potential consequence of low income was that the cost of healthy foods discouraged people from buying them and they sometimes purchased unhealthy foods instead because they were cheaper.^{138, 142}

3.4 Integrating findings from the three reviews

3.4.1 Design and methods

In an attempt to generate more meaningful and useful evidence for policy makers we draw together the findings from our three systematic reviews: of observational studies on the clustering and co-occurrence of risk behaviours (section 3.1); of evaluative studies of interventions to reduce multiple risk behaviours (section 3.2); and of qualitative studies on exploring people's perceptions and experiences of attempting to change behaviours (section 3.3).

Box 4. Definitions for the integration of review findings

Co-occurrence of risk behaviours: Concurrent engagement in two or more risk behaviours where the risk behaviours co-occur independently. This is assessed in two main ways: prevalence of specific risk behaviour combinations or prevalence of risk indices which sum the number of risk behaviours.¹

Clustering of risk behaviours: Concurrent engagement in two or more risk behaviours where associations exist between the co-occurring risk behaviours. This is assessed using standard statistical techniques for identifying associations (e.g. logistic regression, prevalence odds ratios) or more advanced techniques that identify clusters based on patterns of response to multiple items (e.g. latent class analysis, cluster analysis).¹

Bioecological Model of Human Development: Definition provided in Box 3.

Although there is agreement on how to conduct evidence syntheses of quantitative studies^{58, 147} and qualitative studies^{118, 121} consensus has yet to be reached on how best to conduct mixed methods syntheses (the integration of findings from quantitative and qualitative studies). Approaches include

critical interpretative synthesis, framework synthesis, realist synthesis, and narrative synthesis¹⁴⁸ but there are relatively few examples where these approaches have been applied in practice. Attempts to integrate the findings from different types of quantitative studies (e.g., observational, experimental) with the findings from qualitative studies are also rare. To our knowledge no previous reviews have sought to integrate distinct but related types of evidence on multiple risk behaviours.

We have two main aims. Firstly, to assess whether the combinations of risk behaviours (clustering and co-occurrence) identified in Review 1 have been the targets of interventions evaluated in Review 2. Secondly, to examine whether the content of intervention studies (included in Review 2) reflects or addresses the barriers and facilitators of behaviour change as identified in Review 3.

Comparing risk behaviours targeted in intervention studies (Review 2) with clustering and co-occurrence findings identified in observational studies (Review 1)

We applied an approach^{149, 150} originally developed to integrate the findings from quantitative and qualitative studies to two distinct types of quantitative data. We mapped the risk behaviours targeted in the 50 intervention studies to the risk clusters identified in our synthesis of 30 observational studies (see Table 7).

This enabled us to address the following questions:

1. Which combination of risk behaviours were most commonly targeted in intervention studies (based on data from Review 2)?
2. What evidence exists on the co-occurrence and clustering (based on data from Review 1) for each risk behaviour combination targeted in intervention studies?

To reflect on whether risk behaviours with strong evidence of clustering or co-occurrence have been targeted in intervention studies and to examine whether there was strong rationale (in terms of evidence of clustering or co-occurrence) for selecting the risk behaviours targeted in intervention studies (most intervention studies do not report why particular combinations of behaviours are selected).

Comparing content used in intervention studies (Review 2) with themes identified in qualitative studies (Review 3)

Our approach^{149, 150} to integrating quantitative and qualitative data involved mapping the content of multiple risk behaviour interventions (Review 2) to themes relating to barriers and facilitators of behaviour change identified in our synthesis of qualitative studies (Review 3).

We used the Social-Ecological Framework to explain and interpret the findings. This approach proposes multiple levels of contextual factors (both immediate and distal) that impact on people's engagement in risky/unhealthy behaviours.¹⁶ Themes from the review of qualitative studies (Review 3) were grouped into four overall categories/levels: intrapersonal (microsystem), interpersonal (mesosystem), geographical (exosystem), and structural (macrosystem). These categories were formed by adapting terms and concepts used in the Bioecological Model of Human Development.¹³² We used a methodological and conceptual matrix to integrate findings from our syntheses of 51 RCTs on the effectiveness of multiple risk behaviour interventions (subsection 3.2.2) and themes which emerged from the synthesis of 14 qualitative studies (subsection 3.3.2). We then applied a set of questions to the data:

1. a) Did intervention studies (Review 2) address themes identified in the qualitative studies (Review 3)?
1. b) If so, did these studies address the themes (based on intervention functions classified using the Behaviour Change Wheel⁵⁶)?
2. Did the intervention studies report any challenges that influenced the delivery of the interventions?
3. If the themes suggested in qualitative studies were not sufficiently taken into account in intervention studies, what intervention content might future studies consider using in a UK context?

Next, we summarised the findings from the methodological and conceptual matrix to identify matches between intervention content (quantitative studies) and themes highlighted in the qualitative synthesis, and also to identify research gaps.¹⁵⁰

Where intervention studies did not appear to address the themes identified in qualitative studies, we categorised relevant behaviour change techniques targeted at the barriers or facilitators identified by the qualitative studies that could be used in future research.

We focused on the nine intervention functions proposed by the Behaviour Change Wheel.⁵⁶ To allow for more specific suggestions on intervention techniques we used the CALO-RE taxonomy of 40 behaviour change techniques¹⁵¹ designed specifically for interventions to change physical activity and healthy eating behaviour (the most commonly targeted behaviour combination in intervention studies).

3.4.2 Findings

Comparing risk behaviours targeted in intervention studies (Review 2) with findings of co-occurrence and clustering in observational studies (Review 1)

Table 7 summarises the combinations of risk behaviours targeted in our review of intervention studies and their rationale. Surprisingly, only four studies explicitly mentioned the clustering or co-occurrence of risk behaviours as part of the rationale for choosing which behaviours to target in their study. The most common rationale for intervention studies was prevention of chronic diseases and weight gain.

By far the most commonly targeted behaviour combination was physical activity and diet (29 studies). Our review of observational studies found no strong evidence of clustering for this behaviour combination but there was strong evidence of co-occurrence reflecting the high prevalence of both behaviours.

For most risk behaviour combinations targeted in intervention studies there was evidence of clustering and co-occurrence (e.g., smoking and diet, alcohol and smoking, sexual risk and substance misuse). However, there were examples where intervention studies targeted a range of risk behaviours where there was no evidence of clustering or co-occurrence.

For example, four studies targeted diet, physical activity, smoking, and alcohol misuse. There is evidence for clustering between alcohol misuse and smoking and also evidence of co-occurrence between diet and physical activity. However physical activity does not appear to cluster with alcohol misuse or smoking. This may reflect that clustering and co-occurrence of risk behaviours may not have been a strong factor in deciding which risk behaviours to target.

Table 7. Risk behaviour combinations targeted in intervention studies (Review 2), and evidence of co-occurrence/clustering among observational studies (Review 1)

Behaviour combination targeted by interventions (Review 2)	Risk behaviour combinations, rationale, and discussion of clustering and co-occurrence of risk behaviours in intervention studies			Evidence of clustering/co-occurrence (Review 1)
	Studies	Rationale for targeting these behaviours	Clustering and co-occurrence discussed	
Diet and PA	Aldana et al. (2006) ⁶⁵	Preventing CVD	No	Evidence of co-occurrence but not clustering
	Burke et al. (2013) ⁶⁷	Not reported	No	
	Campbell et al. (2004) ⁶⁹	Preventing CVD	No	
	Campo et al. (2012) ⁷⁰	Preventing Chronic diseases	No	
	Diez et al. (2012) ⁷²	Not reported	No	
	Emmons et al. (2005) ⁷³	Preventing Cancer	No	
	Franko et al. (2008) ⁷⁴	Preventing Chronic diseases	No	
	Greene et al. (2012) ⁷⁶	Preventing Weight gain	No	
	Hillier et al. (2012) ⁷⁷	Preventing Weight gain	No	
	Hivert et al. (2007) ⁷⁸	Preventing Weight gain	No	
	Hui et al. (2012) ⁷⁹	Preventing Excessive Maternal Weight gain	No	
	Jackson et al. (2011) ⁸⁰	Preventing Excessive Maternal Weight gain	No	
	Jacobs et al. (2011) ⁸¹	Preventing CVD	No	
	Jeffery et al. (1999) ⁸²	Preventing Weight gain	No	
	Keyserling et al. (2008) ⁸³	Preventing CVD	No	
	Lachausse et al. (2012) ⁸⁶	Preventing Weight gain	No	
	Lee et al. (2011) ⁸⁷	Preventing Weight gain	No	
	Lombard et al. (2009) ⁹⁰	Preventing Weight gain	No	
	Rauh et al. (2013) ⁹⁶	Preventing Excessive Maternal Weight gain	No	
	Resnicow et al. (2005) ⁹⁷	Preventing Chronic diseases	No	
	Simkin-Silverman et al. (1998) ¹⁰¹	Preventing CVD	No	
	Spring et al. (2012) ¹⁰²	Preventing Chronic diseases	No	
	Staten et al. (2004) ¹⁰³	Preventing Chronic diseases	No	
	Vandelanotte et al. (2008) ¹⁰⁷	Preventing Chronic diseases	Yes	
	van Keulen et al. (2011) ¹⁰⁶	Not reported	No	
	Walker et al. (2009) ¹⁰⁹	Preventing Chronic diseases	No	
	Weisman et al. (2011) ¹¹⁰	Improving health in pregnancy	No	

	Wilcox et al. (2013) ¹¹²	Preventing CVD	No	
	Yanek et al. (2001) ¹¹⁴	Preventing CVD	No	
Diet, PA and Smoking	de Vries et al. (2008) ⁷¹	Preventing Chronic diseases	No	Evidence of clustering between smoking and diet but not smoking and PA
	Gow et al. (2010) ⁷⁵	Preventing Weight gain	No	Evidence of co-occurrence between diet and PA
	Oenema et al. (2008) ⁹²	Preventing Chronic diseases	No	
	Ruffin et al. (2011) ⁹⁸	Preventing Chronic diseases	No	
	Wilkinson et al. (2012) ¹¹³	Improving health in pregnancy	No	
Diet, PA, Smoking, and Alcohol,	Kypri et al. (2005) ⁸⁵	Preventing Chronic diseases	No	Evidence of clustering between alcohol and smoking, smoking and diet and alcohol and diet
	OXCHECK study group (1995) ⁹³	Preventing Chronic diseases	No	
	Parekh et al.(2012) ⁹⁴	Preventing Chronic diseases	Yes	But no evidence of clustering between alcohol and PA and smoking and PA
	Zhou et al. (2010) ¹¹⁵	Preventing unhealthy behaviour	No	
Sexual risk and substance misuse	Braithwaite et al. (2005) ⁶⁶	Preventing HIV	No	Evidence of clustering for sexual risk and substance misuse
	Peragallo et al. (2012) ⁹⁵	Preventing HIV	No	
	Sikkema et al. (1995) ¹⁰⁰	Preventing HIV	Yes	
Smoking and diet	Leslie et al. (2012) ⁸⁹	Preventing weight gain in smoking cessation intervention	Yes	Evidence of clustering
	Sallit et al. (2008) ⁹⁹	Preventing weight gain	No	
Alcohol and smoking	Burton et al. (1995) ⁶⁸	Preventing Chronic diseases	No	Evidence of clustering
Smoking, alcohol and drug misuse	McCambridge et al. (2011) ⁹¹	Preventing substance misuse	No	Evidence of clustering between all behaviours
Smoking and PA	Ussher et al. (2003) ¹⁰⁴	Preventing weight gain in smoking cessation intervention	No	No evidence of clustering
Diet, PA, Smoking, Seat belt use	Kreuter et al. (1996) ⁸⁴	Preventing risk behaviour	No	Diet and PA evidence of co-occurrence Diet and Smoking evidence of clustering No evidence of clustering between PA and smoking Unclear whether seat belt use clusters or co-occurs with other behaviours
Diet, PA, Smoking, Alcohol, Seat belt use	Leigh et al. (1992) ⁸⁸	Promoting health and reducing healthcare costs in older adults	No	Diet and PA evidence of co-occurrence Smoking and Alcohol evidence of clustering Diet and Smoking evidence of clustering No evidence of clustering between PA and smoking, and PA and alcohol Unclear whether seat belt use clusters or co-occurs with other behaviours
Diet, Smoking, Alcohol, Sunbed	van Assema et al. (1994) ¹⁰⁵	Preventing Cancer	No	Evidence of clustering between diet and smoking, diet and alcohol, smoking and alcohol Unclear whether sunbed use clusters or co-occurs with other behaviours

PA, Alcohol, Drugs, Drink Driving	Werch et al. (2010) ¹¹¹	Preventing risk behaviours	No	Evidence that alcohol and drugs cluster PA and alcohol do not cluster Unclear whether drink driving clusters or co-occurs with other behaviours
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Comparing intervention content (Review 2) with themes identified in synthesis of qualitative studies (Review 3)

Table 8 summarises the themes and subthemes identified in the qualitative studies. Both qualitative (Review 3) and quantitative studies (Review 2) focused on intrapersonal and interpersonal factors influencing behaviours. There was much less data on geographical and structural factors in qualitative studies, and even less intervention content related to these factors. This possibly reflects that less research has been conducted evaluating policy-level interventions. The lack of intervention data on structural factors may also theoretically be explained by our inclusion criterion requiring RCTs (which may be less able to explore the impact of such factors). However, our scoping review assessed whether different types of intervention were evaluated using different study designs and showed no clear differences in content according to the design used (see Appendix 9).

Further details on the comparison of intervention content data with qualitative themes are presented in Appendix 29.

Table 8. Summary of qualitative themes (Review 3) addressed in intervention studies (Review 2)

Theme identified in qualitative synthesis (Review 3)	Subtheme identified in qualitative synthesis (Review 3):	Did intervention studies address this (Review 2)?
Intrapersonal and interpersonal (microsystem) levels		
Psychological/ physical factors (15 papers reporting on 14 studies)	Perceived risk of future events (e.g., disease, death)	Yes: 50 studies
	Perceived outcomes of healthy lifestyle behaviours	Yes: 50 studies
	Motivation for healthy lifestyle behaviours	Yes: 15 studies DeVries et al. (2008) ⁷¹ Emmons et al. (2005) ⁷³ Gow et al. (2010) ⁷⁵ Hillier et al. (2012) ⁷⁷ Jackson et al. (2011) ⁸⁰ Jacobs et al. (2011) ⁸¹ Keyserling et al. (2008) ⁸³ Lee et al. (2011) ⁸⁷ McCambridge et al. (2011) ⁹¹ Oenema et al. (2008) ⁹² Resnicow et al. (2005) ⁹⁷ Sallit (2008) ⁹⁹ Simkin-Silverman et al. (1998) ¹⁰¹ van Keulen et al. (2011) ¹⁰⁶ Zhou et al. (2010) ¹¹⁵
	Caring about what other people and society think	No

	Will power and discipline	Yes: 50 studies
	Stress, emotions, and mental states	No
	Impact of health status and physiological factors	People with physical conditions excluded from review so not able to assess
Knowledge/Awareness (13 papers reporting on 12 studies)	Knowledge/awareness about risk behaviours and disease	Yes: 50 studies
	Perceived importance of healthy lifestyle behaviours	Yes: 50 studies
	Communication with health professionals/instructors and welfare staff	No
	Strategies used to maintain healthy behaviours	Yes: 50 studies
	Impact of culture and religion on knowledge/awareness, beliefs and lifestyle behaviours	Yes: 6 studies Campbell et al. (2004) ⁶⁹ Resnicow et al. (2005) ⁹⁷ Wilcox et al. (2013) ¹¹² Yanek et al. (2001) ¹¹⁴ Diez et al. (2012) ⁷² Peragallo et al. (2012) ⁹⁵
Interventions (8 papers reporting on 7 studies)	Perceptions and ideas relating to lifestyle interventions	Yes: 50 studies Many of the positively evaluated elements of interventions were taken into account: Portion sizes Cooking skills Nutrition education Social support groups
	The process of changing <i>multiple</i> risk behaviours	Yes: 2 studies Spring et al. (2012) ¹⁰² Vandelanotte et al. (2008) ¹⁰⁷
Personal responsibilities (9 studies)	Being a role model and responsible for others	No
	Competing time demands	Yes: 50 studies
	Disruption to routine	No
Social network (13 studies)	Family habits during childhood and adolescence	Family interventions excluded from review so not possible to assess
	Influence from family and/or friends in adulthood	Family interventions excluded from review so not possible to assess
	Support groups	Yes: 6 studies Campbell et al. (2004) ⁶⁹ Resnicow et al. (2005) ⁹⁷ Wilcox et al. (2013) ¹¹² Yanek et al. (2001) ¹¹⁴ Simkin-Silverman et al. (1998) ¹⁰¹ Weisman et al. (2011) ¹¹⁰
	Social occasions	No

Geographical (exosystem) level		
Geographical location and environment (10 studies)	Access to physical activity spaces and equipment	Yes: 4 studies Burke et al. (2013) ⁶⁷ Hui et al. (2012) ⁷⁹ Lombard et al. (2009) ⁹⁰ Resnicow et al. (2005) ⁹⁷
	Access to healthy foods	No
	Influence of local environment on smoking and alcohol use	No
	Personal safety	No
	Weather	No
Structural (macro-system) level		
Income status and availability of resources (4 studies)	Influence of low or unstable income on lifestyle behaviours	No

Intrapersonal factors (microsystem) level – Psychological/physical factors

Four qualitative studies reported perceptions of risk for future health-related events.^{134, 135, 137, 141} Educational content relevant to this theme was clearly addressed in all 50 intervention studies.

However, important contextual factors were identified in qualitative studies, many of which did not appear to be addressed in any intervention studies. Our synthesis of qualitative studies showed that people's perceptions of risk (associated with unhealthy behaviours) were strongly impacted by their experiences of health problems occurring in friends and relatives. Some studies showed these experiences could have a positive impact on behaviour,^{134, 137, 141} but also could lead to a fatalistic acceptance that nothing could be done to prevent the same health problems happening to them.¹³⁵ No intervention studies addressed this issue (CALO-RE: stimulate anticipation of future rewards; Behaviour change wheel: persuasion). Similarly, no intervention studies examined whether fatalistic beliefs about experiencing health problems may be a barrier to engaging in behaviour change (CALO-RE: identification of barriers/problem solving; behaviour change wheel: enablement).

Eight qualitative studies reported on the perceived outcomes of adopting healthy lifestyle behaviours;^{64, 89, 134, 135, 137, 140-142, 145} including health benefits as well as other positive aspects such as increased energy, improved appearance, and greater self-esteem. Most intervention studies included educational content focusing on the benefits of behaviour change and were consistent with the experiences reported in the qualitative studies.

Motivation/persuasion was considered an important factor in changing risk behaviours in 10 qualitative studies.^{64, 89, 133-137, 139-142} Persuasion was commonly used to motivate healthy behaviours in intervention studies.^{71, 73, 75, 77, 80, 81, 83, 87, 91, 92, 97, 99, 101, 106, 115}

The importance of others' perceptions of engaging in particular lifestyle behaviours was reported in three qualitative studies.^{135, 140, 142} Although no specific content was included on social approval, the use of modelling to encourage behaviour change through providing an example for people to aspire to or imitate was a common intervention strategy.^{66, 69, 77, 78, 89, 97, 100, 101, 112, 114} However, barriers related to the perceptions of others (such as feeling self-conscious about attending the gym was particularly prevalent in women aged over 40 years)¹³⁵ and cultural acceptance of being over-weight

and obese¹⁴¹ as reported in qualitative studies did not appear to be addressed in interventions studies.

Will power and discipline were commonly discussed in qualitative studies.^{134-139, 141} All intervention studies included content such as training and goal setting to improve will power and discipline but synthesis of these studies suggested the benefits of interventions on behaviour change declined as follow-up increased, which may reflect a decline in discipline over time.

The impact of stress and negative emotions, particularly in relation to eating an unhealthy diet, was commonly reported in qualitative studies.^{133, 137, 140, 141, 143, 144} Surprisingly, no intervention studies specifically addressed the impact of stress and negative emotions. Intervention content to address these themes may include stress management/emotion control training (CALO-RE).

The impact of health status and physiological factors was reported in three qualitative studies.^{64, 89, 135, 140} As our review of intervention studies did not include participants diagnosed with physical conditions we were not able to examine the extent to which intervention studies addressed these barriers. However, two studies which included older adults included adaptations to address the limitations of this population: conducting the intervention in participants' homes and providing telephone/email support,⁸⁷ and provision of additional counselling and behaviour review for participants with more complex health needs.⁶⁸

Knowledge and awareness

Qualitative studies identified the importance of knowledge and awareness about risk behaviours;^{64, 89, 133-138, 141-143, 145} this was addressed in all intervention studies through education and training.

Educational aspects included the impact on risk of future health problems, perceiving the importance of healthy lifestyle behaviours, and addressing knowledge deficits as a barrier to behaviour change. Participants also discussed the importance of acquiring skills for maintaining healthy behaviours (e.g., planning meals, identifying healthy food substitutes, healthy cooking skills, counting calories, and incorporating physical activity into regular schedule).

However, some aspects of knowledge and awareness and the associated barriers to changing risk behaviours were not addressed in the intervention studies. Two qualitative studies^{140, 143} found that participants had difficulty communicating with healthcare professionals/welfare staff. No intervention studies addressed this potential barrier specifically (CALO-RE: general communication skills training; Behaviour change: training). Other studies reported positive communication between participants and professionals.^{89, 141, 142}

Intervention studies from the USA^{69, 95, 97, 112, 114} sought to address specific barriers related to knowledge and awareness in minority ethnic groups (African American and Hispanic American participants). We did not identify any intervention studies that aimed specifically to reduce multiple risk behaviours in black and minority ethnic groups in the UK. We included one UK-based qualitative study¹⁴⁵ that identified cultural (e.g., lack of awareness of healthy alternatives to traditional South Asian dishes) and religious barriers (e.g., no segregation of men and women in UK swimming pools) to adopting a healthy diet and physical activity in South Asians. None of these factors were addressed in US intervention studies, which is not surprising as they are unlikely to represent substantial barriers for African Americans or Hispanic Americans. Potentially relevant intervention content to address these themes could include: providing information on consequences for the

individual or cultural group (CALO-RE); planning social support/social change (CALO-RE); social environmental restructuring (CALO-RE, Behaviour Change Wheel); and education (Behaviour Change Wheel) and enablement (Behaviour Change Wheel).

Interventions to change risk behaviours

Eight qualitative studies suggested content that should be included in behaviour change interventions.^{64, 89, 135, 136, 138, 141, 143, 145} Most of the suggestions made in these qualitative studies were included in the intervention studies in Review 2 (subsection 3.2) (e.g., provide information on how to perform the behaviour, provide information where and when to perform behaviour, modelling, provide information on consequences to the individual; education, training, enablement, modelling).

One UK-based qualitative study⁶⁴ suggested that participants used different strategies when trying to change multiple behaviours; some tried to change multiple behaviours simultaneously and others tried to change behaviours one at a time. The effectiveness of these different strategies was investigated in one intervention study.¹⁰⁷ There was no evidence that either strategy was more effective.

We examined the process of changing multiple risk behaviours through our multivariate meta-analyses. Review 2 (see section 3.2.2) revealed mostly moderate positive correlations between behaviour combinations, suggesting that participants were reducing their risks in both behaviours simultaneously (reflecting the aim of most intervention studies). However, for one behaviour combination (diet, physical activity and smoking), participants improved their diet and physical activity simultaneously (i.e. these behaviours were positively correlated at follow up) but showed a deterioration in smoking behaviour.

Interpersonal factors (microsystem) level – Personal responsibilities

A strong and consistent theme that emerged from the qualitative studies was the importance, primarily for women, of being a role model with responsibility for the rest of the family and how this impacted on people's own risk behaviours.^{134, 136, 137, 140, 141}

None of the intervention studies addressed this theme despite its importance in the synthesis of qualitative studies. This might partly reflect that we excluded family intervention studies from our review. Intervention content to address this theme may include prompting identification as role model/position advocate (CALO-RE), or modelling (Behaviour Change Wheel).

Competing time demands was identified as an important barrier to changing unhealthy diet and physical inactivity in seven qualitative studies.^{135, 136, 138-141, 145} Most intervention studies appeared to take this into account through provision of training.

Disruption to routine was not addressed in any intervention study but this was found to be a barrier to behaviour change in only two qualitative studies.^{137, 141} Intervention content to address this theme might include relapse prevention/coping planning (CALO-RE) and training (Behaviour change wheel).

Social network

The inclusion criteria (we excluded studies on family interventions and those focusing on children and young people) of our intervention review precluded full examination of whether some

subthemes (e.g., family habits during childhood and adolescence, influence from family and/or friends in adulthood) of social networks were addressed in intervention studies.

The importance of support groups was identified in the synthesis of qualitative studies.^{89, 136, 141} Some interventions included relevant enablement content either drawing on existing social networks (e.g., African American churches)^{69, 97, 112, 114} or encouraging social support among group members participating in their trial.^{101, 110}

Four qualitative studies found that social occasions could act as a barrier to attempts to change unhealthy diet.^{135, 136, 138, 142} Most studies included an element of training in problem solving but none specifically addressed how to deal with social occasions acting as a barrier to change. This may be addressed in future intervention studies through more specific barrier identification/problem solving (CALO-RE) or enablement (Behaviour Change Wheel) content.

Geographical factors (exosystem) level – Geographical location

Six qualitative studies reported that participants found difficulty in accessing physical activity spaces and equipment,^{133, 138-141, 144} although this tended to be reported by participants in rural areas of USA. Four intervention studies addressed this issue through enablement content by providing equipment and materials to improve access and allowing more flexibility to engage in physical activity.^{67, 79, 90, 97} We found that intervention studies that included enabling strategies such as providing equipment to be used outside of the study setting were associated with greater improvement in physical activity in the meta-regression analyses (see section 3.2.2).

None of the other subthemes related to geographical location were addressed in intervention studies. Future intervention studies may address these themes including content such as environmental restructuring (CALO-RE, Behaviour Change Wheel), barrier identification/problem solving (CALO-RE), and enablement (Behaviour Change Wheel).

Structural factors (macrosystem) level – Income status and availability of resources

Four qualitative studies reported the influences of low or unstable income on lifestyle behaviours.^{133, 138, 142, 143} Seven intervention studies specifically targeted low income populations.^{67, 73, 77, 80, 83, 103, 110}

There was limited evidence of intervention studies adapting interventions to take into account the specific needs of this population group. Based on the findings from the qualitative studies, the following behaviour change techniques could be used to address these themes in future studies: barrier identification/ problem solving (CALO-RE), environmental restructuring (CALO-RE, Behaviour Change Wheel), and enablement (Behaviour Change Wheel).

Summary of suggestions for future intervention content

Table 9 summarises barriers and facilitators for changing risk behaviours (identified in our review of qualitative studies) not addressed in our review of intervention studies. Where possible we have provided suggestions for future intervention content based on CALO-RE and Behaviour Change Wheel taxonomies.

We have provided suggestions for further qualitative research where there is limited data to inform potential barriers and facilitators to be addressed by interventions. The most important limitation identified was the lack of research on the challenges of making changes to multiple behaviours either sequentially or simultaneously.

Table 9: Summary of themes not addressed and suggestions for future intervention content

Theme identified in qualitative synthesis	Subtheme identified in qualitative synthesis:	Intervention content/qualitative research suggested for future studies
Intrapersonal and interpersonal (microsystem)		
Psychological/ physical factors	Caring about what other people and society think	<i>CALO-RE taxonomy</i> : provide information about others approval <i>Behaviour change wheel</i> : Modelling (closest intervention function but does not completely encompass the theme)
	Stress and emotions/mental states	<i>CALO-RE taxonomy</i> : Stress management/emotional control training <i>Behaviour change wheel</i> : training
Knowledge/ Awareness	Communication with health professionals/instructors	Future qualitative studies may examine further whether this is a common barrier. And if so how to improve communication between healthcare professionals and the public.
	Impact of culture and religion on knowledge/awareness, beliefs and lifestyle behaviours	Cultural and religious barriers of South Asians in UK not targeted. Also needs of Black British groups and other minority ethnic groups in the UK may be different from those in the USA <i>CALO-RE taxonomy</i> : -environmental restructuring -plan social support/social change <i>Behaviour change wheel</i> : -environmental restructuring -enablement
Interventions	The process of changing <i>multiple</i> risk behaviours	Very limited data on process of multiple risk behaviour change from both qualitative and intervention studies. Further qualitative research on understanding the challenges of changing multiple behaviours is needed with barriers and facilitators identified in such studies translated into intervention content to address these.
Personal responsibilities	Being a role model and responsible for others	Future interventions should include specifically for women taking into account their role in their families: <i>CALO-RE taxonomy</i> : -Prompt identification as role model/position advocate -[social] environmental restructuring <i>Behaviour change wheel</i> : [social] environmental restructuring

	Disruption to routine	<i>CALO-RE taxonomy:</i> relapse prevention/coping planning <i>Behaviour change wheel:</i> training
Social network	Social occasions	<i>CALO-RE taxonomy:</i> Barrier identification/problem solving <i>Behaviour change wheel:</i> enablement
Geographical (exosystem)		
Geographical location and environment	Access to physical activity spaces and equipment	This barrier to physical activity was specifically noted in people from rural locations therefore future interventions may focus on specific groups where location is a barrier to physical activity <i>CALO-RE taxonomy:</i> Prompt practice <i>Behaviour change wheel:</i> Enablement
	Access to healthy foods	<i>CALO-RE taxonomy:</i> Environmental restructuring <i>Behaviour change wheel:</i> Environmental restructuring
	Personal safety	<i>CALO-RE taxonomy:</i> Barrier identification/ problem solving <i>Behaviour change wheel:</i> Enablement Intervention content where personal safety is a barrier may include: encouraging people to attend an exercise class/gym as a group, finding alternatives that involve exercising at home
	Weather	<i>CALO-RE taxonomy:</i> Barrier identification/ problem solving <i>Behaviour change wheel:</i> Enablement Where weather is a particular barrier to physical activity encouraging exercise at home or other indoor locations may be targeted
Structural (macrosystem)		
Income status and availability of resources	Influence of low or unstable income on lifestyle behaviours	<i>CALO-RE taxonomy:</i> -Environmental restructuring -Barrier identification/ problem solving <i>Behaviour change wheel:</i> -Environmental restructuring -Enablement

4 CONCLUSIONS/CONSIDERATIONS

Summary of Main Findings

Our synthesis of observational, trial and qualitative studies on multiple risk behaviours provides a rich overview of the literature. We have shown that in general adult populations, alcohol misuse and low fruit and vegetable intake each clustered with smoking and that physical inactivity and smoking each co-occurred alongside low fruit and vegetable intake. In young adults there was consistent evidence that sexual risk behaviours clustered with smoking, alcohol misuse, and drug misuse. Socio-economic status was the strongest predictor of risk clusters.

Although socio-economic status was found to be the strongest predictor of risk clusters, with those in lower socio-economic groups more likely to engage in two, three, or four risk behaviours, only seven intervention studies targeted low income populations. One of these studies was from the UK and the others were from the USA or Australia.

Overall, intervention studies have targeted risk behaviours shown to cluster or co-occur, with most attempting to improve diet and increase physical activity through education and skills training. Small improvements in diet (e.g., fruit and vegetable intake) and physical activity levels were found, but effects diminished over time. Use of enablement strategies such as behavioural support alongside education and training was associated with greater effectiveness. Interventions were not effective in reducing smoking. The evidence was inconclusive for other behaviours including alcohol misuse and sexual risk taking.

Some of the barriers to adopting healthy behaviours - such as lack of information and skills - were addressed by intervention studies, but many were not. Access to healthy foods and low or unstable incomes were reported as being important influences on lifestyle choices, but were not the main focus in any of the intervention studies.

Strengths and limitations

Strengths and limitations of the review

A major strength of our project is that we reviewed observational, trial, and qualitative literature on multiple risk behaviours which provided a richer overview of the literature than if we limited our focus to a narrower range of study designs and review questions. We have drawn together the findings from three sets of studies using an approach developed to integrate intervention and qualitative studies.^{118, 150} We expanded this technique to integrate observational studies with intervention and qualitative studies. This enabled us to identify i) where interventions have targeted risk behaviours that cluster or co-occur and ii) where interventions have adopted behaviour change techniques that address barriers to making healthy choices. This approach is helpful in understanding why complex behaviour change interventions may or may not work in different contexts and can be used inform the development of future interventions.

Another strength of our review is that we carried out a scoping review to map the intervention literature before deciding which study designs to include in our systematic review. This was to ensure that limiting the review to RCTs would not exclude specific categories of intervention that

were evaluated using study designs other than RCTs. This has been identified as a potential problem in reviews of public health interventions.¹⁵² Our scoping review revealed that interventions evaluated using RCTs were similar to those evaluated by other study designs and limiting our inclusion criteria to RCTs would not exclude entire categories of intervention.

Our focus on UK studies to investigate clustering and co-occurrence of risk behaviours is a possible weakness as it could introduce bias. We decided to limit our inclusion criteria because the initial scoping exercise identified approximately 2,000 records of potential relevance and we had to make the review feasible within the available resource. We chose to limit by country as the primary aim of our review was to inform public health policy in the UK and results of the scoping exercise confirmed that restricting the review to UK studies did not limit the range of risk behaviours investigated.

Strengths and limitations of the evidence base

Overall the studies included in our three systematic reviews were of reasonable quality. The main limitations of studies that investigated clustering and co-occurrence of risk behaviours were a lack of prospective cohort design and differences in thresholds for determining risk behaviours. Together these limitations made comparisons across studies difficult.

The quality of the RCTs that investigated the effectiveness of multiple risk behaviour interventions was variable. Using the Cochrane risk of bias tool we found that just over half of the studies had a high risk of bias for at least one of the domains assessed. We found variation between studies in the ways that behaviours were measured, particularly physical activity and alcohol intake, which made comparisons difficult. There were also limitations in the reporting of intermediate outcomes such as self-esteem, attitudes, social norms and knowledge, which are important in testing the theoretical basis of the intervention in specific contexts. Importantly, few studies provided contextual information, for example important external events that occurred at the time of the intervention.

All qualitative studies that explored perceptions about and experiences of making lifestyle changes were of high or medium quality. All investigated experiences of changing multiple risk behaviours, but many of the identified themes reflected experiences of changing a single behaviour or behaviour in general and this limited the relevance of the findings to our overall aim.

The main limitation of the multiple risk behaviour evidence base is that a number of unanswered questions remain (see 'Implications for policy and future research' below).

Findings of our review in context

The findings from our reviews add to the growing evidence base on multiple risk behaviours. Many studies have investigated clustering and co-occurrence of risk behaviours in the general population and in specific age groups but to our knowledge this is the first attempt to synthesise these data using systematic review methods. Our review has shown that the most frequently studied are diet, physical activity, smoking, and alcohol misuse. Risky sexual activity and drug use have also been investigated in younger populations. The focus on diet, physical activity, smoking and alcohol is not surprising given that they are associated with about 29 per cent of the disease burden in most highly industrialised countries in Europe, North America and Asia.¹⁵³ A further 15 per cent of the disease

burden is associated with obesity, overweight, and high cholesterol which are linked to lack of physical activity, low fruit and vegetable consumption, smoking, and alcohol misuse.

Our findings show that in general adult populations, alcohol misuse and low fruit and vegetable intake each clustered with smoking and that physical inactivity and smoking each co-occurred alongside low fruit and vegetable intake. Our findings from UK studies are consistent with the international literature. For example, the strongest evidence of clustering was for alcohol use and smoking in data from several countries including the Netherlands¹⁵⁴ and Hong Kong.¹⁵⁵ UK co-occurrence data is also consistent with studies in various other countries (e.g., USA) where physical inactivity and low fruit and vegetable intake were identified as the most prevalent co-occurring behaviours.¹⁵⁶

Interventions to change risk behaviours have huge potential to alter current patterns of disease⁶ and there is a growing international literature reporting outcomes of interventions targeting multiple risk behaviours. A Cochrane review¹ is available which focuses on multiple risk factors (as opposed to behaviours, which were the focus of interest in our review) and reports distal outcomes such as mortality, fatal and non-fatal coronary heart disease, and cardiovascular risk factors (data on smoking are included). The authors found limited evidence of benefit from education and counselling interventions on risk factor outcomes. This is largely consistent with the small improvements in physical activity and diet and limited evidence for effectiveness for all other outcomes found in our review.

Similarly, findings from a recent review of non-pharmacological interventions for reducing risk behaviours in the workplace found small benefits for diet, physical activity and smoking.¹⁵⁷ However, no clear distinctions were made between studies targeting multiple or single behaviours and synthesis was based on a method of vote-counting (counting how many studies were statistically significant).

Most reviews have focused on adult populations, but an on-going Cochrane review⁵³ is evaluating the effectiveness of interventions using a range of techniques (e.g., education, training, counselling) with young people.

In our review we were unable to directly compare the relative effectiveness of multiple and single risk behaviour interventions due to a lack of primary studies addressing this question (see 'Implications for policy and future research' below). However, systematic reviews of interventions focusing on single behaviours are plentiful and we highlight below the findings from recent reviews of diet, physical activity, smoking and alcohol misuse.

A review of interventions to improve diet in general populations¹⁵⁸ found small improvements, which is similar to our finding (e.g., 0.5 more servings of fruit and vegetables in the intervention groups compared to control; our review found 0.33 more servings for the intervention group). In contrast, a review¹⁵⁹ focusing on dietary change (information about diet programmes such as the Atkins diet, other low carbohydrate diets, Zone diet etc.) in overweight or obese populations found much larger weight loss (~8kg) than in our review (0.85kg).

Reviews that focused on interventions to increase physical activity in primary care¹⁶⁰ and in older adults¹⁶¹ found small improvements in self-reported levels of physical activity (~SMD 0.2) which were similar to those reported in our review.

A Cochrane review¹⁶² that evaluated non-pharmacological smoking interventions delivered in the workplace found strong benefits (OR~2) compared with controls. Importantly, studies that targeted smoking as part of a multiple risk behaviour intervention were not effective in reducing smoking, and this is consistent with the findings of our review. We found that participants who improved their diet and physical activity were less likely to stop smoking. This is an important finding as smoking was a commonly targeted behaviour (only diet and physical activity were more frequently targeted in our included studies) and suggests that interventions to reduce smoking may be more effective if delivered in isolation rather than as part of a multiple risk behaviour intervention.

It is possible that interventions that target dietary change at the same time as attempting to reduce smoking undermine the success of stopping smoking, given that hunger and cigarette cravings are related and that hunger can undermine quit efforts.¹⁶³ This finding needs to be confirmed more formally in a new systematic review (see 'Implications for policy and future research' below).

A Cochrane review¹⁶⁴ of brief interventions used in primary care and systematic reviews of non-pharmacological interventions to inform NICE guidance¹⁶⁵ found small reductions in alcohol misuse.

The importance of understanding the context in which people make lifestyle changes is increasingly being recognised and a growing number of qualitative studies address this question. We identified one systematic review that explored factors that influence lifestyle changes in people at risk of cardiovascular events.¹¹⁷ Important factors included social support, cost of adopting healthy behaviours, balancing health behaviours with everyday life (e.g. routines, time management), cultural preferences, and environmental barriers. Despite the differences in population groups these factors are very similar to those that emerged in our review. As with our review, few data addressed the specific challenge of changing multiple risk behaviours, despite most studies (14/22) including participants with more than one risk behaviour.

Implications for policy and future research

There is a burgeoning evidence base on multiple risk behaviours but gaps in knowledge remain and it is difficult to direct policy-makers to research that is explicit about strategies to effectively target and reduce risk behaviours. Therefore, we consider implications for policy alongside gaps in knowledge and highlight where future research is needed urgently (see Box 5 for a summary of key implications for future research).

Box 5. Implications for future research

- Understanding the challenges of changing multiple risk behaviours
- Targeting multiple versus single risk behaviours
- Approaches to behaviour change: theory and content
- Clustering and co-occurrence of risk behaviours
- Health inequalities
- Further UK-based studies

Understanding the challenges of changing multiple risk behaviours

All the qualitative studies in our review investigated experiences of changing multiple risk behaviours but many of the identified themes reflected experiences of changing a single behaviour or behaviour in general. Data on the specific challenges of attempting to change multiple risk behaviours (the primary aim of our review) were very limited. Another systematic review focusing on people at risk of cardiovascular events reported similar findings. Therefore, there is a need for further qualitative studies that explore the particular challenge of changing multiple risk behaviours.

Targeting multiple versus single risk behaviours

Despite the plethora of research evaluating interventions that target both multiple and single behaviours the question of which approach is more effective remains largely unanswered. In our review we found insufficient data to directly address this question as only one included study⁸⁹ compared multiple and single risk behaviour interventions.

Comparing our findings for multiple risk behaviour interventions with those of systematic reviews that have evaluated interventions targeting single behaviours suggests that both types of intervention result in small changes to diet and physical activity. The small changes in alcohol consumption reported in reviews that targeted this behaviour singularly appeared similar in our review but there were not sufficient numbers of studies to confirm this conclusively. Perhaps the most important finding relates to smoking. We found evidence that multiple risk behaviour interventions were not effective in reducing smoking rates. A recent Cochrane review¹⁶² that found evidence in support of non-pharmacological interventions delivered in the workplace showed that smoking rates were not reduced when workplace interventions targeted two or more behaviours. Together these findings suggest interventions to reduce smoking may be more effective if delivered in isolation, but this needs to be confirmed more formally in a new systematic review using network meta-analysis. This would allow direct comparisons to be made of non-pharmacological interventions targeting smoking alone or in addition to other risk behaviours.

Understanding how people approach behaviour change, especially when multiple behaviours are involved, is key to developing effective interventions. A UK qualitative study⁶⁴ found that people differ in their strategies for change when attempting to alter risk behaviours. Some try to change behaviours in tandem (simultaneous change), whereas others seek to change risk behaviours one at a time (sequential change). The importance of understanding whether interventions should be delivered in tandem or in sequence is clear but we found only one study which attempted to address this question and the findings were inconclusive.^{107, 108}

Recent NICE guidance on behaviour change¹⁶⁶ recommended that further studies are needed to compare these approaches. We consider that head-to-head trials of simultaneous versus sequential interventions are needed.

Approaches to behaviour change: theory and content

Using the Behaviour Change Wheel⁵⁶ to classify intervention components, we found that most studies evaluated educational approaches, often combined with skills training and sometimes with persuasion, enablement, and modelling. Incentives and environmental restructuring were used infrequently and coercion and restriction were not used at all.

Unsurprisingly given the focus of most interventions, the most commonly reported theories and models of interventions were social cognitive approaches (e.g., Social Cognitive Theory, the Transtheoretical Model, the Health Belief Model, the Theory of Planned Behaviour, and Motivational Interviewing). Twenty-seven of the 35 intervention studies that reported theoretical foundations used social cognitive approaches.

Our findings suggest that educational approaches to multiple behaviour change, with or without additional components, result in relatively small benefits. For example, we found an increase of 0.33 portions of fruit or vegetables eaten when compared with controls and even this small gain attenuated over time. The heavy focus on education and training meant that most of the geographical and structural barriers identified as important in qualitative studies were not addressed in intervention studies. This might help explain why most studies found no or only small changes in risk behaviours.

The importance of the physical and social environment in determining health behaviours is increasingly recognised and the idea that changing the environment can influence the choices that people make (“choice architecture”) has gained traction in policy circles. However, evidence is lacking to support the use of interventions that involve changing small-scale physical and social environments, such as shops and workplaces¹⁶⁷ and the findings of our own review are consistent with this view. We identified only two studies^{105, 112} that included an element of environmental restructuring as part of their intervention package. In both studies these were suggestions for change, and it was unclear whether the suggestions were implemented.

Despite the lack of RCT evidence in support of environmental restructuring, findings from field and laboratory experiments suggest that human behaviour is prompted by cues in the environment.¹⁶⁸ Therefore, if the environment encourages people to make healthy choices (e.g., offering fruit rather than biscuits) then risky behaviours will be reduced. This promising approach to large scale behaviour change requires proper evaluation through good quality RCT’s.

Clustering and co-occurrence of risk behaviours

Most of the observational studies compared clustering and co-occurrence of two risk behaviours at a time. Few data are available on how combinations of three or more risk behaviours may cluster and co-occur. A similar pattern was also found in a recent scoping review of statistical techniques used in studies of co-occurrence and clustering of risk behaviours.¹

Only seven studies investigated factors associated with multiple risk behaviours (all studies were based on risk indices). Further research is needed on factors associated with specific behaviour combinations where there is strong evidence of clustering (e.g. alcohol misuse and smoking in adults, sexual risk behaviour and smoking in young adults) as predictors of engaging in multiple risk behaviours may differ depending on the combination of risk behaviours investigated.

Health inequalities

Given that effective public health interventions (particularly those focusing on ‘downstream’ interventions such as education and skills training) have the potential to increase inequalities by disproportionately benefiting more advantaged groups¹⁶⁹ it is surprising that so few studies analysed their findings according to specific subgroups. Although most studies collected and reported

participant data on income, occupation, education, ethnicity, and gender we were unable to explore differential effects in a meaningful way because of limitations in how data were reported in the study publications.

It should be noted that seven studies specifically targeted low income groups^{67, 77, 80, 83, 95, 103, 110} including one from the UK⁷⁷ and five studies targeted black and minority ethnic groups in the USA.^{69, 95, 97, 112, 114} A lack of data meant it was inconclusive whether interventions conducted in low income or black and minority ethnic groups differed in effectiveness compared with other studies included in the meta-analysis.

Given our finding that people of lower socio-economic status were up to five times more likely to engage in multiple risk behaviours, it is surprising that only seven studies targeted this specific group. Future studies should fully explore the potential impact of socio-demographic factors on intervention effectiveness. Additionally, were data fully reported it would be possible to explore the influence of socio-economic status, ethnicity, and gender through an individual participant data meta-analysis.

Overall, we found a lack of evidence about factors that impact on lifestyle change in minority groups. We identified one qualitative study of South Asians in the UK¹⁴⁵ which reported a number of barriers and facilitators to improving diet and increasing physical activity. Potential strategies for addressing barriers and facilitators in ethnic minority groups through adaptation of interventions have been reviewed in more detail elsewhere.¹⁷⁰⁻¹⁷³ There was insufficient evidence about how best to deliver smoking cessation, physical activity and healthy eating-related interventions to these groups. Further research is needed to explore the particular challenges faced by minority groups, especially those from lower socio-economic backgrounds.

Lack of UK-based studies

Overall, there was a lack of UK-based intervention and qualitative studies. We included five UK-based intervention studies^{77, 89, 91, 93, 104} and four qualitative studies.^{64, 89, 144, 145} This was in contrast to 30 UK observational studies (k=30).^{77, 89, 91, 93, 104}

The UK intervention and qualitative studies differed substantially from one another, for example in terms of behaviours and populations targeted. Therefore, our results from UK studies were inconclusive and further research is needed.

Future direction of public health policy

A major theme identified throughout our reviews is the importance of the social and environmental context of people engaging in different risk behaviours. This fits with the current drive to promote a 'fifth wave' of public health where improvements in population health are conditional on a health-promoting societal context.¹⁷⁴ Where this is successful, healthy behaviours become the norm and the social and physical environment supports people to make choices that are beneficial to their long-term health.

5 DISSEMINATION/OUTPUTS

Full manuscripts published

Wright, K., Golder, S., & Rodriguez-Lopez, R. Citation searching: a systematic review case study of multiple risk behavior interventions. *BMC Med Res Methodol* 2014; 14:73.

Full manuscripts submitted for publication

Characteristics of interventions targeting multiple lifestyle risk behaviours in adult populations: A systematic scoping review. PLOS ONE.

Full manuscripts in preparation

A systematic review on the clustering and co-occurrence of multiple risk behaviours in the UK. Target Journal: Preventive Medicine.

Exploring the effectiveness of multiple risk behaviour interventions: a systematic review, meta-analysis and meta-regression. Target journal: BMJ

People's perceptions and experiences of multiple risk behaviour change, and the contexts in which changes occur: a thematic synthesis. Target journal: Journal of Health Psychology.

A comparative synthesis of the content of multiple risk behaviour interventions with evidence of co-occurrence and clustering of behaviours, and barriers and facilitators identified in qualitative studies. Target journal: American Journal of Public Health.

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7 APPENDICES

**Multiple risk behaviours and interventions to reduce
multiple risk behaviours**

General Background

Scientific Literature

Modifiable health risk behaviours (e.g., physical inactivity, smoking, low fruit and vegetable intake) contribute significantly to the global burden of disease (1). The co-occurrence of these behaviours are common, for example 55.1% of adults in the Netherlands (2), 52% in the USA (3), 59.4% in Brazil (4), and 68% in England (5) reportedly engage in two or more risk behaviours. Moreover, all-cause mortality risk has been shown to be four times higher among individuals with multiple risk behaviours, both in the USA (6) and the UK (7). There is also a growing research base which suggests that risk behaviours such as smoking, physical inactivity, poor diet, and excessive alcohol use may cluster within individuals (5, 8, 9). Clustering refers to the higher prevalence of combinations of risk behaviours than would be expected if the behaviours were independent.

Risk behaviours do not take place in a social vacuum however, but need to be viewed in the context of the social and economic environment (10). In particular, risk behaviour clustering has been identified in less advantaged groups including lower social class households, those who are economically inactive, and non-homeowners (5). 'Risk conditions,' such as crowded and inadequate housing, and poor working environments, also tend to cluster in less advantaged groups and often accumulate from disadvantage in childhood (11). It is important to identify risk behavior clusters, and consider the extent to which 'risk conditions' interact with risk behaviours to magnify or diminish risk of disease.

Policy Relevance

The Government is planning to re-balance allocation of public health funds so that more is spent on treating the causes of diseases, rather than the diseases themselves (12). Thus, collation and evaluation of relevant evidence is vital for increasing understanding of health inequalities, risk behaviour clusters and factors that influence these clusters. This would also aid policy decision-making for financial expenditure and the appropriateness of interventions for particular communities, families and individuals and financial expenditure. In turn, this would increase the effectiveness of service delivery and achieve overarching goals of health protection and resilience (13).

This project aims to support public health policies to improve national health and well-being by investigating multiple risk behaviours (risk clusters), predictors of risk clusters (review 1), interventions and intervention context for reducing risk behaviours (review 2), and people's experiences of making lifestyle changes (review 3). The project will use systematic review methods to identify, appraise and synthesise existing research evidence. The findings from the individual systematic reviews will be brought together in an overall comparative synthesis, allowing key policy questions to be answered.

Methods

As the proposed methods for each of the systematic reviews are quite different we will incorporate the methods for each of the reviews in turn, starting with review 1.

Systematic review on identification and prediction of multiple risk behaviour clusters (review 1)

Research Questions

- i) Which lifestyle risk behaviours cluster or co-occur? (e.g., smoking, excessive alcohol use, inactivity, poor diet).
- ii) What are the predictors of risk clusters? (e.g., social class, educational background).

Search strategy

The following electronic databases will be searched from 1990 to 10th February 2012:

- MEDLINE
- EMBASE
- PsycINFO
- Science Citation Index

Searches will not be restricted by language. The MEDLINE search strategy is reported elsewhere and will be translated to run appropriately on the other databases.

Electronic searches will be supplemented by examination of the bibliographies of included studies and existing reviews.

Determining Inclusion criteria

Initial screening and mapping

Titles and abstracts of records identified by the electronic searches were downloaded into Endnote and assessed for inclusion by one reviewer and checked by a second reviewer. Initially broad inclusion criteria were used in order to map out the literature in an inclusive manner. Studies that were published after 1990, examined the association between two or more risk behaviours (see Table 1.1) and conducted with non-clinical populations were included. Studies focusing on children and young people (up to the age of 15) were excluded, so as to avoid duplication with work being led by Rona Campbell, University of Bristol (14).

Table 1.1. Risk behaviours of interest

Smoking
Alcohol misuse
Low levels of physical activity/exercise
Low fruit and vegetable intake
Other dietary intake
Illicit drug misuse
Sexual risk behaviour
Lack of seatbelt use
Sedentary behaviours
Lack of Motorcycle or bicycle helmet use
Lack of sunscreen use
Gambling
Poor oral hygiene habits
Drink driving
Smoking

For studies that met the initial inclusion criteria the following data were mapped: country where study conducted (each OECD country was listed and all other countries were classified as non-OECD); and whether the study was prospective or retrospective. An evidence map was created and discussed with the full project team to judge whether more detailed inclusion criteria were required given the volume of literature identified and the likely applicability of the findings within a UK context.

Further inclusion criteria after mapping

Since a very large number of records met the initial inclusion criteria (>2000) it was decided that the scope would be narrowed to included only UK studies as the mapping exercise identified a substantial number (total = 84) of such studies as being potentially relevant. The full article was ordered for each UK study and more detailed mapping was conducted to further investigate the implications of narrowing the inclusion criteria. The additional mapping items were: risk behaviours examined, predictors of clustering of risk behaviours, study design (cross-sectional, cohort, case-control), sample size. On the basis of this further mapping of the full articles it was decided that sufficient data was available to include only UK studies.

In addition, studies were required to examine either clustering or co-occurrence of two or more risk behaviours or predictors of these relationships (see table 1 for a list of included behaviours). Although the emphasis of the systematic review is on clustering of risk behaviours initial scoping suggested that relevant statistical analysis techniques had not been widely used. This includes comparing the observed prevalence of multiple risk behaviours with that expected if the behaviours were independent (e.g., prevalence odds ratios) or other methods of identifying clusters of behaviours (e.g. latent class analysis, cluster analysis, discriminant function analysis). Therefore it was judged that data examining co-occurrence of risk behaviours would provide relevant data to supplement that provided by studies specifically investigating clustering of these behaviours.

Data extraction

Data extraction will be piloted on a selection of studies to ensure consistency. Data will be extracted by one reviewer, using a standardised data extraction form developed in EPPI Reviewer (version 4), and checked by a second reviewer. Discrepancies will be resolved by discussion, with involvement of a third reviewer when necessary. If time constraints allow, attempts will be made to contact authors for any missing data. Data from multiple publications of the same study (or dataset) will be extracted and reported as a single study.

Quality assessment

The quality of the individual studies will be assessed independently by two reviewers using a tool developed by the University of Wales (College of Medicine) for the critical appraisal of observational studies (15). Any disagreements will be resolved by consensus and if necessary a third reviewer will be consulted.

Methods of analysis and synthesis

Given the anticipated diversity of the studies in terms of design, settings and methods of analyses, we propose to conduct a narrative synthesis. During the process of developing an evidence map and extracting data, it will be assessed whether the use of meta-analyses may be possible or appropriate as a component of the synthesis.

The synthesis will describe, organise, explore and interpret the study findings, taking into account any contextual factors that might have impacted on study outcomes. In particular, studies that have focused on clustering or co-occurrence of risk behaviours will be considered separately in the narrative synthesis. In addition, studies investigating risk behaviours in particular subgroups (e.g. young adults, homosexual men, etc) will be synthesised separately from studies focusing on the general population.

The methodological strengths and weaknesses of the studies will also be taken into account. As part of this process we will investigate the similarities and differences between study findings.

Advisory group

Professor Rona Campbell, University of Bristol, has acted as an advisor to the project.

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Appendix 2: Review 1 – Mapping exercises conducted during the review process

During the search process, approximately 87,000 records were identified. A large number of these records were identified as being potentially relevant (total = 2,128).

Studies were required to examine either clustering or co-occurrence of two or more risk behaviours or predictors of these relationships. Although the emphasis of the systematic review was on clustering of risk behaviours, initial mapping on a random selection of the potentially relevant studies at this stage suggested that relevant statistical analysis techniques had not been widely used (Table 2.1). This includes comparing the observed prevalence of multiple risk behaviours with that expected if the behaviours were independent (e.g., prevalence odds ratios), or other methods of identifying clusters of behaviours (e.g. latent class analysis, cluster analysis, discriminant function analysis). Therefore it was judged that data examining co-occurrence of risk behaviours could be included in the review also, because it would supplement data provided by studies specifically investigating clustering of risk behaviours.

Table 2.1. Frequency table showing the types of analyses utilised for exploring the clustering of health risk behaviours in a random selection of potentially relevant studies (total = 67)

Frequencies	11
Odds ratios	12
Cluster analysis	9
Observed/expected prevalence rates (odds ratio or percentage)	7
Correlation	6
Log-linear analyses	1
Linear associations	5
Unrelated t-test	2
Factor analysis	3
Principal components analysis	3
P values (from GLIMMIX analyses)	1
Mean values	1
Linear regression	1
MANCOVA and ANOVAs	1
Fry-Lee test	1
Discriminant function analysis	1
Multiple correspondence analysis	1
Latent class analysis	1

Due to the large number of studies initially identified as potentially eligible (total = 2,128), a further mapping exercise was conducted prior to the ordering of full papers.

Details for each study (reported by titles/abstracts) were mapped according to the following codes:

- **Country:** Individual countries who are members or partners of the Organisation for Economic Co-operation and Development (OECD)/non-OECD countries
- **Study design:** Prospective/retrospective
- **Population:** Adults/ Elderly/ School children, adolescents, college students

The software program, Eppi-Reviewer 4, was used to record these details; the following tables demonstrate the results from this mapping exercise.

Note: All codes had a '?' coding option to indicate when the code information was not available.

Code frequencies

Table 2.2. Frequencies for study populations

Population	Count
?	439
School children, adolescents, students	877
Adults	786
Elderly	26

Table 2.3. Frequencies for study designs

Study design	Count
?	550
Prospective	1279
Retrospective	299

Table 2.4. Frequencies for study countries

Country	Count
?	308
Non-OECD	254
Australia	52
Austria	3
Belgium	6
Canada	72
Chile	2
Czech Republic	6
Denmark	17
Estonia	3
Finland	40
France	28
Germany	31
Greece	12
Hungary	9
Iceland	4
Ireland	7
Israel	7
Italy	15
Japan	22
Korea	12
Luxembourg	1
Mexico	15
New Zealand	13
Netherlands	22
Norway	18
Poland	7
Portugal	10
Slovak Republic	4
Slovenia	2
Spain	48
Sweden	25
Switzerland	18
Turkey	12
UK	84
US	939

Cross-tabulations

Table 2.5. Study design by country (A-G)

Study design	?	Non-OECD	Australia	Austria	Belgium	Canada	Chile	Czech Republic	Denmark	Estonia	Finland	France	Germany	Greece
?	416	0	2	0	0	3	0	0	1	0	1	2	1	0
Prospective	88	30	48	6	3	53	3	5	11	3	27	23	28	11
Retrospective	5	1	5	0	4	17	1	1	5	0	12	4	1	1

Table 2.6. Study design by country (H-P)

Study design	Hungary	Iceland	Ireland	Israel	Italy	Japan	Korea	Luxembourg	Mexico	New Zealand	Netherlands	Norway	Poland	Portugal
?	0	0	0	0	1	1	0	0	2	0	0	1	0	0
Prospective	9	2	5	6	14	16	9	1	11	12	19	13	6	10
Retrospective	0	2	2	1	0	4	3	0	2	1	3	4	1	0

Table 2.7. Study design by country (S-U)

Study design	Slovak Republic	Slovenia	Spain	Sweden	Switzerland	Turkey	UK	US
?	0	0	0	4	1	0	3	41
Prospective	4	2	43	14	13	12	64	714
Retrospective	0	0	5	7	5	0	18	195

Table 2.8. Study population by country (A-G)

Study population	?	Non-OECD	Australia	Austria	Belgium	Canada	Chile	Czech Republic	Denmark	Estonia	Finland	France	Germany	Greece
?	371	0	0	0	0	0	0	0	0	0	0	1	0	0
School children, adolescents, students	73	16	18	0	2	38	2	3	4	1	19	14	11	7
Adults	45	17	36	3	3	32	0	3	11	2	22	14	19	5
Elderly	1	2	0	0	1	2	0	0	2	0	1	0	0	0

Table 2.9. Study population by country (H-P)

Study population	Hungary	Iceland	Ireland	Israel	Italy	Japan	Korea	Luxembourg	Mexico	New Zealand	Netherlands	Norway	Poland	Portugal
?	0	0	0	0	0	0	0	0	0	0	0	0	0	0
School children, adolescents, uni students	9	3	3	2	9	9	9	1	10	5	8	9	4	5
Adults	0	1	4	4	7	11	3	0	5	7	14	9	2	3
Elderly	0	0	0	1	1	2	0	0	2	1	1	0	1	1

Table 2.10. Study population by country (S-U)

Study population	Slovak Republic	Slovenia	Spain	Sweden	Switzerland	Turkey	UK	US
?	0	0	0	0	0	0	0	5
School children, adolescents, students	2	1	25	8	10	9	31	530
Adults	2	1	23	16	7	3	54	419
Elderly	0	0	2	2	1	0	1	9

Table 2.4 shows that a good proportion of the mapped studies were UK-based. Therefore, one option was that we focus on UK studies as a way of making the review doable within the timescale/resource available. It would also make the findings more relevant for UK policy. The full article was ordered for each UK study and more detailed mapping was conducted to further investigate the implications of narrowing the inclusion criteria. During this mapping exercise, any ineligible studies were excluded and their details were not mapped. For the eligible UK studies the additional mapping items were as follows:

- **Risk behaviours examined**
- **Predictors of clustering of risk behaviours**
- **Study design** (cross-sectional, cohort, case-control)
- **Sample size**

Table 2.11 presents the findings from this mapping exercise. Based on these findings, it was decided that there were sufficient data available to include only UK studies in the review.

Note: All codes had a '?' coding option to indicate when the code information was not available.

Table 2.11. Mapped study characteristics of the UK studies

First author (year of publication)	Sample size	Cross-sectional/longitudinal	Risk behaviours and definition	Predictors of Risk Clusters
Abel (1992)	500	Cross-sectional	<p>N.B. For all risk behaviour variables, higher scores indicated less favourable consumption patterns.</p> <p>Alcohol misuse Based on 2 questions: 1) During the past month how often did you have any alcoholic drink on average? (ranging from 'never'=0 to 'almost every day'=5). 2) On the days when you take a drink, about how many drinks do you have on average? (categories ranging from 1 to 10 or more).</p> <p>Other dietary intake Unhealthy eating habits: 1) added salt to food 2) ate white bread 4) ate red meat</p> <p>Answers for items 2 and 4 were coded as 'most days', 'at least once a week,' 'less than once a week', and 'rarely or never.'</p> <p>Smoking Smokers were asked if they smoke now and how many on average per day. Answers were re-coded as 1) non-smokers, 2) less than 20 cigarettes per day, and 3) 21 or more cigarettes per day.</p>	Not investigated
Aicken (2011)	24,926	Cross-sectional	<p>Alcohol misuse <i>>14 units for females and >21 units for males per week</i></p> <p>Sexual risk behaviour <i>unprotected sex with 2+ partners</i></p>	Gender
Balabanis (2002)	196	Cross-sectional	<p>Gambling Smoking</p>	Not investigated
Bolding (2006)	1752	Cross-sectional	<p>Illicit drug misuse <i>use of crystal meth (methamphetamine), cocaine, ecstasy, ketamine, speed in previous 12</i></p>	Not investigated

			<i>months</i> Sexual risk behaviour <i>unprotected anal intercourse in previous 3 months</i>	
Cade (1991)	800	Cross-sectional	Other dietary intake Smoking	Not investigated
Crawley (1995)	3430	Cross-sectional	Low level of fruit and vegetable intake Other dietary intake Smoking	Not investigated
Crombie (1990)	10,359	Cross-sectional	Alcohol misuse <i>self-reported consumption of at least 40 units per week for men, and 20 units per week for women</i> Other dietary intake - 'Regular' consumption of lard (exact frequencies not reported) - Mean number of eggs consumed (exact frequencies not reported) - (Note: is this really an UNhealthy habit?) Smoking <i>self-reported consumption of 20 or more cigarettes per day</i>	Not investigated
Dodd (2010)	410	Cross-sectional	Alcohol misuse <i>4 or more alcoholic beverages for females and 5 or more for males</i> Low level of physical activity/exercise <i><4 times a week of 30 minutes moderate exercise or 20 minutes vigorous exercise</i> Low level of fruit and vegetable intake <i><5 a day</i> Smoking <i>occasional or frequent/regular smoker - thresholds not defined</i>	Age Gender Ethnicity
Egginton (2002)	815	Longitudinal	Alcohol misuse Illicit drug misuse Smoking	Not investigated
Evans (1995)	938	Cross-sectional	Sexual risk behaviour Smoking	Not investigated
Fear (2007)	8686	Cross-sectional	Alcohol misuse <i>Alcohol Use Disorders Identification Test (AUDIT) ≥ 8 (hazardous drinking)</i> <i>Alcohol Use Disorders Identification Test (AUDIT) ≥ 16 (high level of alcohol problems)</i> <i>AUDIT score can be broke down into 3 subcomponents: hazardous level 4+ for women abd 5+ for men; alcohol dependence 4+ and alcohol-related harm 4+.</i>	Age Gender Ethnicity Education Marital status

			<i>Binge drinking defined as drinking 6 or more units of alcohol on one occasion on at least a weekly basis.</i> Smoking	Employment status Other <i>rank, children living at home, parent with drink/drug problem</i>
Gossop (2002)	735	Cross-sectional	Alcohol misuse Illicit drug misuse	Not investigated
Griffiths (1994)	210	Cross-sectional	Alcohol misuse Illicit drug misuse Sedentary behaviour Gambling	Not investigated
Griffiths (2010)	9003	Cross-sectional	Alcohol misuse Gambling Smoking	Not investigated
Griffiths (2011)	9003	Cross-sectional	Alcohol misuse Gambling Smoking	Not investigated
Haste (1990)	112	Cross-sectional	Low level of fruit and vegetable intake Other dietary intake Smoking	Not investigated
Lake (2009)	73	Cross-sectional	Low level of physical activity/exercise Other dietary intake Sedentary behaviour	Not investigated
Lawder (2010)	6574	Cross-sectional	Alcohol misuse <i>Exceeding 21 units per week for men, and 14 units per week for women</i> Low level of physical activity/exercise <i>Not meeting the recommended 30 minutes of moderate exercise on 5 or more days of the week.</i> Low level of fruit and vegetable intake <i>Not consuming five or more portions of fruit and vegetables per day.</i> Smoking <i>Smoking cigarettes, cigars or a pipe regularly (at least once per day for a month) - data were validated by salivary cotinine analysis.</i>	Age Gender Ethnicity Education Marital status Employment status Social class Other <i>deprivation quintile</i>
Liao (1995)	106	Cross-sectional	Alcohol misuse Low level of physical activity/exercise	Not investigated

			Smoking	
Macgregor (1998)	2756	Cross-sectional	Poor oral hygiene Smoking	Not investigated
McAloney (2010)	1132	Longitudinal	Alcohol misuse Illicit drug misuse Sexual risk behaviour Smoking	Not investigated
Miller (1995)	1387	Cross-sectional	Alcohol misuse Illicit drug misuse Sexual risk behaviour	Not investigated
Parkes (2007)	1322	Longitudinal	Alcohol misuse Illicit drug misuse Sexual risk behaviour Smoking	Gender Social class Other <i>neighbourhood deprivation</i>
Plant (1990)	205	Cross-sectional	Alcohol misuse Illicit drug misuse Sexual risk behaviour Smoking	Not investigated
Plant (2002)	2027	Cross-sectional	Alcohol misuse Illicit drug misuse Smoking	Not investigated
Pollard (2001)	35367	Cross-sectional	Alcohol misuse Low level of fruit and vegetable intake Smoking	Not investigated
Poortinga (2007)	11,617	Cross-sectional	Alcohol misuse Low level of physical activity/exercise Smoking	Not investigated
Poortinga (2007)	11,492	Cross-sectional	Alcohol misuse Low level of physical activity/exercise Low level of fruit and vegetable intake Smoking	Age Gender Marital status Employment status Social class Other <i>household tenure</i>
Shankar (2010)	11,214	Cross-sectional	Alcohol misuse	Age

			Low level of physical activity/exercise Smoking	Gender Education Marital status Other <i>limiting long-term illness, subjective socioeconomic status, wealth quartile</i>
Shelton (2005)	7434	Cross-sectional	Low level of physical activity/exercise Low level of fruit and vegetable intake Other dietary intake Smoking	Not investigated
Singleton (2003)	?	Cross-sectional	Alcohol misuse Illicit drug misuse smoking	Not investigated
Smith (1994)	8,000	Cross-sectional	Alcohol misuse Low level of physical activity/exercise Low level of fruit and vegetable intake Other dietary intake Smoking	Age Gender Education Marital status Social class Other <i>geographical area</i>
Sutherland (1998)	5383	Cross-sectional	Alcohol misuse Illicit drug misuse Smoking	Not investigated
Tang (1997)	8109	Cross-sectional	Alcohol misuse Low level of physical activity/exercise Low level of fruit and vegetable intake Other dietary intake Smoking	Not investigated
Thomas (1990)	209	Cross-sectional	Alcohol misuse Illicit drug misuse Sexual risk behaviour	Not investigated
Thompson (1992)	9003	Cross-sectional	Low level of physical activity/exercise Low level of fruit and vegetable intake Other dietary intake	Not investigated

			Smoking	
Thompson (1999)	5553	Cross-sectional	Low level of fruit and vegetable intake <i>consumption of fruit and/or vegetables limited to 8 a week or less</i> Smoking <i>self-reported smoking status (current smoker/ex-smoker/never smoked)</i>	Not investigated
Thornton (1994)	?	Cross-sectional	Alcohol misuse Low level of physical activity/exercise Low level of fruit and vegetable intake Other dietary intake Smoking	Not investigated
Uitenbroek (1993)	5471	Cross-sectional	Alcohol misuse <i>Classified as light drinkers, moderate drinkers or heavy drinkers. Heavy drinkers had consumed more than 5 alcoholic beverages on more than 5 occasions in the past month.</i> Low level of physical activity/exercise <i>Did not exercise at least once for at least 20 minutes in the past week.</i> Other dietary intake <i>Assessed whether they regularly consumed salt ('most of the time' or 'sometimes') (risk) and what they spread on their bread (e.g., butter=risk)</i> Sexual risk behaviour <i>Number of sexual partners during the past 5 years (risk= more than 3 partners)</i> Lack of seat belt use <i>Use of seatbelt: Always vs. never (risk) (dichotomous)</i> Smoking <i>Answered yes to both questions to be classified as a smoker:</i> <i>1) Have you smoked at least 100 cigarettes in your life?</i> <i>2) Do you smoke now?</i>	Not investigated
Uitenbroek (1994)	7717		Alcohol misuse Low level of physical activity/exercise Drink driving Smoking	Not investigated
Underwood (2007)	767	Cross-sectional	Alcohol misuse Illicit drug misuse Smoking	Not investigated
Underwood (2010)	384	Cross-sectional	Alcohol misuse Illicit drug misuse	Not investigated

Wadsworth (2004)	7979	Cross-sectional	Alcohol misuse <i>Alcohol consumption greater than 14 units per week for women, and 21 units for men.</i> Illicit drug misuse <i>Self-reported use (yes/no) over three time periods: 1) ever used, 2) used in the last year, 3) used in the last month</i> Smoking <i>Self-reported current and past smoking habits (yes/no)</i>	Not investigated
Wadsworth (2004)	7979	Cross-sectional	Alcohol misuse <i>units of alcohol consumed per week</i> Illicit drug misuse <i>Self-reported use over three time periods: 1) ever used, 2) used in the last year, 3) used in the last month</i> Smoking <i>Self-reported current and past smoking habits (including number of cigarettes smoked per day)</i>	Not investigated
Weatherburn (1993)	461	Cross-sectional	Alcohol misuse <i>Day, time, units and perceived effect - no cut-off values for risk drinking provided.</i> Sexual risk behaviour <i>Condom use for anal intercourse (yes/no) (where no is the risk behaviour), type of partner (casual or regular), or anal intercourse (yes/no)</i>	Not investigated
Woodward (1994)	9491	Cross-sectional	Alcohol misuse <i>g/day</i> Other dietary intake <i>fiber (g/day), vitamin E (mg/day), vitamin C (mg/day), b-carotene (g/day - see paper), percentages for physical inactivity, consumption of ready-made foods, butter/hard margarine, full-fat milk.</i> Smoking <i>Any participant with a self-reported current consumption of cigarette, cigar or pipe tobacco (either regular or occasional). Non-smokers had CO with expired air of 6ppm or above, serum cotinine of 17.5ng/ml or above, or SCN of 63.4 mol/liter or above.</i>	Not investigated

Appendix 3: Review 1 – Search strategy

Embase <1980 to 2012 Week 03>

22nd December 2012

-
- 1 (health\$ adj2 (diet\$ or eating or food or foods)).ti,ab. (11207)
 - 2 (unhealth\$ adj2 (diet\$ or eating or food or foods)).ti,ab. (1175)
 - 3 fruit/ or vegetable/ (38885)
 - 4 (fruit\$ adj2 (eat or eats or eating or intake or consum\$ or increas\$ or portion\$ or serving\$ or frequenc\$ or number\$ or preference\$ or choice\$)).ti,ab. (5845)
 - 5 (vegetable\$ adj2 (eat or eats or eating or intake or consum\$ or increas\$ or portion\$ or serving\$ or frequenc\$ or number\$ or preference\$ or choice\$)).ti,ab. (5317)
 - 6 "5 a day".mp. (150)
 - 7 "five a day".ti,ab. (36)
 - 8 (junk food or fast food).ti,ab. (1514)
 - 9 ((decreas\$ or reduc\$ or discourag\$ or limit\$ or lessen or eat\$ less) adj2 (salt or fat)).ti,ab. (10401)
 - 10 (food adj (choice\$ or frequenc\$ or select\$)).ti,ab. (9135)
 - 11 Feeding Behavior/ (44841)
 - 12 eating habit/ or food preference/ (12171)
 - 13 diet therapy/ (39638)
 - 14 obesity/ (179547)
 - 15 or/1-14 (314233)
 - 16 (editorial or letter).pt. (1142862)
 - 17 15 not 16 (298179)
 - 18 limit 17 to yr="1990 -Current" (245711)
 - 19 (physical\$ adj3 (fit\$ or train\$ or activ\$ or inactiv\$ or endur\$)).ti,ab. (69678)
 - 20 (exercis\$ adj3 (fit\$ or train\$ or activ\$ or endur\$)).ti,ab. (23217)
 - 21 ((promot\$ or uptak\$ or encourag\$ or increas\$ or start\$ or adher\$) adj3 (exercis\$ or gym\$ or sport\$ or fitness)).ti,ab. (22338)
 - 22 ((decreas\$ or reduc\$ or discourag\$) adj3 (sedentary or deskbound or desk-bound)).ti,ab. (427)
 - 23 (sedentary behaviour\$ or sedentary behavior\$ or sedentary lifestyle\$ or sedentariness).ti,ab. (3299)
 - 24 sedentary lifestyle/ (1256)
 - 25 ((watch\$ or view\$) adj2 (tv or television)).ti,ab. (2677)
 - 26 (sport\$ or walk\$ or running or jogging or bicycling or biking or swimming).ti,ab. (160252)
 - 27 (active adj (travel\$ or transport\$ or commut\$)).ti,ab. (6122)
 - 28 fitness/ or physical activity/ (75131)
 - 29 exp Recreation/ or leisure/ (31661)
 - 30 physical exercise/ (144134)
 - 31 running/ or jogging/ or swimming/ or walking/ (50211)
 - 32 or/19-31 (408692)
 - 33 (editorial or comment).pt. (389767)
 - 34 32 not 33 (401898)
 - 35 limit 34 to yr="1990 -Current" (322584)
 - 36 exp smoking/ (175056)
 - 37 (smoking or antismoking or anti-smoking).ti,ab. (146170)
 - 38 (smoker or smokers).ti,ab. (58144)
 - 39 tobacco abuse/ or tobacco addiction/ or tobacco dependence/ (9951)
 - 40 36 or 37 or 38 or 39 (226866)
 - 41 (editorial or comment).pt. (389767)
 - 42 40 not 41 (221596)

43 limit 42 to yr="1990 -Current" (188944)
 44 exp Alcohol abuse/ (17560)
 45 exp Alcohol Intoxication/ (9682)
 46 exp Alcoholic Beverages/ (15630)
 47 exp Drinking Behavior/ (29181)
 48 (beer or wine\$ or cider or alcopop\$ or spirit or spirits).ti,ab. (23363)
 49 alcohol\$.ti,ab. (246224)
 50 (drink\$ adj2 (binge or excessive or harm\$ or heavy or misus\$ or abus\$ or consum\$)).ti,ab.
 (10959)
 51 (intoxicat\$ or inebriat\$ or drunk\$).ti,ab. (42160)
 52 44 or 45 or 46 or 47 or 48 or 49 or 50 or 51 (317504)
 53 (editorial or letter).pt. (1142862)
 54 52 not 53 (309749)
 55 limit 54 to yr="1990 -Current" (235824)
 56 Unsafe Sex/ (1398)
 57 multiple sexual partner\$.ti,ab. (784)
 58 multiple casual partner\$.ti,ab. (9)
 59 one time sex\$ encounter\$.ti,ab. (3)
 60 one-time sex\$ encounter\$.ti,ab. (3)
 61 (sex\$ adj2 holiday\$).ti,ab. (8)
 62 casual sex\$.ti,ab. (496)
 63 casual partner\$.ti,ab. (644)
 64 non-regular sex\$ partner\$.ti,ab. (25)
 65 non regular sex\$ partner\$.ti,ab. (25)
 66 (unprotected adj2 intercourse).ti,ab. (1752)
 67 (unprotected adj2 sex\$).ti,ab. (2419)
 68 (condomless adj (sex or intercourse)).ti,ab. (6)
 69 (condom free adj (sex or intercourse)).ti,ab. (2)
 70 (RUI or UI).ti,ab. (268)
 71 (barebacking or bareback sex\$ or bugchas\$ or bug chas\$).ti,ab. (65)
 72 anal intercourse.ti,ab. (1464)
 73 anal sex.ti,ab. (1031)
 74 or/56-73 (7284)
 75 sexual behavior/ (70604)
 76 high risk behavior/ (10648)
 77 75 and 76 (2993)
 78 (risk\$ sex\$ behavio\$ or unsafe sex\$).ti,ab. (3023)
 79 74 or 77 or 78 (11215)
 80 (comment or editorial).pt. (389767)
 81 79 not 80 (11111)
 82 limit 81 to yr="1990 -Current" (10825)
 83 exp drug abuse/ (52287)
 84 substance abuse/ (31830)
 85 ((drug\$ or substance\$) adj2 (use\$ or using or abuse\$ or abusing or misuse\$ or misusing)).ti,ab.
 (146481)
 86 ((heroin or opiate\$ or cocaine or crack) adj2 (use\$ or using or abuse\$ or abusing or misuse\$ or
 misusing)).ti,ab. (13429)
 87 ((cannabis or marijuana) adj2 (use\$ or using or abuse\$ or abusing or misuse\$ or
 misusing)).ti,ab. (6692)
 88 ((benzodiazepine\$ or amphetamine\$ or methamphetamine\$ or MDMA or ecstasy) adj2 (use\$
 or using or abuse\$ or abusing or misuse\$ or misusing)).ti,ab. (6786)

89 (solvent\$ adj2 (use\$ or using or abuse\$ or abusing or misuse\$ or misusing)).ti,ab. (7195)
 90 street drug\$.ti,ab. (493)
 91 (prescri\$ drug\$ adj2 (use\$ or using or abuse\$ or abusing or misuse\$ or misusing)).ti,ab. (1319)
 92 polydrug use\$.ti,ab. (586)
 93 inject\$ drug use\$.ti,ab. (7482)
 94 (needle\$ adj3 (share\$ or sharing)).ti,ab. (1254)
 95 (syringe\$ adj3 (share\$ or sharing)).ti,ab. (489)
 96 or/83-95 (202126)
 97 (editorial or comment).pt. (389767)
 98 96 not 97 (199055)
 99 limit 98 to yr="1990 -Current" (173040)
 100 sunbathing/ (189)
 101 sunscreen/ or sunburn/ (7998)
 102 (sunbath\$ or sunscreen\$ or sunburn\$ or suntan\$ or sunbed\$).ti,ab. (6063)
 103 (sun bath\$ or sun screen\$ or sun burn\$ or sun tan\$ or sun bed\$).ti,ab. (333)
 104 sun protect\$.ti,ab. (2130)
 105 (tanning adj (bed\$ or salon\$ or studio\$)).ti,ab. (198)
 106 100 or 101 or 102 or 103 or 104 or 105 (10801)
 107 (comment or editorial).pt. (389767)
 108 106 not 107 (10599)
 109 limit 108 to yr="1990 -Current" (9306)
 110 dental health/ or dental caries/ (37121)
 111 mouth hygiene/ or tooth brushing/ (21083)
 112 (dental care or dental health or dental hygiene).ti,ab. (14973)
 113 (oral care or oral health or oral hygiene).ti,ab. (18034)
 114 (gingival care or gingival health or gingival hygiene).ti,ab. (645)
 115 ((unsupervised or irregular\$ or regular\$ or lack or seldom or never or infrequent\$ or frequen\$ or insufficient\$) adj2 (toothbrushing or flossing)).ti,ab. (311)
 116 ((irregular\$ or regular\$ or seldom or lack or never or infrequent\$ or frequen\$) adj3 (dental or dentist\$)).ti,ab. (2407)
 117 ((irregular\$ or regular\$ or seldom or lack or never or infrequent\$ or frequen\$) adj3 dental visit\$).ti,ab. (258)
 118 ((irregular\$ or regular\$ or seldom or lack or never or infrequent\$ or frequen\$) adj3 dental attendance).ti,ab. (77)
 119 (clean\$ teeth adj2 (irregular\$ or regular\$ or infrequent\$ or frequen\$ or seldom or never)).ti,ab. (3)
 120 (brush\$ teeth adj2 (irregular\$ or regular\$ or infrequent\$ or frequen\$ or seldom or never)).ti,ab. (9)
 121 ((sweet\$ drink\$ or fizzy drink\$ or sugary snack\$ or sweets or confectionery) adj6 (tooth or teeth or dental or oral or caries or decay)).ti,ab. (154)
 122 or/110-121 (72550)
 123 (editorial or comment).pt. (389767)
 124 122 not 123 (71763)
 125 limit 124 to yr="1990 -Current" (42453)
 126 patient compliance/ (79283)
 127 treatment refusal/ (9560)
 128 126 and 127 (966)
 129 (non-adherence adj2 (patient\$ or medication\$ or screen\$ or treatment or therapy or immunisation or immunization or regimen\$ or drug\$)).ti,ab. (803)
 130 (nonadherence adj2 (patient\$ or medication\$ or screen\$ or treatment or therapy or immunisation or immunization or regimen\$ or drug\$)).ti,ab. (932)

131 (low adherence adj2 (patient\$ or medication\$ or screen\$ or treatment or therapy or immunisation or immunization or regimen\$ or drug\$)).ti,ab. (105)
 132 (poor adherence adj2 (patient\$ or medication\$ or screen\$ or treatment or therapy or immunisation or immunization or regimen\$ or drug\$)).ti,ab. (479)
 133 ((loss or lack or failure or barrier\$ or impediment\$ or selective or minimal) adj2 adherence).ti,ab. (1298)
 134 (non-compliance adj2 (patient\$ or medication\$ or screen\$ or treatment or therapy or immunisation or immunization or regimen\$ or drug\$)).ti,ab. (932)
 135 (noncompliance adj2 (patient\$ or medication\$ or screen\$ or treatment or therapy or immunisation or immunization or regimen\$ or drug\$)).ti,ab. (1301)
 136 (low compliance adj2 (patient\$ or medication\$ or screen\$ or treatment or therapy or immunisation or immunization or regimen\$ or drug\$)).ti,ab. (113)
 137 (poor compliance adj2 (patient\$ or medication\$ or screen\$ or treatment or therapy or immunisation or immunization or regimen\$ or drug\$)).ti,ab. (553)
 138 ((loss or lack or failure or barrier\$ or impediment\$ or selective or minimal) adj2 compliance).ti,ab. (1331)
 139 treatment refusal/ (9560)
 140 mass screening/ (41664)
 141 139 and 140 (48)
 142 (non-attend\$ adj3 screen\$).ti,ab. (61)
 143 (nonattend\$ adj3 screen\$).ti,ab. (18)
 144 (non-attend\$ adj3 appoint\$).ti,ab. (65)
 145 (nonattend\$ adj3 appoint\$).ti,ab. (23)
 146 (non-attend\$ adj3 (check-up\$ or checkup\$)).ti,ab. (3)
 147 (nonattend\$ adj3 (check-up\$ or checkup\$)).ti,ab. (0)
 148 (non-attend\$ adj3 (mammogra\$ or smear test\$ or PAP test\$ or breast exam\$ or CBE)).ti,ab. (15)
 149 (nonattend\$ adj3 (mammogra\$ or smear test\$ or PAP test\$ or breast exam\$ or CBE)).ti,ab. (5)
 150 128 or 129 or 130 or 131 or 132 or 133 or 134 or 135 or 136 or 137 or 138 or 141 or 142 or 143 or 144 or 145 or 146 or 147 or 148 or 149 (8585)
 151 (editorial or comment).pt. (389767)
 152 150 not 151 (8533)
 153 limit 152 to yr="1990 -Current" (7940)
 154 seatbelt/ (3325)
 155 (seat belt\$ or seatbelt\$).ti,ab. (2753)
 156 seat restraint\$.ti,ab. (42)
 157 passenger\$ restraint\$.ti,ab. (52)
 158 driver\$ restraint\$.ti,ab. (11)
 159 ((unbelted or unrestrained) adj2 (driver\$ or passenger\$)).ti,ab. (109)
 160 154 or 155 or 156 or 157 or 158 or 159 (4508)
 161 helmet/ (2823)
 162 (cycle helmet\$ or bike helmet\$ or bicycle helmet\$).ti,ab. (505)
 163 161 or 162 (2893)
 164 protective equipment/ (8344)
 165 fire/ or smoke/ (12633)
 166 164 and 165 (121)
 167 (smoke adj (alarm\$ or sensor\$)).ti,ab. (146)
 168 (fire adj (alarm\$ or sensor\$)).ti,ab. (57)
 169 166 or 167 or 168 (298)
 170 drunken driving/ (1700)
 171 (drink\$ adj2 (drive\$ or driving)).ti,ab. (1373)

172 alcohol impaired driv\$.ti,ab. (205)
 173 170 or 171 or 172 (2733)
 174 160 or 163 or 169 or 173 (10007)
 175 (letter or comment).pt. (753095)
 176 174 not 175 (9482)
 177 limit 176 to yr="1990 -Current" (7670)
 178 pathological gambling/ (3565)
 179 (gambling or gambler).mp. or gamblers.ti,ab. [mp=title, abstract, subject headings, heading word, drug trade name, original title, device manufacturer, drug manufacturer, device trade name, keyword] (4429)
 180 178 or 179 (4429)
 181 (editorial or comment).pt. (389767)
 182 180 not 181 (4317)
 183 limit 182 to yr="1990 -Current" (3946)
 184 (18 and 35) or (18 and 43) or (18 and 55) or (18 and 82) or (18 and 99) or (18 and 109) or (18 and 125) or (18 and 153) or (18 and 177) or (18 and 183) (56189)
 185 (35 and 18) or (35 and 43) or (35 and 55) or (35 and 82) or (35 and 99) or (35 and 109) or (35 and 125) or (35 and 153) or (35 and 177) or (35 and 183) (56026)
 186 (43 and 18) or (43 and 35) or (43 and 55) or (43 and 82) or (43 and 99) or (43 and 109) or (43 and 125) or (43 and 153) or (43 and 177) or (43 and 183) (57776)
 187 (55 and 18) or (55 and 35) or (55 and 43) or (55 and 82) or (55 and 99) or (55 and 109) or (55 and 125) or (55 and 153) or (55 and 177) or (55 and 183) (65218)
 188 (82 and 18) or (82 and 35) or (82 and 43) or (82 and 55) or (82 and 99) or (82 and 109) or (82 and 125) or (82 and 153) or (82 and 177) or (82 and 183) (4276)
 189 (99 and 18) or (99 and 35) or (99 and 43) or (99 and 55) or (99 and 82) or (99 and 109) or (99 and 125) or (99 and 153) or (99 and 177) or (99 and 183) (41381)
 190 (109 and 18) or (109 and 35) or (109 and 43) or (109 and 55) or (109 and 82) or (109 and 99) or (109 and 125) or (109 and 153) or (109 and 177) or (109 and 183) (1017)
 191 (125 and 18) or (125 and 35) or (125 and 43) or (125 and 55) or (125 and 82) or (125 and 99) or (125 and 109) or (125 and 153) or (125 and 177) or (125 and 183) (4216)
 192 (153 and 18) or (153 and 35) or (153 and 43) or (153 and 55) or (153 and 82) or (153 and 99) or (153 and 109) or (153 and 125) or (153 and 177) or (153 and 183) (1476)
 193 (177 and 18) or (177 and 35) or (177 and 43) or (177 and 55) or (177 and 82) or (177 and 99) or (177 and 109) or (177 and 125) or (177 and 153) or (177 and 183) (3205)
 194 (183 and 18) or (183 and 35) or (183 and 43) or (183 and 55) or (183 and 82) or (183 and 99) or (183 and 109) or (183 and 125) or (183 and 153) or (183 and 177) (1381)
 195 184 or 185 or 186 or 187 or 188 or 189 or 190 or 191 or 192 or 193 or 194 (132710)
 196 animal experiment/ (1485468)
 197 195 not 196 (130082)
 198 cohort analysis/ or longitudinal study/ or retrospective study/ or prospective study/ or cross-sectional study/ (590381)
 199 (cohort adj (study or studies)).tw. (71475)
 200 cohort analy\$.tw. (3220)
 201 ("follow up" adj (study or studies)).tw. (37282)
 202 (observational adj (study or studies)).tw. (39792)
 203 (descriptive adj (study or studies)).tw. (15227)
 204 (epidemiologic\$ adj (study or studies)).tw. (60567)
 205 longitudinal.tw. (125093)
 206 retrospective.tw. (269045)
 207 prospective.tw. (348601)
 208 cross sectional.tw. (141577)

209 health survey/ (129850)
 210 or/198-209 (1285521)
 211 197 and 210 (35753)

Database: Ovid MEDLINE(R) In-Process & Other Non-Indexed Citations and Ovid MEDLINE(R) <1946 to Present>

Search date: 23rd December 2012

 1 (health\$ adj2 (diet\$ or eating or food or foods)).ti,ab. (9220)
 2 (unhealth\$ adj2 (diet\$ or eating or food or foods)).ti,ab. (987)
 3 fruit/ or vegetables/ (29321)
 4 (fruit\$ adj2 (eat or eats or eating or intake or consum\$ or increas\$ or portion\$ or serving\$ or frequenc\$ or number\$ or preference\$ or choice\$)).ti,ab. (5091)
 5 (vegetable\$ adj2 (eat or eats or eating or intake or consum\$ or increas\$ or portion\$ or serving\$ or frequenc\$ or number\$ or preference\$ or choice\$)).ti,ab. (4625)
 6 "5 a day".mp. (126)
 7 "five a day".ti,ab. (26)
 8 (junk food or fast food).ti,ab. (1257)
 9 ((decreas\$ or reduc\$ or discourag\$ or limit\$ or lessen or eat\$ less) adj2 (salt or fat)).ti,ab. (8929)
 10 (food adj (choice\$ or frequenc\$ or select\$)).ti,ab. (7988)
 11 Feeding Behavior/ (33125)
 12 food habits/ or food preferences/ (24048)
 13 nutrition therapy/ or exp diet therapy/ (37188)
 14 obesity/ or overweight/ (105809)
 15 or/1-14 (229653)
 16 (comment or editorial or letter).pt. (1144084)
 17 15 not 16 (219188)
 18 limit 17 to yr="1990 -Current" (156354)
 19 (physical\$ adj3 (fit\$ or train\$ or activ\$ or inactiv\$ or endur\$)).ti,ab. (57920)
 20 (exercis\$ adj3 (fit\$ or train\$ or activ\$ or endur\$)).ti,ab. (19437)
 21 ((promot\$ or uptak\$ or encourag\$ or increas\$ or start\$ or adher\$) adj3 (exercis\$ or gym\$ or sport\$ or fitness)).ti,ab. (19479)
 22 ((decreas\$ or reduc\$ or discourag\$) adj3 (sedentary or deskbound)).ti,ab. (364)
 23 (sedentary behaviour\$ or sedentary behavior\$ or sedentary lifestyle\$ or sedentariness).ti,ab. (2714)
 24 sedentary lifestyle/ (939)
 25 ((watch\$ or view\$) adj2 (tv or television)).ti,ab. (2304)
 26 (sport\$ or walk\$ or running or jogging or bicycling or biking or swimming).ti,ab. (135633)
 27 (active adj (travel\$ or transport\$ or commut\$)).ti,ab. (6532)
 28 physical fitness/ (19149)
 29 exp Recreation/ or leisure activities/ (113329)
 30 exp Exercise Therapy/ or Exercise/ (78276)
 31 running/ or jogging/ or swimming/ or walking/ (36153)
 32 or/19-31 (326294)
 33 (letter or editorial or comment).pt. (1144084)
 34 32 not 33 (314737)
 35 limit 34 to yr="1990 -Current" (246568)
 36 exp smoking/ (106047)
 37 (smoking or antismoking or anti-smoking).ti,ab. (124050)
 38 (smoker or smokers).ti,ab. (49322)
 39 tobacco/ or tobacco.ti,ab. (63819)

40 36 or 37 or 38 or 39 (211282)
 41 (letter or editorial or comment).pt. (1144084)
 42 40 not 41 (201949)
 43 limit 42 to yr="1990 -Current" (159226)
 44 exp Alcohol Drinking/ (44202)
 45 exp Alcoholic Intoxication/ (10157)
 46 exp Alcoholic Beverages/ (11911)
 47 exp Drinking Behavior/ (49358)
 48 (beer or wine\$ or cider or alcopop\$ or spirit or spirits).ti,ab. (19044)
 49 alcohol\$.ti,ab. (200605)
 50 (drink\$ adj2 (binge or excessive or harm\$ or heavy or misus\$ or abus\$ or consum\$)).ti,ab.
 (9119)
 51 (intoxicat\$ or inebriat\$ or drunk\$).ti,ab. (36346)
 52 44 or 45 or 46 or 47 or 48 or 49 or 50 or 51 (264632)
 53 (comment or editorial or letter).pt. (1144084)
 54 52 not 53 (257016)
 55 limit 54 to yr="1990 -Current" (177578)
 56 Unsafe Sex/ (1936)
 57 multiple sexual partner\$.ti,ab. (697)
 58 multiple casual partner\$.ti,ab. (10)
 59 one time sex\$ encounter\$.ti,ab. (3)
 60 one-time sex\$ encounter\$.ti,ab. (3)
 61 (sex\$ adj2 holiday\$).ti,ab. (8)
 62 casual sex\$.ti,ab. (451)
 63 casual partner\$.ti,ab. (600)
 64 non-regular sex\$ partner\$.ti,ab. (22)
 65 non regular sex\$ partner\$.ti,ab. (22)
 66 (unprotected adj2 intercourse).ti,ab. (1746)
 67 (unprotected adj2 sex\$).ti,ab. (2344)
 68 (condomless adj (sex or intercourse)).ti,ab. (7)
 69 (condom free adj (sex or intercourse)).ti,ab. (2)
 70 (RUAI or UAI).ti,ab. (236)
 71 (barebacking or bareback sex\$ or bugchas\$ or bug chas\$).ti,ab. (59)
 72 anal intercourse.ti,ab. (1373)
 73 anal sex.ti,ab. (960)
 74 or/56-73 (7225)
 75 sexual behavior/ (36589)
 76 risk taking/ (15617)
 77 75 and 76 (4504)
 78 (risk\$ sex\$ behavio\$ or unsafe sex\$).ti,ab. (2666)
 79 74 or 77 or 78 (11703)
 80 (letter or comment or editorial).pt. (1144084)
 81 79 not 80 (11384)
 82 limit 81 to yr="1990 -Current" (11011)
 83 substance-related disorders/ or inhalant abuse/ or marijuana abuse/ or substance abuse,
 intravenous/ (82985)
 84 Drug Users/ (605)
 85 ((drug\$ or substance\$) adj2 (use\$ or using or abuse\$ or abusing or misuse\$ or misusing)).ti,ab.
 (119941)
 86 ((heroin or opiate\$ or cocaine or crack) adj2 (use\$ or using or abuse\$ or abusing or misuse\$ or
 misusing)).ti,ab. (11375)

87 ((cannabis or marijuana) adj2 (use\$ or using or abuse\$ or abusing or misuse\$ or misusing)).ti,ab. (5635)

88 ((benzodiazepine\$ or amphetamine\$ or methamphetamine\$ or MDMA or ecstasy) adj2 (use\$ or using or abuse\$ or abusing or misuse\$ or misusing)).ti,ab. (5612)

89 (solvent\$ adj2 (use\$ or using or abuse\$ or abusing or misuse\$ or misusing)).ti,ab. (5485)

90 street drug\$.ti,ab. (397)

91 (prescri\$ drug\$ adj2 (use\$ or using or abuse\$ or abusing or misuse\$ or misusing)).ti,ab. (1099)

92 polydrug use\$.ti,ab. (531)

93 inject\$ drug use\$.ti,ab. (6780)

94 (needle\$ adj3 (share\$ or sharing)).ti,ab. (1190)

95 (syringe\$ adj3 (share\$ or sharing)).ti,ab. (431)

96 or/83-95 (178426)

97 (letter or editorial or comment).pt. (1144084)

98 96 not 97 (170668)

99 limit 98 to yr="1990 -Current" (132081)

100 sunbathing/ (178)

101 sunscreening agents/ (3374)

102 (sunbath\$ or sunscreen\$ or sunburn\$ or suntan\$ or sunbed\$).ti,ab. (4849)

103 (sun bath\$ or sun screen\$ or sun burn\$ or sun tan\$ or sun bed\$).ti,ab. (245)

104 sun protect\$.ti,ab. (1665)

105 (tanning adj (bed\$ or salon\$ or studio\$)).ti,ab. (166)

106 100 or 101 or 102 or 103 or 104 or 105 (7059)

107 (letter or comment or editorial).pt. (1144084)

108 106 not 107 (6590)

109 limit 108 to yr="1990 -Current" (5579)

110 dental care/ or dental caries/ (46076)

111 oral hygiene/ or toothbrushing/ (13570)

112 (dental care or dental health or dental hygiene).ti,ab. (15079)

113 (oral care or oral health or oral hygiene).ti,ab. (18102)

114 (gingival care or gingival health or gingival hygiene).ti,ab. (702)

115 ((unsupervised or irregular\$ or regular\$ or seldom or lack or never or infrequent\$ or frequen\$ or insufficient\$) adj2 (toothbrushing or flossing)).ti,ab. (320)

116 ((irregular\$ or regular\$ or seldom or lack or never or infrequent\$ or frequen\$) adj3 (dental or dentist\$)).ti,ab. (2363)

117 ((irregular\$ or regular\$ or seldom or lack or never or infrequent\$ or frequen\$) adj3 dental visit\$).ti,ab. (259)

118 ((irregular\$ or regular\$ or seldom or lack or never or infrequent\$ or frequen\$) adj3 dental attendance).ti,ab. (79)

119 (clean\$ teeth adj2 (irregular\$ or regular\$ or infrequent\$ or frequen\$ or never or seldom)).ti,ab. (3)

120 (brush\$ teeth adj2 (irregular\$ or regular\$ or infrequent\$ or frequen\$ or never or seldom)).ti,ab. (9)

121 ((sweet\$ drink\$ or fizzy drink\$ or sugary snack\$ or sweets or confectionery) adj6 (tooth or teeth or dental or oral or caries or decay)).ti,ab. (145)

122 or/110-121 (74333)

123 (letter or editorial or comment).pt. (1144084)

124 122 not 123 (71117)

125 limit 124 to yr="1990 -Current" (37061)

126 patient compliance/ (41426)

127 treatment refusal/ (9855)

128 126 and 127 (776)

129 (non-adherence adj2 (patient\$ or medication\$ or screen\$ or treatment or therapy or immunisation or immunization or regimen\$ or drug\$)).ti,ab. (510)

130 (nonadherence adj2 (patient\$ or medication\$ or screen\$ or treatment or therapy or immunisation or immunization or regimen\$ or drug\$)).ti,ab. (752)

131 (low adherence adj2 (patient\$ or medication\$ or screen\$ or treatment or therapy or immunisation or immunization or regimen\$ or drug\$)).ti,ab. (60)

132 (poor adherence adj2 (patient\$ or medication\$ or screen\$ or treatment or therapy or immunisation or immunization or regimen\$ or drug\$)).ti,ab. (325)

133 ((loss or lack or failure or barrier\$ or impediment\$ or selective or minimal) adj2 adherence).ti,ab. (1012)

134 (non-compliance adj2 (patient\$ or medication\$ or screen\$ or treatment or therapy or immunisation or immunization or regimen\$ or drug\$)).ti,ab. (674)

135 (noncompliance adj2 (patient\$ or medication\$ or screen\$ or treatment or therapy or immunisation or immunization or regimen\$ or drug\$)).ti,ab. (1080)

136 (low compliance adj2 (patient\$ or medication\$ or screen\$ or treatment or therapy or immunisation or immunization or regimen\$ or drug\$)).ti,ab. (86)

137 (poor compliance adj2 (patient\$ or medication\$ or screen\$ or treatment or therapy or immunisation or immunization or regimen\$ or drug\$)).ti,ab. (397)

138 ((loss or lack or failure or barrier\$ or impediment\$ or selective or minimal) adj2 compliance).ti,ab. (1002)

139 treatment refusal/ (9855)

140 mass screening/ (72173)

141 139 and 140 (127)

142 (non-attend\$ adj3 screen\$).ti,ab. (49)

143 (nonattend\$ adj3 screen\$).ti,ab. (17)

144 (non-attend\$ adj3 appoint\$).ti,ab. (36)

145 (nonattend\$ adj3 appoint\$).ti,ab. (17)

146 (non-attend\$ adj3 (check-up\$ or checkup\$)).ti,ab. (3)

147 (nonattend\$ adj3 (check-up\$ or checkup\$)).ti,ab. (0)

148 (non-attend\$ adj3 (mammograph\$ or smear test\$ or PAP test\$ or breast exam\$ or CBE)).ti,ab. (11)

149 (nonattend\$ adj3 (mammograph\$ or smear test\$ or PAP test\$ or breast exam\$ or CBE)).ti,ab. (5)

150 128 or 129 or 130 or 131 or 132 or 133 or 134 or 135 or 136 or 137 or 138 or 141 or 142 or 143 or 144 or 145 or 146 or 147 or 148 or 149 (6575)

151 (letter or editorial or comment).pt. (1144084)

152 150 not 151 (6431)

153 limit 152 to yr="1990 -Current" (5868)

154 seat belts/ (3143)

155 (seatbelt\$ or seat belt\$).ti,ab. (2657)

156 seat restraint\$.ti,ab. (40)

157 passenger\$ restraint\$.ti,ab. (52)

158 driver\$ restraint\$.ti,ab. (11)

159 ((unbelted or unrestrained) adj2 (driver\$ or passenger\$)).ti,ab. (108)

160 154 or 155 or 156 or 157 or 158 or 159 (4256)

161 head protective devices/ (2129)

162 (cycle helmet\$ or bike helmet\$ or bicycle helmet\$).ti,ab. (480)

163 161 or 162 (2218)

164 protective devices/ (5460)

165 fires/ or smoke/ (10879)

166 164 and 165 (154)

167 (smoke adj (alarm\$ or sensor\$)).ti,ab. (133)
168 (fire adj (alarm\$ or sensor\$)).ti,ab. (47)
169 166 or 167 or 168 (285)
170 automobile driving/ (11762)
171 alcoholic intoxication/ or alcohol drinking/ (52148)
172 170 and 171 (2255)
173 (drink\$ adj2 (drive\$ or driving)).ti,ab. (1161)
174 alcohol impaired driv\$.ti,ab. (188)
175 172 or 173 or 174 (2850)
176 160 or 163 or 169 or 175 (9267)
177 (editorial or letter or comment).pt. (1144084)
178 176 not 177 (8500)
179 limit 178 to yr="1990 -Current" (6146)
180 Gambling/ (2666)
181 (gambling or gambler).mp. or gamblers.ti,ab. [mp=title, abstract, original title, name of
substance word, subject heading word, protocol supplementary concept, rare disease
supplementary concept, unique identifier] (3571)
182 180 or 181 (3571)
183 (letter or editorial or comment).pt. (1144084)
184 182 not 183 (3361)
185 limit 184 to yr="1990 -Current" (2987)
186 (18 and 35) or (18 and 43) or (18 and 55) or (18 and 82) or (18 and 99) or (18 and 109) or (18
and 125) or (18 and 153) or (18 and 179) or (18 and 185) (33147)
187 (35 and 18) or (35 and 43) or (35 and 55) or (35 and 82) or (35 and 99) or (35 and 109) or (35
and 125) or (35 and 153) or (35 and 179) or (35 and 185) (35046)
188 (43 and 18) or (43 and 35) or (43 and 55) or (43 and 82) or (43 and 99) or (43 and 109) or (43
and 125) or (43 and 153) or (43 and 179) or (43 and 185) (44075)
189 (55 and 18) or (55 and 35) or (55 and 43) or (55 and 82) or (55 and 99) or (55 and 109) or (55
and 125) or (55 and 153) or (55 and 179) or (55 and 185) (53767)
190 (82 and 18) or (82 and 35) or (82 and 43) or (82 and 55) or (82 and 99) or (82 and 109) or (82
and 125) or (82 and 153) or (82 and 179) or (82 and 185) (4600)
191 (99 and 18) or (99 and 35) or (99 and 43) or (99 and 55) or (99 and 82) or (99 and 109) or (99
and 125) or (99 and 153) or (99 and 179) or (99 and 185) (32110)
192 (109 and 18) or (109 and 35) or (109 and 43) or (109 and 55) or (109 and 82) or (109 and 99)
or (109 and 125) or (109 and 153) or (109 and 179) or (109 and 185) (659)
193 (125 and 18) or (125 and 35) or (125 and 43) or (125 and 55) or (125 and 82) or (125 and 99)
or (125 and 109) or (125 and 153) or (125 and 179) or (125 and 185) (3534)
194 (153 and 18) or (153 and 35) or (153 and 43) or (153 and 55) or (153 and 82) or (153 and 99)
or (153 and 109) or (153 and 125) or (153 and 179) or (153 and 185) (1035)
195 (179 and 18) or (179 and 35) or (179 and 43) or (179 and 55) or (179 and 82) or (179 and 99)
or (179 and 109) or (179 and 125) or (179 and 153) or (179 and 185) (3183)
196 (185 and 18) or (185 and 35) or (185 and 43) or (185 and 55) or (185 and 82) or (185 and 99)
or (185 and 109) or (185 and 125) or (185 and 153) or (185 and 179) (1023)
197 186 or 187 or 188 or 189 or 190 or 191 or 192 or 193 or 194 or 195 or 196 (96292)
198 exp animals/ not humans.sh. (3644792)
199 197 not 198 (92397)
200 cohort studies/ or longitudinal studies/ or retrospective studies/ or prospective studies/ or
cross sectional studies/ or follow-up studies/ or epidemiologic studies/ (1245985)
201 (cohort adj (study or studies)).tw. (59543)
202 cohort analy\$.tw. (2709)
203 ("follow up" adj (study or studies)).tw. (33042)

204 (observational adj (study or studies)).tw. (30873)
 205 (descriptive adj (study or studies)).tw. (12030)
 206 (epidemiologic\$ adj (study or studies)).tw. (51931)
 207 longitudinal.tw. (111494)
 208 retrospective.tw. (213679)
 209 prospective.tw. (286276)
 210 cross sectional.tw. (123369)
 211 health surveys/ (38746)
 212 or/200-211 (1575862)
 213 199 and 212 (33584)

Database: PsycINFO <1987 to January Week 4 2012>

Search date: 30th January 2012

1 (health\$ adj2 (diet\$ or eating or food or foods)).ti,ab. (2565)
 2 (unhealth\$ adj2 (diet\$ or eating or food or foods)).ti,ab. (535)
 3 (fruit\$ adj2 (eat or eats or eating or intake or consum\$ or increas\$ or portion\$ or serving\$ or frequenc\$ or number\$ or preference\$ or choice\$)).ti,ab. (1015)
 4 (vegetable\$ adj2 (eat or eats or eating or intake or consum\$ or increas\$ or portion\$ or serving\$ or frequenc\$ or number\$ or preference\$ or choice\$)).ti,ab. (924)
 5 "5 a day".mp. (61)
 6 "five a day".ti,ab. (5)
 7 (junk food or fast food).ti,ab. (595)
 8 ((decreas\$ or reduc\$ or discourag\$ or limit\$ or lessen or eat\$ less) adj2 (salt or fat)).ti,ab. (549)
 9 (food adj (choice\$ or frequenc\$ or select\$)).ti,ab. (1642)
 10 Eating Behavior/ (4990)
 11 food preferences/ (2122)
 12 nutrition/ or diets/ (10011)
 13 obesity/ or overweight/ (10658)
 14 1 or 2 or 3 or 4 or 5 or 6 or 7 or 8 or 9 or 10 or 11 or 12 or 13 (26676)
 15 (comment reply or editorial or letter).dt. (102427)
 16 14 not 15 (25685)
 17 limit 16 to yr="1990 -Current" (24408)
 18 (physical\$ adj3 (fit\$ or train\$ or activ\$ or inactiv\$ or endur\$)).ti,ab. (15473)
 19 (exercis\$ adj3 (fit\$ or train\$ or activ\$ or endur\$)).ti,ab. (2881)
 20 ((promot\$ or uptak\$ or encourag\$ or increas\$ or start\$ or adher\$) adj3 (exercis\$ or gym\$ or sport\$ or fitness)).ti,ab. (2936)
 21 ((decreas\$ or reduc\$ or discourag\$) adj3 (sedentary or deskbound)).ti,ab. (111)
 22 (sedentary behaviour\$ or sedentary behavior\$ or sedentary lifestyle\$ or sedentariness).ti,ab. (803)
 23 ((watch\$ or view\$) adj2 (tv or television)).ti,ab. (2382)
 24 (sport\$ or walk\$ or running or jogging or bicycling or biking or swimming).ti,ab. (33926)
 25 (active adj (travel\$ or transport\$ or commut\$)).ti,ab. (183)
 26 physical fitness/ (2138)
 27 exp Recreation/ or leisure time/ (19586)
 28 Exercise/ (10639)
 29 running/ or swimming/ or walking/ (4073)
 30 18 or 19 or 20 or 21 or 22 or 23 or 24 or 25 or 26 or 27 or 28 or 29 (70426)
 31 (letter or editorial or comment reply).dt. (102427)
 32 30 not 31 (68167)
 33 limit 32 to yr="1990 -Current" (64576)

34 exp tobacco smoking/ (16927)
 35 (smoking or antismoking or anti-smoking).ti,ab. (24175)
 36 (smoker or smokers).ti,ab. (10997)
 37 tobacco.ti,ab. (10497)
 38 34 or 35 or 36 or 37 (30858)
 39 (letter or editorial or comment reply).dt. (102427)
 40 38 not 39 (29469)
 41 limit 40 to yr="1990 -Current" (28264)
 42 exp Alcohol abuse/ (26735)
 43 exp Alcohol Intoxication/ (1535)
 44 exp alcoholism/ (15747)
 45 exp alcohol drinking patterns/ (37151)
 46 (beer or wine\$ or cider or alcopop\$ or spirit or spirits).ti,ab. (7445)
 47 alcohol\$.ti,ab. (66118)
 48 (drink\$ adj2 (binge or excessive or harm\$ or heavy or misus\$ or abus\$ or consum\$)).ti,ab.
 (5854)
 49 (intoxicat\$ or inebriat\$ or drunk\$).ti,ab. (5882)
 50 42 or 43 or 44 or 45 or 46 or 47 or 48 or 49 (77549)
 51 (comment reply or editorial or letter).dt. (102427)
 52 50 not 51 (74503)
 53 limit 52 to yr="1990 -Current" (68653)
 54 sexual risk taking/ (4972)
 55 multiple sexual partner\$.ti,ab. (297)
 56 multiple casual partner\$.ti,ab. (3)
 57 one time sex\$ encounter\$.ti,ab. (5)
 58 one-time sex\$ encounter\$.ti,ab. (5)
 59 (sex\$ adj2 holiday\$).ti,ab. (3)
 60 casual sex\$.ti,ab. (398)
 61 casual partner\$.ti,ab. (376)
 62 non-regular sex\$ partner\$.ti,ab. (8)
 63 non regular sex\$ partner\$.ti,ab. (8)
 64 (unprotected adj2 intercourse).ti,ab. (767)
 65 (unprotected adj2 sex\$).ti,ab. (1470)
 66 (condomless adj (sex or intercourse)).ti,ab. (7)
 67 (condom free adj (sex or intercourse)).ti,ab. (0)
 68 (RUAI or UAI).ti,ab. (174)
 69 (barebacking or bareback sex\$ or bugchas\$ or bug chas\$).ti,ab. (91)
 70 anal intercourse.ti,ab. (788)
 71 anal sex.ti,ab. (625)
 72 or/54-71 (6907)
 73 (risk\$ sex\$ behavio\$ or unsafe sex\$).ti,ab. (2379)
 74 72 or 73 (7859)
 75 (letter or comment reply or editorial).dt. (102427)
 76 74 not 75 (7617)
 77 limit 76 to yr="1990 -Current" (7562)
 78 exp drug abuse/ (63136)
 79 exp drug dependency/ (15202)
 80 ((drug\$ or substance\$) adj2 (use\$ or using or abuse\$ or abusing or misuse\$ or misusing)).ti,ab.
 (64097)
 81 ((heroin or opiate\$ or cocaine or crack) adj2 (use\$ or using or abuse\$ or abusing or misuse\$ or
 misusing)).ti,ab. (6846)

82 ((cannabis or marijuana) adj2 (use\$ or using or abuse\$ or abusing or misuse\$ or misusing)).ti,ab. (4745)

83 ((benzodiazepine\$ or amphetamine\$ or methamphetamine\$ or MDMA or ecstasy) adj2 (use\$ or using or abuse\$ or abusing or misuse\$ or misusing)).ti,ab. (3291)

84 (solvent\$ adj2 (use\$ or using or abuse\$ or abusing or misuse\$ or misusing)).ti,ab. (173)

85 street drug\$.ti,ab. (195)

86 (prescri\$ drug\$ adj2 (use\$ or using or abuse\$ or abusing or misuse\$ or misusing)).ti,ab. (491)

87 polydrug use\$.ti,ab. (512)

88 inject\$ drug use\$.ti,ab. (2987)

89 (needle\$ adj3 (share\$ or sharing)).ti,ab. (679)

90 (syringe\$ adj3 (share\$ or sharing)).ti,ab. (223)

91 or/78-90 (101288)

92 (letter or editorial or comment reply).dt. (102427)

93 91 not 92 (96899)

94 limit 93 to yr="1990 -Current" (90821)

95 (sunbath\$ or sunscreen\$ or sunburn\$ or suntan\$ or sunbed\$).ti,ab. (254)

96 (sun bath\$ or sun screen\$ or sun burn\$ or sun tan\$ or sun bed\$).ti,ab. (21)

97 sun protect\$.ti,ab. (216)

98 (tanning adj (bed\$ or salon\$ or studio\$)).ti,ab. (20)

99 95 or 96 or 97 or 98 (376)

100 (letter or comment reply or editorial).dt. (102427)

101 99 not 100 (370)

102 limit 101 to yr="1990 -Current" (368)

103 dental health/ (130)

104 oral health/ (300)

105 (dental care or dental health or dental hygiene).ti,ab. (558)

106 (oral care or oral health or oral hygiene).ti,ab. (590)

107 (gingival care or gingival health or gingival hygiene).ti,ab. (1)

108 ((unsupervised or irregular\$ or regular\$ or seldom or lack or never or infrequent\$ or frequen\$ or insufficient\$) adj2 (toothbrushing or flossing)).ti,ab. (18)

109 ((irregular\$ or regular\$ or seldom or lack or never or infrequent\$ or frequen\$) adj3 (dental or dentist\$)).ti,ab. (89)

110 ((irregular\$ or regular\$ or seldom or lack or never or infrequent\$ or frequen\$) adj3 dental visit\$).ti,ab. (12)

111 ((irregular\$ or regular\$ or seldom or lack or never or infrequent\$ or frequen\$) adj3 dental attendance).ti,ab. (5)

112 (clean\$ teeth adj2 (irregular\$ or regular\$ or infrequent\$ or frequen\$ or never or seldom)).ti,ab. (0)

113 (brush\$ teeth adj2 (irregular\$ or regular\$ or infrequent\$ or frequen\$ or never or seldom)).ti,ab. (0)

114 ((sweet\$ drink\$ or fizzy drink\$ or sugary snack\$ or sweets or confectionery) adj6 (tooth or teeth or dental or oral or caries or decay)).ti,ab. (4)

115 or/103-114 (1081)

116 (letter or editorial or comment reply).dt. (102427)

117 115 not 116 (1030)

118 limit 117 to yr="1990 -Current" (981)

119 (non-adherence adj2 (patient\$ or medication\$ or screen\$ or treatment or therapy or immunisation or immunization or regimen\$ or drug\$)).ti,ab. (231)

120 (nonadherence adj2 (patient\$ or medication\$ or screen\$ or treatment or therapy or immunisation or immunization or regimen\$ or drug\$)).ti,ab. (355)

121 (low adherence adj2 (patient\$ or medication\$ or screen\$ or treatment or therapy or immunisation or immunization or regimen\$ or drug\$)).ti,ab. (15)
 122 (poor adherence adj2 (patient\$ or medication\$ or screen\$ or treatment or therapy or immunisation or immunization or regimen\$ or drug\$)).ti,ab. (96)
 123 ((loss or lack or failure or barrier\$ or impediment\$ or selective or minimal) adj2 adherence).ti,ab. (332)
 124 (non-compliance adj2 (patient\$ or medication\$ or screen\$ or treatment or therapy or immunisation or immunization or regimen\$ or drug\$)).ti,ab. (150)
 125 (noncompliance adj2 (patient\$ or medication\$ or screen\$ or treatment or therapy or immunisation or immunization or regimen\$ or drug\$)).ti,ab. (483)
 126 (low compliance adj2 (patient\$ or medication\$ or screen\$ or treatment or therapy or immunisation or immunization or regimen\$ or drug\$)).ti,ab. (10)
 127 (poor compliance adj2 (patient\$ or medication\$ or screen\$ or treatment or therapy or immunisation or immunization or regimen\$ or drug\$)).ti,ab. (52)
 128 ((loss or lack or failure or barrier\$ or impediment\$ or selective or minimal) adj2 compliance).ti,ab. (181)
 129 treatment refusal/ (561)
 130 screening/ (5073)
 131 129 and 130 (2)
 132 (non-attend\$ adj3 screen\$).ti,ab. (6)
 133 (nonattend\$ adj3 screen\$).ti,ab. (4)
 134 (non-attend\$ adj3 appoint\$).ti,ab. (22)
 135 (nonattend\$ adj3 appoint\$).ti,ab. (11)
 136 (non-attend\$ adj3 (check-up\$ or checkup\$)).ti,ab. (0)
 137 (nonattend\$ adj3 (check-up\$ or checkup\$)).ti,ab. (0)
 138 (non-attend\$ adj3 (mammograph\$ or smear test\$ or PAP test\$ or breast exam\$ or CBE)).ti,ab. (2)
 139 (nonattend\$ adj3 (mammograph\$ or smear test\$ or PAP test\$ or breast exam\$ or CBE)).ti,ab. (1)
 140 119 or 120 or 121 or 122 or 123 or 124 or 125 or 126 or 127 or 128 or 131 or 132 or 133 or 134 or 135 or 136 or 137 or 138 or 139 (1883)
 141 (letter or editorial or comment reply).dt. (102427)
 142 140 not 141 (1802)
 143 limit 142 to yr="1990 -Current" (1743)
 144 safety belts/ (419)
 145 (seatbelt\$ or seat belt\$).ti,ab. (559)
 146 seat restraint\$.ti,ab. (2)
 147 passenger\$ restraint\$.ti,ab. (12)
 148 driver\$ restraint\$.ti,ab. (3)
 149 ((unbelted or unrestrained) adj2 (driver\$ or passenger\$)).ti,ab. (23)
 150 144 or 145 or 146 or 147 or 148 or 149 (743)
 151 safety devices/ or protective devices/ (475)
 152 (cycle helmet\$ or bike helmet\$ or bicycle helmet\$).ti,ab. (105)
 153 151 or 152 (510)
 154 fire prevention/ (77)
 155 (smoke adj (alarm\$ or sensor\$)).ti,ab. (32)
 156 (fire adj (alarm\$ or sensor\$)).ti,ab. (21)
 157 154 or 155 or 156 (121)
 158 driving under the influence/ (1419)
 159 (drink\$ adj2 (drive\$ or driving)).ti,ab. (901)
 160 alcohol impaired driv\$.ti,ab. (124)

161 158 or 159 or 160 (1801)
 162 150 or 153 or 157 or 161 (3019)
 163 (editorial or letter or comment reply).dt. (102427)
 164 162 not 163 (2938)
 165 limit 164 to yr="1990 -Current" (2630)
 166 gambling/ (1800)
 167 (gambling or gambler or gamblers).ti,ab. (4763)
 168 166 or 167 (5106)
 169 (comment reply or editorial or letter).dt. (102427)
 170 168 not 169 (4869)
 171 limit 170 to yr="1990 -Current" (4637)
 172 (17 and 33) or (17 and 41) or (17 and 53) or (17 and 77) or (17 and 94) or (17 and 102) or (17 and 118) or (17 and 143) or (17 and 165) or (17 and 171) (6007)
 173 (33 and 17) or (33 and 41) or (33 and 53) or (33 and 77) or (33 and 94) or (33 and 102) or (33 and 118) or (33 and 143) or (33 and 165) or (33 and 171) (11825)
 174 (41 and 17) or (41 and 33) or (41 and 53) or (41 and 77) or (41 and 94) or (41 and 102) or (41 and 118) or (41 and 143) or (41 and 165) or (41 and 171) (12511)
 175 (53 and 17) or (53 and 33) or (53 and 41) or (53 and 77) or (53 and 94) or (53 and 102) or (53 and 118) or (53 and 143) or (53 and 165) or (53 and 171) (44044)
 176 (77 and 17) or (77 and 33) or (77 and 41) or (77 and 53) or (77 and 94) or (77 and 102) or (77 and 118) or (77 and 143) or (77 and 165) or (77 and 171) (3266)
 177 (94 and 17) or (94 and 33) or (94 and 41) or (94 and 53) or (94 and 77) or (94 and 102) or (94 and 118) or (94 and 143) or (94 and 165) or (94 and 171) (43987)
 178 (102 and 17) or (102 and 33) or (102 and 41) or (102 and 53) or (102 and 77) or (102 and 94) or (102 and 118) or (102 and 143) or (102 and 165) or (102 and 171) (71)
 179 (118 and 17) or (118 and 33) or (118 and 41) or (118 and 53) or (118 and 77) or (118 and 94) or (118 and 102) or (118 and 143) or (118 and 165) or (118 and 171) (215)
 180 (143 and 17) or (143 and 33) or (143 and 41) or (143 and 53) or (143 and 77) or (143 and 94) or (143 and 102) or (143 and 118) or (143 and 165) or (143 and 171) (441)
 181 (165 and 17) or (165 and 33) or (165 and 41) or (165 and 53) or (165 and 77) or (165 and 94) or (165 and 102) or (165 and 118) or (165 and 143) or (165 and 171) (1639)
 182 (171 and 17) or (171 and 33) or (171 and 41) or (171 and 53) or (171 and 77) or (171 and 94) or (171 and 102) or (171 and 118) or (171 and 143) or (171 and 165) (3865)
 183 172 or 173 or 174 or 175 or 176 or 177 or 178 or 179 or 180 or 181 or 182 (58837)
 184 (empirical study or prospective study or longitudinal study or retrospective study or followup study).md. (1300521)
 185 (cohort adj (study or studies or analy\$)).tw. (7035)
 186 ("follow up" adj (study or studies)).tw. (6364)
 187 (observational adj (study or studies)).tw. (3510)
 188 (descriptive adj (study or studies)).tw. (3551)
 189 (epidemiologic\$ adj (study or studies)).tw. (7487)
 190 (longitudinal or prospective or retrospective).tw. (87597)
 191 cross sectional.tw. (27017)
 192 or/184-191 (1321046)
 193 183 and 192 (44869)

Science Citation Index Expanded

via Web of Science

search date 26th January 2012

Note: Not possible to combine sets #25 to #35 so each set of records downloaded separately, imported into an endnote library and de-duplicated in that way

Total of 31,023 records downloaded into Endnote bibliographic software and these were deduplicated to 14,136 records

Search History

# 35	59	(#24 AND #14) OR (#24 AND #15) OR (#24 AND #16) OR (#24 AND #17) OR (#24 AND #18) OR (#24 AND #19) OR (#24 AND #20) OR (#24 AND #21) OR (#24 AND #22) OR (#24 AND #23) <i>Databases=SCI-EXPANDED Timespan=1990-2012 Lemmatization=Off</i>	<input type="checkbox"/>	<input type="checkbox"/>
# 34	116	(#23 AND #14) OR (#23 AND #15) OR (#23 AND #16) OR (#23 AND #17) OR (#23 AND #18) OR (#23 AND #19) OR (#23 AND #20) OR (#23 AND #21) OR (#23 AND #22) OR (#23 AND #24) <i>Databases=SCI-EXPANDED Timespan=1990-2012 Lemmatization=Off</i>	<input type="checkbox"/>	<input type="checkbox"/>
# 33	255	(#22 AND #14) OR (#22 AND #15) OR (#22 AND #16) OR (#22 AND #17) OR (#22 AND #18) OR (#22 AND #19) OR (#22 AND #20) OR (#22 AND #21) OR (#22 AND #23) OR (#22 AND #24) <i>Databases=SCI-EXPANDED Timespan=1990-2012 Lemmatization=Off</i>	<input type="checkbox"/>	<input type="checkbox"/>
# 32	472	(#21 AND #14) OR (#21 AND #15) OR (#21 AND #16) OR (#21 AND #17) OR (#21 AND #18) OR (#21 AND #19) OR (#21 AND #20) OR (#21 AND #22) OR (#21 AND #23) OR (#21 AND #24) <i>Databases=SCI-EXPANDED Timespan=1990-2012 Lemmatization=Off</i>	<input type="checkbox"/>	<input type="checkbox"/>
# 31	57	(#20 AND #14) OR (#20 AND #15) OR (#20 AND #16) OR (#20 AND #17) OR (#20 AND #18) OR (#20 AND #19) OR (#20 AND #21) OR (#20 AND #22) OR (#20 AND #23) OR (#20 AND #24) <i>Databases=SCI-EXPANDED Timespan=1990-2012 Lemmatization=Off</i>	<input type="checkbox"/>	<input type="checkbox"/>
# 30	2,415	(#19 AND #14) OR (#19 AND #15) OR (#19 AND #16) OR (#19 AND #17) OR (#19 AND #18) OR (#19 AND #20) OR (#19 AND #21) OR (#19 AND #22) OR (#19 AND #23) OR (#19 AND #24) <i>Databases=SCI-EXPANDED Timespan=1990-2012 Lemmatization=Off</i>	<input type="checkbox"/>	<input type="checkbox"/>
# 29	915	(#18 AND #14) OR (#18 AND #15) OR (#18 AND #16) OR (#18 AND #17) OR (#18 AND #19) OR (#18 AND #20) OR (#18 AND #21) OR (#18 AND #22) OR (#18 AND #23) OR (#18 AND #24) <i>Databases=SCI-EXPANDED Timespan=1990-2012 Lemmatization=Off</i>	<input type="checkbox"/>	<input type="checkbox"/>
# 28	1,847	(#17 AND #14) OR (#17 AND #15) OR (#17 AND #16) OR (#17 AND #18) OR (#17 AND #19) OR (#17 AND #20) OR (#17 AND #21) OR (#17 AND #22) OR (#17 AND #23) OR (#17 AND #24) <i>Databases=SCI-EXPANDED Timespan=1990-2012 Lemmatization=Off</i>	<input type="checkbox"/>	<input type="checkbox"/>
# 27	8,797	(#16 AND #14) OR (#16 AND #15) OR (#16 AND #17) OR (#16 AND #18) OR (#16 AND #19) OR (#16 AND #20) OR (#16 AND #21) OR (#16 AND #22) OR (#16 AND #23) OR (#16 AND #24) <i>Databases=SCI-EXPANDED Timespan=1990-2012 Lemmatization=Off</i>	<input type="checkbox"/>	<input type="checkbox"/>
# 26	7,554	(#15 AND #14) OR (#15 AND #16) OR (#15 AND #17) OR (#15 AND #18) OR (#15 AND #19) OR (#15 AND #20) OR (#15 AND #21) OR (#15 AND #22) OR (#15 AND #23) OR (#15 AND #24) <i>Databases=SCI-EXPANDED Timespan=1990-2012 Lemmatization=Off</i>	<input type="checkbox"/>	<input type="checkbox"/>
# 25	8,536	(#14 AND #15) OR (#14 AND #16) OR (#14 AND #17) OR (#14 AND #18) OR (#14 AND #19) OR (#14 AND #20) OR (#14 AND #21) OR (#14 AND #22) OR (#14 AND #23) OR (#14 AND #24) <i>Databases=SCI-EXPANDED Timespan=1990-2012</i>	<input type="checkbox"/>	<input type="checkbox"/>

<i>Lemmatization=Off</i>			
# 24	225	(#11 not #12) and #13 <i>Databases=SCI-EXPANDED Timespan=1990-2012 Lemmatization=Off</i>	<input type="checkbox"/> <input type="checkbox"/>
# 23	280	(#10 not #12) and #13 <i>Databases=SCI-EXPANDED Timespan=1990-2012 Lemmatization=Off</i>	<input type="checkbox"/> <input type="checkbox"/>
# 22	1,409	(#9 not #12) and #13 <i>Databases=SCI-EXPANDED Timespan=1990-2012 Lemmatization=Off</i>	<input type="checkbox"/> <input type="checkbox"/>
# 21	2,262	(#8 not #12) and #13 <i>Databases=SCI-EXPANDED Timespan=1990-2012 Lemmatization=Off</i>	<input type="checkbox"/> <input type="checkbox"/>
# 20	354	(#7 not #12) and #13 <i>Databases=SCI-EXPANDED Timespan=1990-2012 Lemmatization=Off</i>	<input type="checkbox"/> <input type="checkbox"/>
# 19	10,126	(#6 not #12) and #13 <i>Databases=SCI-EXPANDED Timespan=1990-2012 Lemmatization=Off</i>	<input type="checkbox"/> <input type="checkbox"/>
# 18	2,537	(#5 not #12) and #13 <i>Databases=SCI-EXPANDED Timespan=1990-2012 Lemmatization=Off</i>	<input type="checkbox"/> <input type="checkbox"/>
# 17	2,978	(#4 not #12) and #13 <i>Databases=SCI-EXPANDED Timespan=1990-2012 Lemmatization=Off</i>	<input type="checkbox"/> <input type="checkbox"/>
# 16	26,000	(#3 not #12) and #13 <i>Databases=SCI-EXPANDED Timespan=1990-2012 Lemmatization=Off</i>	<input type="checkbox"/> <input type="checkbox"/>
# 15	20,566	(#2 not #12) and #13 <i>Databases=SCI-EXPANDED Timespan=1990-2012 Lemmatization=Off</i>	<input type="checkbox"/> <input type="checkbox"/>
# 14	24,055	(#1 not #12) and #13 <i>Databases=SCI-EXPANDED Timespan=1990-2012 Lemmatization=Off</i>	<input type="checkbox"/> <input type="checkbox"/>
# 13	460,838	TS=(cohort NEAR/2 (study or studies or analysis)) OR TS=(longitudinal NEAR/2 (study or studies)) OR TS=(retrospective NEAR/2 (study or studies)) OR TS=(prospective NEAR/2 (study or studies)) OR TS=(cross sectional OR cross-sectional) OR TS=(descriptive NEAR/2 (study or studies)) OR TS=("follow up study" or "follow-up study") OR TS=(epidemiologic* NEAR/2 (study or studies)) OR TS="health survey" <i>Databases=SCI-EXPANDED Timespan=1990-2012 Lemmatization=Off</i>	<input type="checkbox"/> <input type="checkbox"/>
# 12	1,030,643	TI=((rat or rats or mouse or mice or hamster or hamsters or bird or birds or pig or pigs or monkey or monkeys or sheep or goat or goats or lamb or lambs or cow or cows or horse or horses or fish or fishes or insect or insects)) <i>Databases=SCI-EXPANDED Timespan=1990-2012 Lemmatization=Off</i>	<input type="checkbox"/> <input type="checkbox"/>
# 11	3,839	TS=(gambling or gamble*) <i>Databases=SCI-EXPANDED Timespan=1990-2012 Lemmatization=Off</i>	<input type="checkbox"/> <input type="checkbox"/>
# 10	2,879	TS=("seat belt*" or seatbelt* or "seat restraint*" or "passenger* restraint*" or "driver* restraint*") OR TS=("cycle helmet*" or "bike helmet*" or "bicycle helmet*") OR TS=(smoke NEAR/2 (alarm* or sensor*)) OR TS=(fire NEAR/2 (alarm* or sensor*)) OR TS=(drink* NEAR/2 (drive* or driving)) OR TS=("alcohol impaired driving") <i>Databases=SCI-EXPANDED Timespan=1990-2012 Lemmatization=Off</i>	<input type="checkbox"/> <input type="checkbox"/>

- # 9 **10,991** TS=("patient compliance") OR TS=("treatment refusal") OR TS=(non-adherence NEAR/2 (patient* or medication* or screen* or treatment or therapy or immunisation or immunization or regimen* or drug*)) OR TS=(nonadherence NEAR/2 (patient* or medication* or screen* or treatment or therapy or immunisation or immunization or regimen* or drug*)) OR TS=("low adherence" NEAR/2 (patient* or medication* or screen* or treatment or therapy or immunisation or immunization or regimen* or drug*)) OR TS=("poor adherence" NEAR/2 (patient* or medication* or screen* or treatment or therapy or immunisation or immunization or regimen* or drug*)) OR TS=((loss or lack or failure or barrier* or impediment* or selective or minimal) NEAR/2 adherence) OR TS=(non-compliance NEAR/2 (patient* or medication* or screen* or treatment or therapy or immunisation or immunization or regimen* or drug*)) OR TS=(noncompliance NEAR/2 (patient* or medication* or screen* or treatment or therapy or immunisation or immunization or regimen* or drug*)) OR TS=("low compliance" NEAR/2 (patient* or medication* or screen* or treatment or therapy or immunisation or immunization or regimen* or drug*)) OR TS=("poor compliance" NEAR/2 (patient* or medication* or screen* or treatment or therapy or immunisation or immunization or regimen* or drug*)) OR TS=((loss or lack or failure or barrier* or impediment* or selective or minimal) NEAR/2 compliance) OR TS=(non-attend* NEAR/2 (screen* or appoint* or mammogram* or mammograph* or checkup* or check-up* or "smear test*" or "PAP test*" or "breast exam*")) OR TS=(nonattend* NEAR/2 (screen* or appoint* or mammogram* or mammograph* or checkup* or check-up* or "smear test*" or "PAP test*" or "breast exam*"))
Databases=SCI-EXPANDED Timespan=1990-2012
Lemmatization=Off ☐ ☐
-
- # 8 **14,882** TS=("dental care" or "dental health" or "dental hygiene") OR TS=("oral care" or "oral health" or "oral hygiene") OR TS=("gingival care" or "gingival health" or "gingival hygiene") OR TS=((unsupervised or irregular* or regular* or seldom or lack or never or infrequent* or frequen* or insufficient*) NEAR/2 toothbrushing) OR TS=((unsupervised or irregular* or regular or seldom or lack or never or infrequent* or frequen* or insufficient*) NEAR/2 flossing) OR TS=((irregular* or regular* or seldom or lack or never or infrequent* or frequen*) NEAR/2 dental) OR TS=((irregular* or regular* or seldom or lack or never or frequen* or infrequent*) NEAR/2 dentist) OR TS=((("sweet* drink*" or "fizzy drink*" or "sugary snack*" or sweets or confectionery) NEAR/2 (tooth or teeth or dental or oral or caries or decay)) OR TS=("clean* teeth" NEAR/2 (irregular* or regular* or infrequent* or frequen* or seldom or never)) OR TS=("brush* teeth" NEAR/2 (irregular* or regular* or infrequent* or frequen* or seldom or never))
Databases=SCI-EXPANDED Timespan=1990-2012
Lemmatization=Off ☐ ☐
-
- # 7 **6,251** TS=(sunbath* or sunscreen* or sunburn* or suntan* or sunbed*) OR TS=("sun bath*" or "sun screen*" or "sun burn*" or "sun tan*" or "sun bed*") OR TS=(sun NEAR/2 protect*) OR TS=(tanning NEAR/2 (bed* or salon* or studio*))
Databases=SCI-EXPANDED Timespan=1990-2012
Lemmatization=Off ☐ ☐
-
- # 6 **129,035** TS=(drug* NEAR/2 (use* or using or abuse* or abusing or misuse* or misusing)) OR TS=(heroin NEAR/2 (use* or using or abuse* or abusing or misuse* or misusing)) OR TS=(cocaine NEAR/2 (use* or using or abuse* or abusing or misuse* or misusing)) OR TS=(crack NEAR/2 (use* or using or abuse* or abusing or misuse* or misusing)) OR TS=(opiate* NEAR/2 (use* or using or abuse* or abusing or misuse* or misusing)) OR TS=(cannabis NEAR/2 (use* or using or abuse* or abusing or misuse* or misusing)) OR TS=(marijuana NEAR/2 (use* or using or abuse* or abusing or misuse* or misusing)) OR TS=(benzodiazepine* NEAR/2 (use* or using or abuse* or abusing or misuse* or misusing)) OR TS=(amphetamine* NEAR/2 (use* or using or abuse* or abusing or misuse* or misusing)) OR TS=(methamphetamine* NEAR/2 (use* or using or abuse* or abusing or misuse* or misusing)) OR TS=(MDMA NEAR/2 (use* or using or abuse* or abusing or misuse* or misusing)) OR TS=(ecstasy NEAR/2 (use* or using or abuse* or abusing or misuse* or misusing)) OR TS=(solvent* NEAR/2 (use* or using or abuse* or abusing or misuse* or misusing)) OR TS=(needle* NEAR/2 (share* or sharing)) OR TS=(syringe* NEAR/2 (share* or sharing))
Databases=SCI-EXPANDED Timespan=1990-2012
Lemmatization=Off ☐ ☐
-
- # 5 **10,777** TS=("unsafe sex") OR TS=("multiple sex* partner*" or "multiple casual partner*") OR TS=("one time sex* encounter*" or "one-time sex* encounter*") OR TS=(sex NEAR/2 holiday*) OR TS=("casual sex*" or "casual partner*") OR TS=("non regular sex* partner*" or "non-regular sex* partner*") OR TS=((unprotected NEAR/2 intercourse) or

		(unprotected NEAR/2 sex*)) OR TS=((condomless NEAR/2 intercourse) or (condomless NEAR/2 sex*)) OR TS=((condom-free NEAR/2 intercourse) or (condom-free NEAR/2 sex*)) OR TS=(barebacking or "bareback sex*" or bugchas* or "bug chas*") OR TS=((anal NEAR/2 sex) or (anal NEAR/2 intercourse)) OR TS=(risk* NEAR/2 sex*) <i>Databases=SCI-EXPANDED Timespan=1990-2012</i> <i>Lemmatization=Off</i>		
# 4	19,253	TS=((alcohol* NEAR/2 (drinking or intoxicat* or behavior* or behavior*)) OR TS=(drink* NEAR/2 (behavior* or behaviour* or binge or excessive or harm* or heavy or misus* or abus* or consum*)) <i>Databases=SCI-EXPANDED Timespan=1990-2012</i> <i>Lemmatization=Off</i>	<input type="checkbox"/>	<input type="checkbox"/>
# 3	165,500	TS=(smoking or smoker or smokers) OR TS=(tobacco) <i>Databases=SCI-EXPANDED Timespan=1990-2012</i> <i>Lemmatization=Off</i>	<input type="checkbox"/>	<input type="checkbox"/>
# 2	270,142	TS=((physical* NEAR/2 (fitness or train* or activ* or inactiv* or endurance))) OR TS=((exercise* NEAR/2 (fitness or train* or activ* or endurance))) OR TS=((promot* or uptak* or encourag* or increas* or start* or adherence) NEAR/3 (exercis* or gym* or sport* or fitness))) OR TS=((decreas* or reduc* or discourag*) NEAR/3 (sedentary or deskbound or desk-bound))) OR TS=((sedentary NEAR/2 (behavior* or behaviour* or lifestyle*))) OR TS=((watch* or view*) NEAR/2 (television))) OR TS=((sport* or walk* or running or jogging or bicycling or biking or swimming)) OR TS=((active NEAR/2 (travel* or transport* or commut*))) <i>Databases=SCI-EXPANDED Timespan=1990-2012</i> <i>Lemmatization=Off</i>	<input type="checkbox"/>	<input type="checkbox"/>
# 1	183,584	TS=((fruit* NEAR/2 (eat or eats or eating or intake or consum* or increase* or portion* or serving* or frequenc* or number* or preference* or choice*))) OR TS=((vegetable* NEAR/2 (eat or eats or eating or intake or consum* or increase* or portion* or serving* or frequenc* or number* or preference* or choice*))) OR TS=((("five a day" or "5 a day")) OR TS=((food NEAR/2 (habit* or preference* or select*))) OR TS=((("nutrition therapy" or "diet therapy")) OR TS=((obesity or overweight)) OR TS=((health* NEAR/2 (diet* or eating or food or foods))) OR TS=((unhealth* NEAR/2 (diet* or eating or food or foods))) OR TS=((("junk food*" or "fast food*")) OR TS=((salt NEAR/2 (decreas* or reduc* or discourage* or limit* or less*))) OR TS=((fat NEAR/2 (decreas* or reduc* or discourage* or limit* or less*))) OR TS=((food NEAR/2 (choice* or frequenc*))) <i>Databases=SCI-EXPANDED Timespan=1990-2012</i> <i>Lemmatization=Off</i>	<input type="checkbox"/>	<input type="checkbox"/>

Appendix 4: Review 1 – Data extraction templates

Table 4.1. Example data extracted for study characteristics

First Author (year of publication)	Location/s	Study population	Study design and date of data collection (including name of survey if available)	Data collection method	Risk behaviours and definition of risk
Dodd (2010)	England (West Midlands)	Undergraduate Students (N=410). Ethnicity: White (n=310); Black or Black British (n=20); Mixed (n=20); Asian or Asian British (n=54). Recruited at a university using a convenience sampling method.	2008, Cross-sectional	Pen and paper questionnaire	Alcohol misuse: <i>Binge drinking: 4 or more alcoholic beverages for females and 5 or more for males in one episode.</i> Low level of physical activity/exercise: <i><4 times a week of 30 minutes moderate exercise, or 20 minutes vigorous exercise.</i> Low level of fruit and vegetable intake: <i>Consumption of <5 a fruits and/or vegetables per day.</i> Smoking: <i>Occasional or frequent/regular smoker - thresholds for smoking status were not defined.</i>

Table 4.2. Example data extracted for study findings

First author (year of publication)	Sample size	Statistical analysis for clustering of risk behaviours	Results: clustering of RBs	Results: Predictors of clusters
Dodd (2010)	410	Cluster analysis	Clustering algorithm (method used for clustering, e.g., k-means, 2-step, hierarchical): Two-step. Basis for number of clusters (determined non-statistically or statistically): Statistical -	Other: Associations with cluster membership: Age - no significant difference between the clusters for age ($P<.05$).

			<p>automatically generated.</p> <p>Clusters identified (describe the clusters found, including the % of the study population in each cluster):</p> <ul style="list-style-type: none"> -cluster 1: unhealthy/high risk group - low physical activity, low fruit and vegetable intake, occasional/regular smokers, high psychological stress -cluster 2: moderately healthy/moderate risk group - moderate physical activity, fruit and vegetable intake and psychological stress. But more likely to misuse alcohol and regularly smoke than other clusters -cluster 3: healthy/low risk group - high physical activity, high fruit and vegetable intake, moderate alcohol consumption, highest proportion of non-smokers and low psychological stress <p>Cluster validation (i.e., have they tested it on another, similar population to confirm the cluster findings?): Not reported.</p>	<p>Gender (chi-squared =13.22, $p<.01$)</p> <ul style="list-style-type: none"> - higher percentage of females (61.5%) in cluster 1 and higher percentage of males (54.2%) in cluster 3 (chi-squared=5.65, $p<.05$) - no association between cluster 2 and 3 and gender (chi-squared = 1.76, $p>.05$) <p>Ethnicity (chi-squared = 26.71, $p<.001$)</p> <ul style="list-style-type: none"> -higher percentage of whites in cluster 2 (91.6%) than in cluster 1 (68.9%) or cluster 3 (86.6%) - higher percentage of Asian or Asian British (20.6%) and Black or Black British (10.6%) in cluster 1 than in cluster 2 and 3 (Asian or Asian British 4.8% and 11% respectively; Black or Black British 3.6% and 2.4% respectively)
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Appendix 5: Review 1 – Example of differences in risk behaviour thresholds

Table 5.1. Differences in alcohol misuse thresholds across studies

Study	Population	Alcohol Misuse Threshold
Tang et al (1997)	Adult (16 years +)	≥11 units per week
Thornton et al (1994)	Adult (16 years +)	>6 units per week for females and >11 units for males per week
Plant et al (2002)	Adult (16 years +)	>14 units for females and >21 units for males per week
Lawder et al (2010)	Adult (16 years +)	>14 units for females and >21 units for males per week
Wadsworth et al (2004a)	Adult (16 years +)	>14 units for females and >21 units for males per week
Poortinga (2007)	Adult (16 years +)	≥8 units for males and ≥6 units for females at least once per week
Eggington et al (2002)	Young adults (16-21 years)	≥ 28 units for males and ≥ 21 units for females per week
Shankar et al (2010)	Older adults (50 years +)	>14 units for females and >21 units for males per week over the past 12 months

Appendix 6: Review 1 – Quality assessment results

Table 6.1: Quality assessment results for the 30 included studies

Study author (year of publication)	Appropriate study population	Appropriate outcomes	Clear aims	Appropriate study method	Representative sample	All explanations of effects considered	Good response rate	Rigorous development of questions	Appropriate choice and use of statistical methods	Applicability to national situation	Applicability to specific UK region	All important outcomes/results considered
Aicken (2011)	Yes	Yes	yes	yes	Yes	yes	yes		yes	yes	not applicable	Yes
Balabanis (2002)	Yes	Yes	yes	can't tell	can't tell	can't tell	can't tell	yes	yes	no	no	no
Bolding (2006)	Yes	Yes	yes	yes <i>Although we do not know whether questionnaire administrators and/or participants were blinded, or whether differences in location (e.g., at home vs clinic/gym) may have influenced questionnaire responses?</i>	no <i>The study population were homosexual males, recruited at gyms or HIV testing clinics - not all homosexual men attend these places.</i>	no <i>Perhaps additional variables (e.g., peer influence, partner influence, finances, etc) may have influenced the results.</i>	yes <i>Subsample response rates ranged from 50% to 72% (across the years they were recruited).</i>	can't tell <i>There was no description of the questionnaire's development.</i>	no <i>They did not adjust for all potentially confounding variables in their analyses.</i>	can't tell	can't tell	no <i>They only looked at unprotected anal intercourse with partners - there are several other sexual risk behaviours that are more common - e.g., number of sexual partners.</i>
Buck (2012)	Yes	Yes	yes	yes	Yes	yes	can't tell	Yes	yes	yes	not applicable	yes
Dodd (2010)	yes	Yes	yes	yes	no <i>The study population was a convenience sample, recruited at a UK university.</i>	can't tell <i>They did chi-squared and ANOVA tests to see differences in cluster membership according to ethnicity, gender and</i>	can't tell <i>Not reported.</i>	Yes	yes <i>Although analyses could have been adjusted for religion.</i>	no <i>The results are specific to students within one UK university.</i>	no <i>The results are specific to students within one UK university.</i>	yes

						age. However, religion may have influenced cluster membership?						
Egginton (2002)	Yes	Yes	yes	yes	can't tell	no Variables like social class, ethnicity, religion, etc, were not controlled for.	can't tell	Yes	no	no	can't tell	yes
Fear (2007)	Yes	Yes	yes	yes	yes Seems to be. Included a random representative population from the UK armed forces.	yes Adjusted for age, rank, service, deployment status, role within parental unit, marital status, children living at home, educational qualifications, smoking status and having a parent with a drink or drug problem.	yes 60%	yes	yes	no	no The relevant analyses were specific to UK armed forces personnel only. This was also a national sample and was not specific to one UK region.	yes
Griffiths (2010, 2011)	yes the whole Britain	Yes	yes	yes	yes	can't tell	Yes	yes same survey had been used in 1999.	can't tell	yes	not applicable	no They could have included smoking as one of the predictors in the regression model.
Jackson (2012)	Yes	Yes	yes	yes	can't tell	yes	Yes	can't tell	yes	can't tell	can't tell	yes
Lawder (2010)	yes	yes	yes	yes	yes	no Although	Yes	Yes	yes Only for	can't tell The study sample was	yes Data were	yes

						<i>they performed adjusted analyses for examining predictors of clusters, they did not perform adjusted analyses for examining the clustering of risk behaviours.</i>			<i>analyses examining predictors of risk behaviour clusters.</i> <i>no</i> <i>In relation to the unadjusted analyses for clustering of risk behaviours.</i>	<i>Scottish, not sure how comparable Scottish and other UK populations are? Perhaps these results would also be relevant to English/Welsh/Northern Irish populations?</i>	<i>collected in Scotland, via a multi-stage stratified probability sampling method.</i>	
Liao (1995)	Yes	Yes	yes	yes	<i>no</i> <i>Specific to 45-year old women in South London only.</i>	<i>no</i> <i>They don't seem to have adjusted for socio-demographic variables such as occupational social class, employment status, ethnicity, marital status, etc. However, this was probably not possible given the nature of the analyses conducted (Chi-squared).</i>	Yes	<i>no</i> <i>Some, but not all of the questionnaire items had been previously validated.</i>	<i>no</i>	<i>no</i>	<i>can't tell</i>	<i>can't tell</i> <i>The results aren't presented clearly per relationship examined.</i>
McAloney (2010)	Yes	Yes	yes	can't tell	can't tell	<i>no</i>	can't tell	can't tell	<i>no</i>	can't tell	can't tell	yes
Parkes (2007)	<i>yes</i> <i>pupil in Scotland 14-16 yrs</i>	yes	yes	yes	can't tell	<i>yes</i> <i>adjusted for gender and social</i>	can't tell		<i>no</i>	can't tell	can't tell	yes

Plant (1990)	Yes	no <i>The outcomes are not very well defined.</i>	yes	yes	no <i>It may be representative of sex workers in Edinburgh, however it would not be representative elsewhere.</i>	<i>background</i> no <i>They don't seem to have adjusted for any confounding variables such as age, gender, etc. The description of the results and analysis is very vague.</i>	can't tell <i>No response rate reported. Not sure if this is applicable given the snowballing technique they used for recruitment, and the nature of the study (face-to-face interviews with sex workers and their clients).</i>	can't tell <i>This is possible, they reported that the interview used was a standardised one.</i>	can't tell <i>The description is far too vague.</i>	no	can't tell <i>Possibly Edinburgh only.</i>	no <i>There are no results relating to relationships between the other behaviours investigated, i.e., smoking, illicit drug use.</i>
Plant (2002)	Yes	Yes	yes	yes	yes	can't tell	can't tell <i>not reported</i>	can't tell	can't tell	yes	can't tell	can't tell <i>The authors gave a very short, concise description of some of their statistical analysis. It was unclear whether they omitted any findings.</i>
Poortinga (2007)	Yes	Yes	yes	yes	yes <i>England only.</i>	yes <i>(analyses investigating predictors of clustering)</i> no <i>(clustering analyses)</i>	can't tell <i>Not reported.</i>	yes	yes <i>Although perhaps more confounding variables could have been controlled for?</i>	yes <i>England only.</i>	yes <i>All English regions.</i>	yes

Sabia (2009)	Yes	Can't tell <i>The alcohol consumption variable was confusing.</i>	yes	yes	can't tell	can't tell	can't tell	can't tell <i>Not reported.</i>	can't tell	can't tell	can't tell	can't tell
Shankar (2010)	Yes	Yes	yes	yes	yes	yes	can't tell	Yes	yes	yes	yes <i>England</i>	can't tell
Singleton (2003)	yes <i>prisoners of ENgland and Wales</i>	Yes	no	can't tell	yes	no	Yes	can't tell	no	can't tell	not applicable	can't tell
Sutherland (1998)	Yes	yes <i>Although the risk thresholds do not include quantities and are therefore a bit vague.</i>	yes	yes	no <i>Five schools from such a variety of areas within England cannot be considered representative for any area?</i>	no	can't tell	can't tell <i>Not reported.</i>	no <i>More sophisticated analytical techniques would have served better for investigating the research questions. The current ones did not allow for adjustment of potentially confounding variables.</i>	can't tell	can't tell	yes <i>It is not clear why they amalgamated cigarette and illicit drug use as one measured variable with alcohol consumption as the other variable.</i>
Tang (1997)	yes	yes	yes	yes	no <i>Perhaps for Bedfordshire only.</i>	can't tell	can't tell <i>not reported</i>	yes <i>Standardised protocols were used and the Dietary Instrument for Nutritional Education questionnaire was administered. Physiological measures included blood pressure, height,</i>	yes <i>Perhaps more confounding factors could have been controlled for?</i>	no	yes <i>Perhaps within Bedfordshire alone.</i>	no

								<i>weight, and serum lipid levels. It was unclear whether the questions relating to exercise, smoking and alcohol habits had been previously piloted/validated.</i>				
Thomas (1990)	Yes	can't tell <i>Risk thresholds aren't very clearly defined (e.g., levels of condom use).</i>	yes	yes	no	no <i>Very little adjustment for confounding factors, e.g., age, income, social class...would this information have been possible to obtain given the nature of the study?</i>	can't tell	can't tell <i>Though the authors stated that it had been a standardised interview schedule?</i>	no	no	no	yes
Thompson (1999)	Yes	Yes	yes	yes	yes	yes <i>They did not adjust for social class but this could have been covered by variables such as occupation, employment and household tenure?</i>	Yes	can't tell <i>The survey instrument was developed by the Health Education Authority - no other details were provided.</i>	yes	yes <i>England only.</i>	not applicable	yes
Thornton (1994) Thompson (1992)*	Yes	Yes	yes	yes	yes	can't tell <i>not sure</i>	can't tell <i>not reported.</i>	can't tell <i>not reported.</i>	can't tell	yes	not applicable	yes

Uitenbroek (1993)	Yes	Yes	yes	yes	can't tell	no <i>only age and occupation</i>	Yes		can't tell	can't tell	can't tell	yes
Uitenbroek (1994)	yes <i>18 to 51</i>	Yes	yes	yes	can't tell	no	yes <i>i thinks its ok 67.5% London and 75.2% Scotland</i>	can't tell	no	can't tell	can't tell	yes
Underwood (2007)	Yes	can't tell	yes	yes	yes <i>vocational dental practitioners</i>	no	Yes	yes <i>piloted in 2000</i>	can't tell	no <i>only dental practitioners</i>	not applicable	can't tell
Underwood (2010)	Yes	No	yes	yes <i>In the lecture theatre, participants were spaced apart from their peers in order to ensure confidentiality for responses.</i>	no <i>Was specific to one English university only.</i>	no <i>No confounding factors (e.g., social class, ethnicity, age, gender) were adjusted for in the analysis of interest.</i>	Yes	can't tell <i>Details of the questionnaire's development were not reported.</i>	no <i>They did not adjust for any confounding variables. The description of the statistical analysis is extremely vague (pretty much non-existent).</i>	no	no	can't tell <i>Difficult to say because we don't know much about their statistical analysis techniques?</i>
Wadsworth (2004)	Yes	Yes	yes	yes	can't tell		No	can't tell <i>The questionnaire was based on another questionnaire - difficult to know whether the questions had been previously validated/piloted.</i>	yes <i>see linked study</i>	can't tell <i>Data are from two cities in Wales.</i>	can't tell <i>Data are from two cities in Wales.</i>	yes
Woodward (1994)	yes	no <i>Not many of the variables tested actually</i>	yes	yes	yes	no <i>They did adjust for age, sex and occupational</i>	Yes	can't tell <i>Some appeared to have been developed from standardised</i>	no	can't tell	yes	no

		<i>have risk thresholds - the definitions are very vague.</i>				<i>social class - however variables such as education, ethnicity and religion might also influence such results.</i>		<i>measures (e.g., the food frequency questionnaire) but others seemed to have been developed for the questionnaire (e.g., the item pertaining to physical activity).</i>				
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Appendix 7: Review 1 – Forest plots for co-occurrence, clustering or prediction

Co-occurrence of risk behaviours

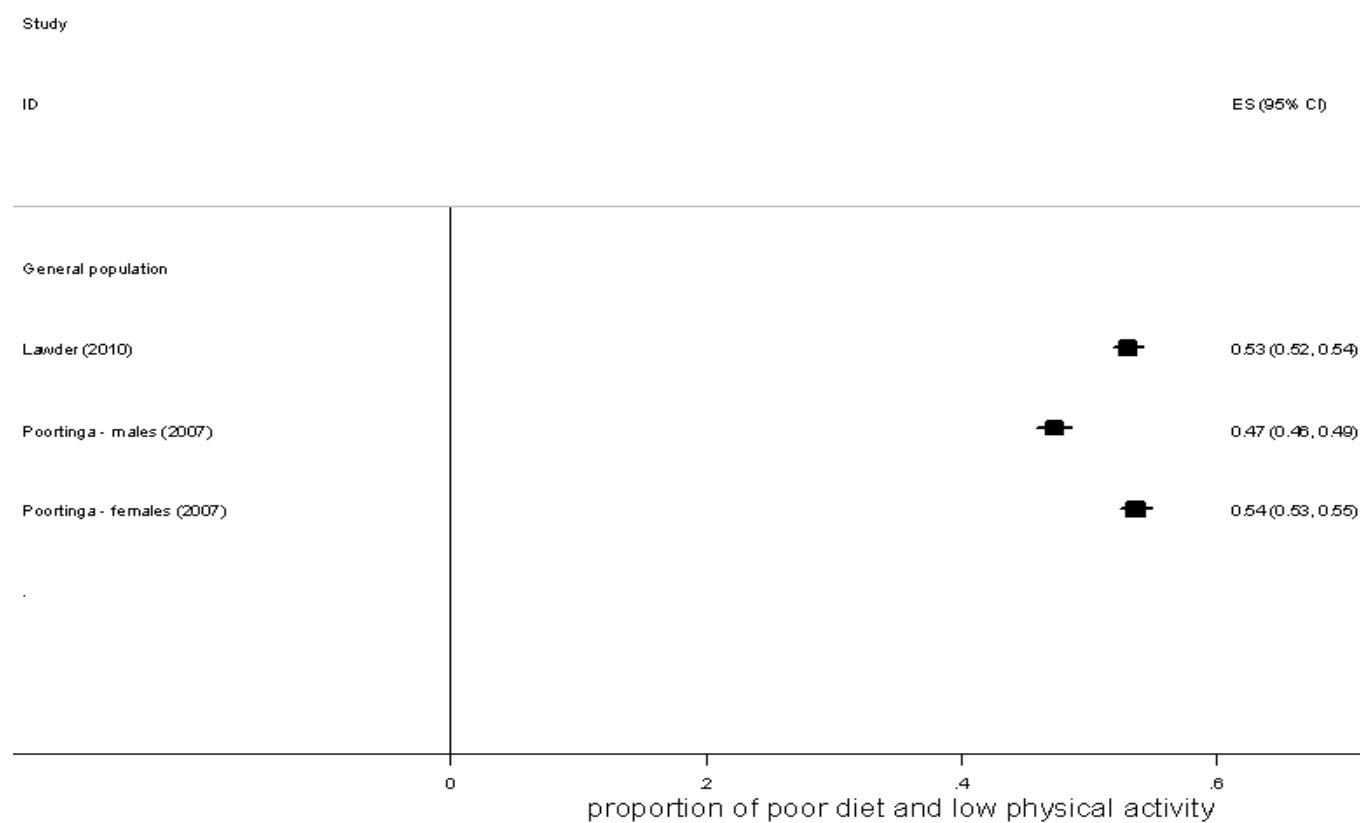


Figure 7.1. Prevalence of low fruit and vegetable intake and low physical activity.

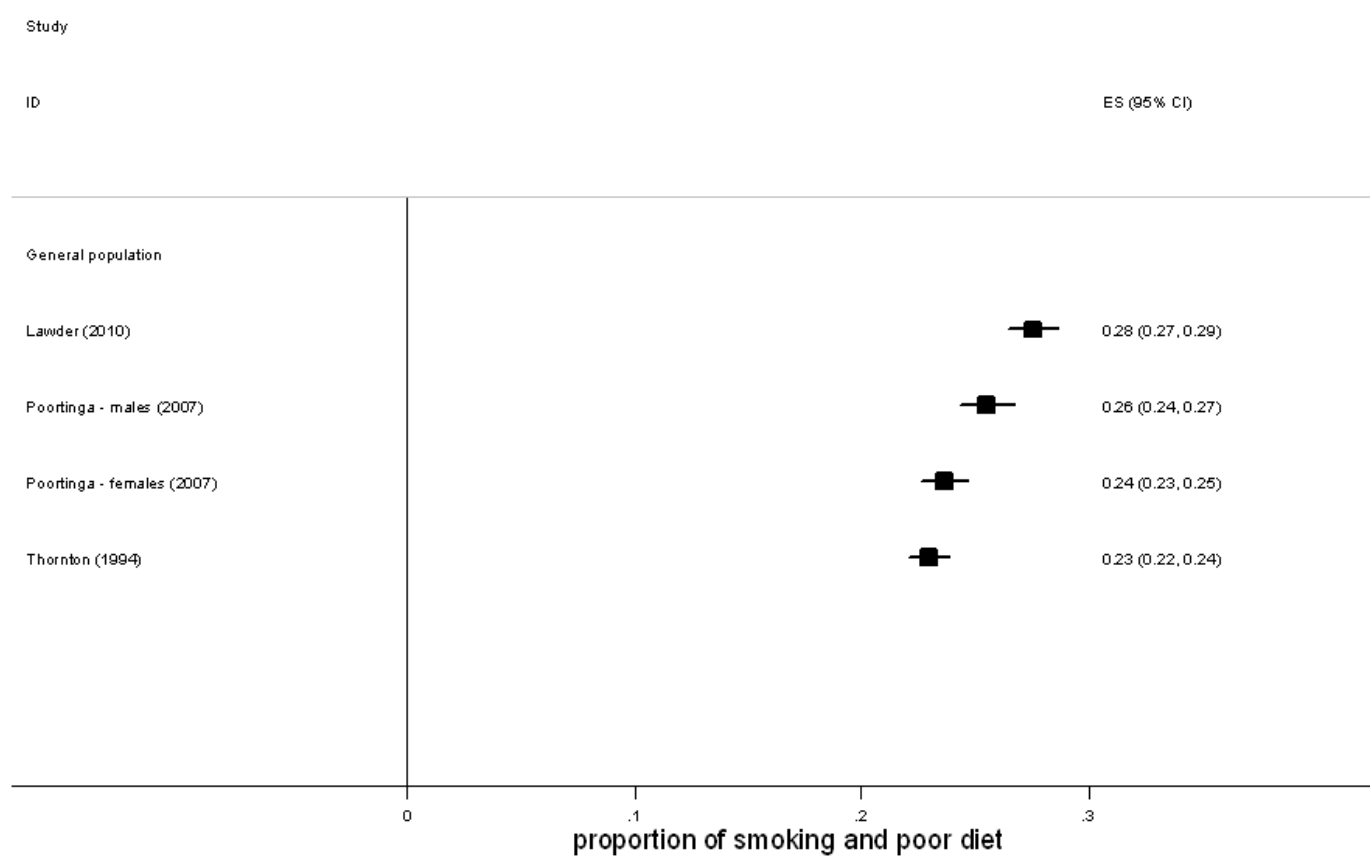


Figure 7.2. Prevalence of smoking and low fruit and vegetable intake.

Clustering of risk behaviours

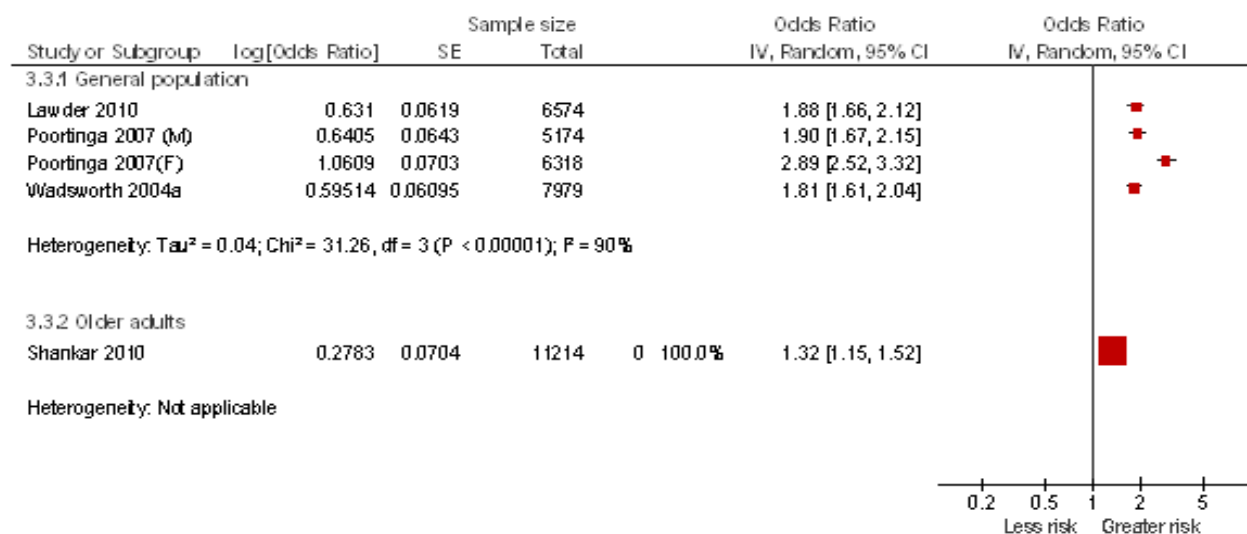


Figure 7.3. Prevalence odds ratios for alcohol misuse and smoking.

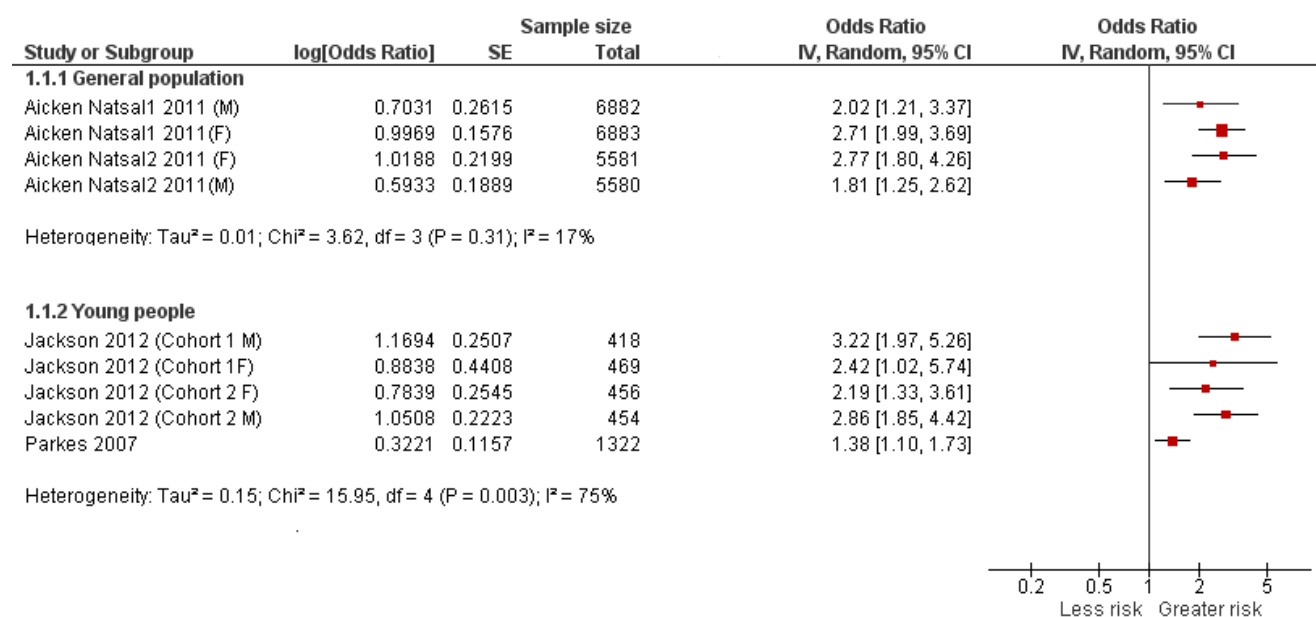


Figure 7.4. Odds ratios for alcohol misuse and sexual risk behaviour.

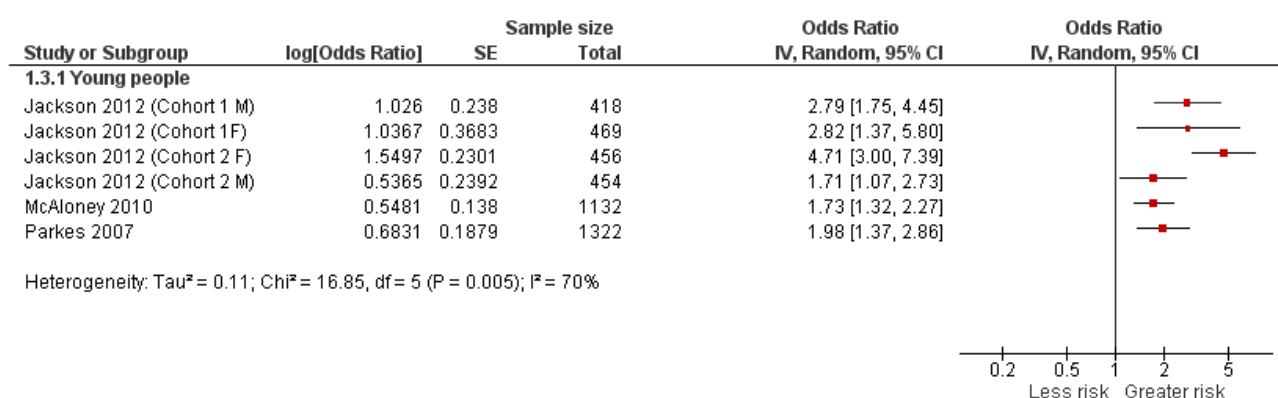


Figure 7.5. Odds ratios for illicit drug use and sexual risk behaviour.

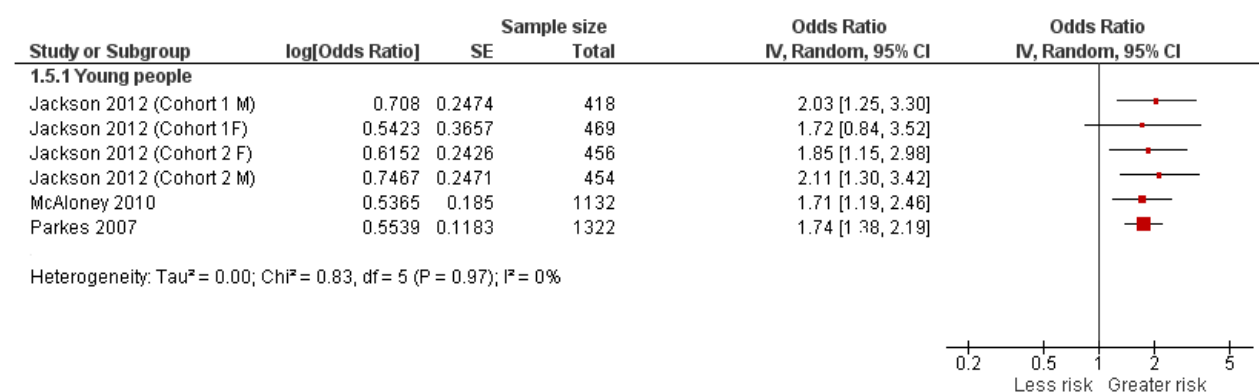


Figure 7.6. Odds ratios for smoking and sexual risk behaviour.

Predictive relationships between sociodemographic factors and risk behaviours

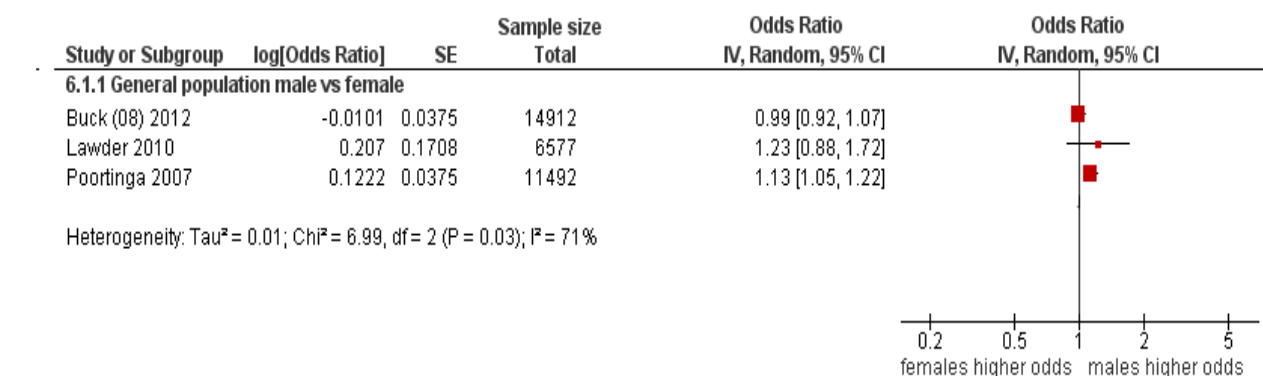


Figure 7.7. Gender as a predictor of two risk behaviours (general adults).

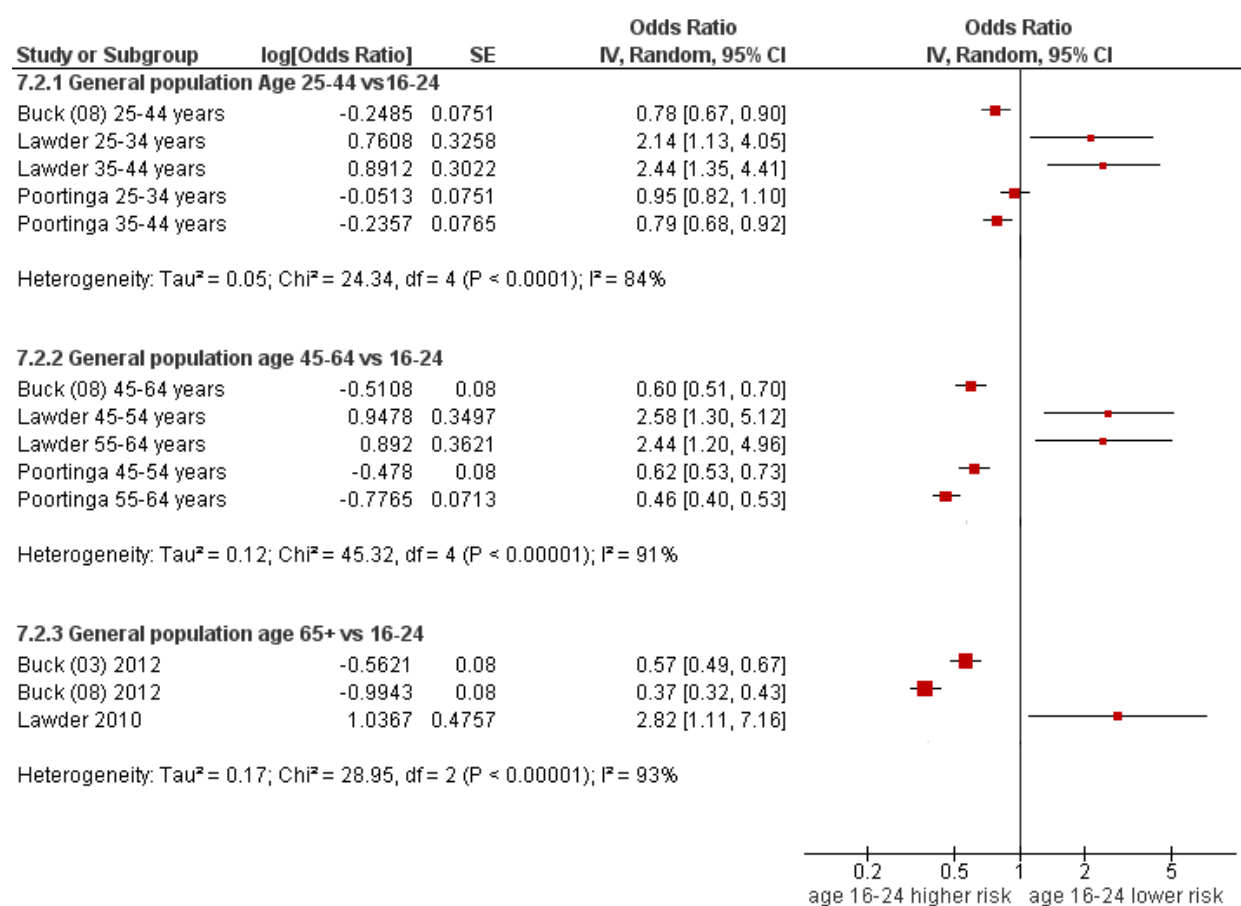


Figure 7.8. Age as a predictor of 3 risk behaviours.

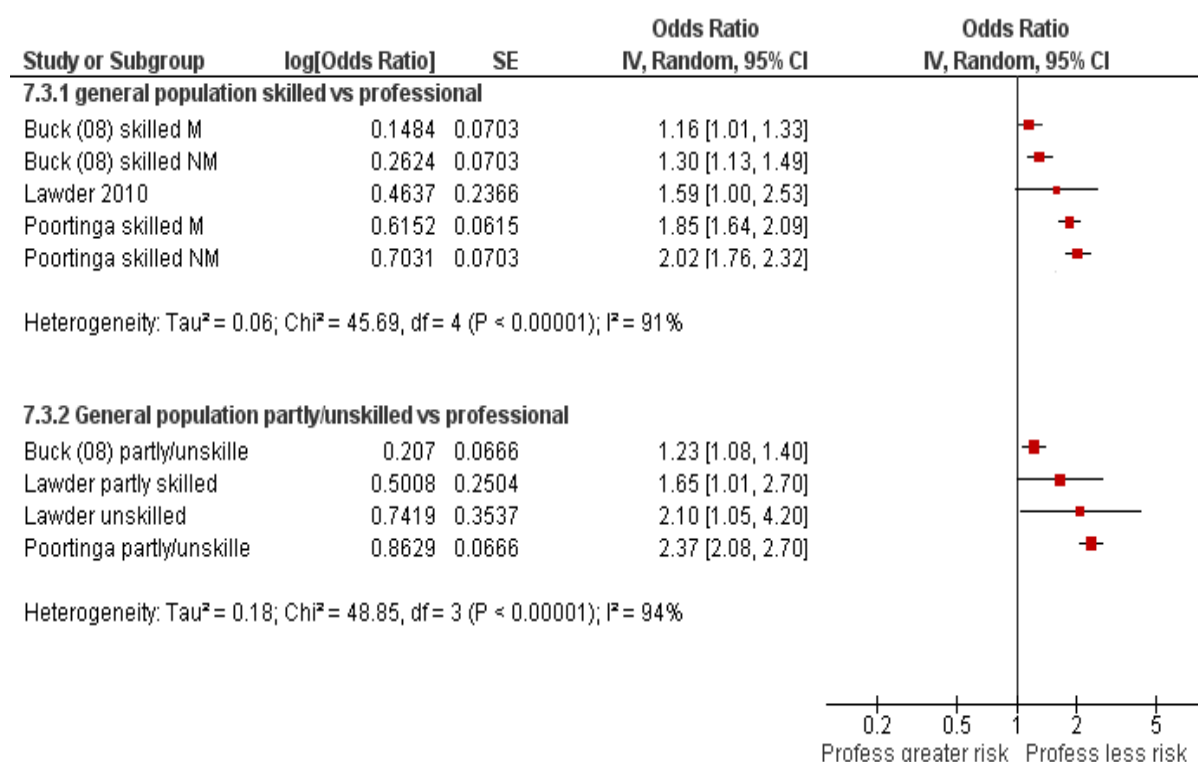


Figure 7.9. Occupational group as a predictor of 2 risk behaviours.

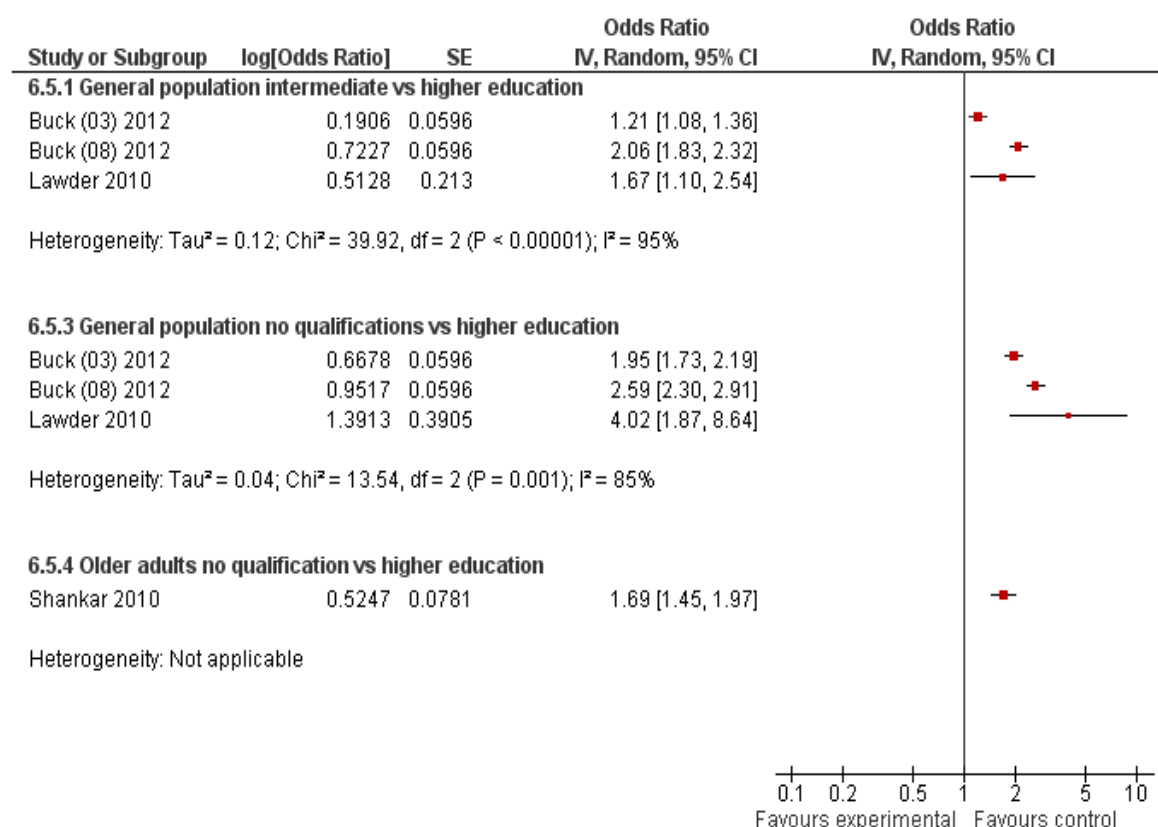


Figure 7.10. Education as a predictor of 2 risk behaviours

Note: Data from the Health Survey for England 2003 were extracted from one study (Buck & Frosini, 2012), as although Poortinga (2007) also used this dataset he did not include education as a predictor. Data from the 2008 wave of the survey were also extracted from Buck and Frosini (2012).

**Multiple risk behaviours and interventions to reduce
multiple risk behaviours**

General background

Scientific Literature

Modifiable health risk behaviours (e.g., physical inactivity, smoking, low fruit and vegetable intake) contribute significantly to the global burden of disease (1). The co-occurrence of these behaviours are common, for example 55.1% of adults in the Netherlands (2), 52% in the USA (3), 59.4% in Brazil (4), and 68% in England (5) reportedly engage in two or more risk behaviours. Moreover, all-cause mortality risk has been shown to be four times higher among individuals with multiple risk behaviours, both in the USA (6) and the UK (7).

Maintenance of healthy behaviours (e.g., regular physical activity, not smoking, high fruit and vegetable intake) in place of risk behaviours is important for preventing all-cause mortality (8, 9), and diseases like cancer, vascular disease and diabetes (9, 10). Previous behaviour change interventions have tended to focus on single risk behaviours (11, 12). These interventions have often failed to achieve consistently positive outcomes however, and more recently interest has grown in the role of multiple risk behaviour interventions. This may be linked to the growing research base which suggests that risk behaviours may cluster within individuals (5, 13, 14). It has also been suggested that these interventions have the potential for greater health benefits and reduction of health care costs (15).

Multiple risk behavior change interventions have been implemented. For example, a systematic review evaluating the effects of interventions (including education or counselling) to modify multiple risk factors among general populations, occupational groups and high risk groups is available (16). The authors reported positive effects for risk behaviours such as smoking, but no overall reduction in mortality. However, the studies were carried out across different countries and times and are likely to have been implemented in varying social contexts. Additionally, many of the interventions included in the review were individual- or family-focused and may not have considered the circumstances in which participants were attempting to make lifestyle changes. Exploration of the effects, content, contexts and processes of multiple risk behaviour interventions may increase understanding as to how, when, and for whom these interventions are most effective.

Policy Relevance

The Government is planning to re-balance allocation of public health funds so that more is spent on treating the causes of diseases, rather than the diseases themselves (21). Thus, collation and evaluation of relevant evidence is vital for increasing understanding of health inequalities, risk behaviour clusters and factors that influence these clusters. This would also aid policy decision-making for financial expenditure and the appropriateness of interventions for particular communities, families and individuals and financial expenditure. In turn, this would increase the effectiveness of service delivery and achieve overarching goals of health protection and resilience (22).

This project aims to support public health policies to improve national health and well-being by investigating multiple risk behaviours (risk clusters), predictors of risk clusters (review 1), interventions and intervention context for reducing risk behaviours (review 2), and people's

experiences of making lifestyle changes (review 3). The project will use systematic review methods to identify, appraise and synthesise existing research evidence. The findings from the individual systematic reviews will be brought together in an overall comparative synthesis, allowing key policy questions to be answered.

Methods

As the proposed methods for each of the systematic reviews are quite different, separate protocols have been produced for each review. The information below refers to review 2 and a related systematic map.

Systematic map and review on identification and exploration of multiple risk behaviour interventions (review 2)

Research aims

- i) To identify and map existing multiple risk behaviour interventions (systematic map/scoping review).
- ii) To evaluate the effects of multiple risk behaviour interventions on behavioural outcomes (review 2).
- iii) To explore the content, contexts and processes of multiple risk behaviour interventions, to better understand how, when, and for whom they are most effective (review 2).

Initial scoping searches for systematic reviews

Prior to commencement of the second review, the following databases were searched for completed or ongoing systematic reviews of studies that described or evaluated multiple risk behaviour interventions:

- PROSPERO
- The Database of Abstracts of Reviews of Effects (DARE)
- The Cochrane Database of Systematic Reviews (CDSR)

The potentially relevant reviews identified were then mapped in an inclusive manner, according to the risk behaviours investigated and study characteristics. This was conducted in order to determine whether a new systematic review was required, or whether it was possible to utilise data from an existing review.

There were 21 potentially relevant reviews identified from PROSPERO, DARE and CDSR. Many focused on non-behavioural outcomes such as change in blood pressure or total cholesterol. Although, most also evaluated change in diet and/or physical activity – as well as blood pressure, etc. A small number of reviews also reported smoking (16-18) and/or alcohol misuse (19) in addition to diet and/or physical activity. Most reviews did not focus on interventions targeting multiple risk behaviours, but on interventions targeting a single behaviour. Some reviews defined their inclusion criteria based on specific participant demographics such as a low income (20), specific modes of intervention delivery, i.e., via computer (21) or telephone (22), or specific types of settings, such as the workplace (23, 24), medical settings (18, 24), or communities (24). Only three systematic reviews appeared to have considered implementation fidelity within the interventions evaluated (22, 24, 25), and none explored the context in which interventions had been delivered. Two ongoing systematic reviews focus on multiple risk behaviours but they are limited to children and young people aged 18-25 years (Campbell *et al.*, protocol unavailable; (26).

To date, it appears that there is no existing systematic review focusing on interventions targeting multiple risk behaviours in general populations, which measure changes in health-related behaviour as the primary outcome. The full versions of the mapping results above are available upon request.

Further scoping searches and mapping of primary studies

In order to determine the scope and size of the multiple risk behaviour literature, a mapping exercise was carried out. Scoping reviews (i.e., mapping exercises) are increasingly being recognised as an important step in informing the systematic review process, particularly in reviews of public health interventions where populations, interventions and study designs can vary greatly (27). For example, we wanted to ensure that if study design eligibility was limited to randomised controlled trials, we wouldn't exclude specific categories of intervention. This has been identified as a potential problem in other reviews of public health interventions (28). Information concerning the scoping review methods and findings is reported in full elsewhere, and is available upon request.

Systematic review inclusion/exclusion criteria

Based on the findings from the scoping review, we have decided to include studies meeting the following criteria: Randomised controlled trials (RCTs) evaluating any (predominantly) non-pharmacological intervention that aimed to change at least two risk behaviours in, 1) general adult populations, or 2) non-targeted subgroups of general populations, such as older adults or pregnant women. The primary outcome will be changes in the risk behaviours targeted after the intervention; secondary outcomes will include changes in body mass index or weight.

Where data from multiple time points are provided, data from the final time point will be included in the syntheses. Studies focusing on targeted subgroups, where screening takes place to determine eligibility, will be excluded. Also excluded are studies targeting populations with biological or genetic risk factors for disease, e.g., people with metabolic syndrome, pregnant women with gestational diabetes, or people at risk of developing type 2 diabetes.

Due to resource and time constraints, we have decided to exclude studies (36 in total) carried out in the workplace.

Using these final inclusion criteria, one reviewer will screen (for eligibility) the studies mapped in the scoping review. These screening decisions will then be checked by a second reviewer.

Data extraction

We will use the included studies identified and search for each of them in four citation sources (Google Scholar, Scopus, Web of Science, and OVIDSP MEDLINE) to retrieve the records of all papers that have cited these studies. After loading into bibliographic software and de-duplicating, two reviewers will independently sift these records to identify any further relevant studies.

Reference lists of all included studies will be manually searched by one reviewer to locate further relevant studies; those assessed as being eligible for inclusion will be checked by a second reviewer.

Data extraction will be piloted on a selection of studies to ensure consistency. Data will be extracted by one reviewer using a modified version of the Cochrane Public Health Group's data extraction and assessment template (available upon request), which will then be checked by a second reviewer. Discrepancies will be resolved by discussion, with involvement of a third reviewer where necessary. If time constraints allow, attempts will be made to contact authors for any missing data. Data from multiple publications of the same study (or dataset) will be extracted and reported as a single study. We will also extract data from any linked process evaluations or qualitative studies. Where possible, we will identify and extract relevant contextual information. Extraction of implementation data will be based on a template adapted from the Oxford Implementation Index (29). This is a tool designed to aid reviewers in the extraction and comparison of implementation data across primary trials. We extracted the following intervention characteristics: core components (based on Michie et

al.'s Behaviour Change Wheel discussed in more detail below); number, frequency and duration of sessions; delivery method; staff characteristics, training, supervision; intervention adaptation by staff and participant compliance/adherence; contamination and/or uptake of treatments/interventions outside of the trial. We sought to distinguish between design, delivery and participant uptake for each of these intervention characteristics as suggested by the Oxford Implementation Index tool. However in most circumstances this was rarely possible due to limitations in reporting.

We extracted the following contextual factors: setting, country; participant characteristics; characteristics of delivery organisation and service environment; significant external events occurring at time of intervention. We sought to distinguish between design and implementation/actual conduct of the trial however as above in most circumstances this was not this was rarely possible due to limitations in reporting.

Two reviewers will independently extract information about the content of each intervention. Where relevant, studies will be coded according to the Behaviour Change Wheel (30); this is a published framework which can be used for characterising behaviour change interventions. because it also considers the influence of multiple societal levels (e.g., individual, communities, populations) on the behaviour change process. Michie et al. (2011) suggest that characterisation of interventions and an understanding of the behaviour/s targeted provide a starting point for determining the circumstances in which intervention types are likely to be effective. This increased understanding can form the basis of future intervention design, and improve the translation of research into practice.

At the hub of the behaviour change wheel, there are three essential individual-level factors (capability, opportunity and motivation) required for behaviour change. Around which, are the nine intervention functions (e.g., education, training, enablement) aimed at addressing deficits in the essential individual-level factors (e.g., education, training, enablement). The outermost part of the wheel consists of seven categories of policies (e.g., regulation, legislation, guidelines) that might enable the interventions to be performed. We focused on the middle and outermost rings of the wheel during the coding of study interventions. The definitions for the codes were previously defined by Michie et al., 2011, and are shown in Table 1.

Quality assessment

The quality of the individual studies will be assessed independently by two reviewers using the Cochrane risk of bias tool (31); disagreements will be resolved by discussion and if necessary a third reviewer will be consulted.

Methods of analysis and synthesis

Given the anticipated diversity of the studies in terms of intervention, settings and methods of analysis, it is not yet possible to judge whether it would be appropriate to conduct meta-analyses.

Meta-analyses

If deemed appropriate meta-analyses will be carried out as a component of the synthesis. Where possible, univariate meta-analysis of the studies will be performed to examine the effects of interventions on one risk behaviour at a time. Any study data not considered amenable to meta-analysis will be synthesised narratively.

Sensitivity analyses

Multivariate meta-analyses will also be conducted as a sensitivity analyses to examine the impact of taking into account expected correlations between different outcomes. Where data from multiple time points is provided, data from the final time point will be included in the syntheses. In addition, to standard univariate meta-analyses we will also included several sensitivity analyses.

A further sensitivity analysis for the proposed meta-analysis is to use robust variance estimation. Standard meta-analyses assume that effect sizes are independent from each other so including more than one effect size from the same study leads to a violation of this assumption (Cochrane Collaboration, 2012). However, studies of multiple risk behaviour interventions commonly include more than one intervention group and more than one follow up time (for example, endpoint and 6 month follow up).

It is therefore challenging to realistically reflect the complexity of these studies using standard methods. Section 2.6.3 above outlines some of the methods used to take into account factors such as multiple intervention groups and follow up times whilst preserving some of these data. However, this approach still leads to a loss of information in the meta-analyses.

More flexible methods are proposed by Hedges et al. (2010) that estimate the covariance between correlated effect sizes estimates (e.g. the effect sizes for two separate interventions compared with a control in the same study) to provide valid robust estimates of variance without the need to impute correlation coefficients of the associations between these outcomes.

For all outcomes where multiple intervention groups and follow up times were used and at least 10 studies included in the meta-analyses, we conducted sensitivity analyses using robust variance estimation to compare with the main analyses.

Synthesising implementation data

Narrative synthesis will be carried out and will describe, organise, explore and interpret the study findings, taking into account any contextual or process-related factors that might have impacted on study outcomes. A component of the synthesis will be to explore the effectiveness of interventions according to the behaviour change techniques employed and other implementation factors using mixed effects meta-regression where appropriate. The methodological strengths and weaknesses of the studies will also be taken into account. As part of this process we will investigate the similarities and differences between study findings.

Advisory group

Professor Rona Campbell, University of Bristol, has acted as an advisor to the project.

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Appendix 9: Scoping review - Summary

The purpose of this scoping review was to identify and map existing multiple risk behaviour interventions (meeting objective 3 of the project).

Seven bibliographic databases were searched between January, 1990, and January/ May, 2013, with no language restrictions. Authors of protocols, conference abstracts, and other relevant articles were contacted. Study characteristics were extracted and inputted into Eppi-Reviewer 4.

Eligible for inclusion were studies of any design which attempted to evaluate the effectiveness of a (predominantly) non-pharmacological intervention targeting change in at least two risk behaviours. Participants had to be aged 16 years or older, drawn from a general population and/or a population with biological or genetic risk factors for disease. Study outcomes had to include measurements of the targeted risk behaviours at intervention endpoint/follow-up. To avoid duplication with a registered protocol of a systematic review (MacArthur et al., 2012), studies of school- or family-based interventions were excluded.

In total, 221 studies were included in the scoping review. Most were randomised controlled trials (62%) conducted in the United States (48%), and targeted diet and physical activity (56%) in people from general populations (14%) or subgroups of general populations (46%). Very few studies had been conducted in the Middle East (2%), Africa (0.4%), or South America (0.4%). There was also a scarcity of studies conducted among young adults (1%), or racial and minority ethnic populations (4%) worldwide.

We concluded that research is required to investigate the interrelationships of lifestyle risk behaviours in varying cultural contexts around the world. Cross-cultural development and evaluation of multiple risk behaviour change interventions were also suggested, particularly in populations of young adults and racial and minority ethnic populations. Further details of the scoping review methods are available upon request; the findings are presented in full in tables 9.1 to 9.4 below.

Table 9.1. Populations, risk behaviour combinations and countries of the mapped studies (221 in total) – presented according to population.

STUDY POPULATION	RISK BEHAVIOURS TARGETED	TOTAL NUMBER OF STUDIES	COUNTRIES OF STUDIES (NUMBER OF STUDIES PER COUNTRY)
GENERAL POPULATION (83 STUDIES, WITH SAMPLE SIZES RANGING FROM 12 TO 5,160):			
General adult population (aged ≥ 16 years) (30 studies)	Diet and physical activity	11	US (7), New Zealand (1), Canada (1), the Netherlands (1), Belgium (1)
	Smoking and physical activity	1	UK
	Smoking, diet, and sedentary behaviours	1	Turkey
	Smoking, diet, and physical activity	7	UK (1), the Netherlands (2), Iran (1), US (2), Denmark (1)
	Smoking, alcohol use, diet, and physical activity	5	Mauritius (1), UK (1), China (1), Vietnam (1), Australia (1)
	Smoking and diet	1	Sweden
	Diet, physical activity, and sedentary behaviours	2	Country not reported (1), US (1)
	Smoking, alcohol use, diet, and sunbathing	1	The Netherlands
	Smoking, alcohol use, diet, physical activity, and seat belt use	1	US
University students (15 studies)	Diet and physical activity	8	US (4), Mexico (1), Jordan (1), country not reported (2)
	Alcohol use and illicit drug use	1	US
	Smoking, diet and physical activity	1	US
	Smoking, alcohol use, diet, and physical activity	2	US (1), New Zealand (1)
	Alcohol use, illicit drug use, and sexual risk behaviours	1	US
	Alcohol use and sexual risk behaviours	1	US
	Alcohol use, diet, illicit drug use, and sexual risk behaviours	1	US
Racial and minority ethnic groups (8 studies)	Alcohol use and illicit drug use	1	US
	Diet and physical activity	6	US
	Illicit drug use and sexual risk behaviours	1	US
Older adults (6 studies)	Smoking, alcohol use, diet, and physical activity	1	US
	Diet and physical activity	3	US (1), Taiwan (1), Australia (1)
	Smoking, alcohol use, diet, physical activity, and seat belt use	1	US
	Smoking and diet	1	China

Homeless /low socio-economic status (6 studies)	Smoking, alcohol use, diet, physical activity, and sun protection	1	Australia
	Diet and physical activity	4	US (1), UK (2), Chile (1)
	Smoking, diet, and physical activity	1	The Netherlands
Parents with children (3 studies)	Diet, physical activity, and sedentary behaviours	2	US (2)
	Diet and physical activity	1	Australia
Pregnant women (3 studies)	Smoking, diet, and physical activity	1	The Netherlands
	Diet and physical activity	2	Australia (1), Country not reported (1)
Young adults other than students (aged 16 to 25 years) (2 studies)	Alcohol use and illicit drug use	1	UK
	Smoking, alcohol use, and illicit drug use	1	UK
Patients from healthcare practices (2 studies)	Smoking, alcohol use, diet, and physical activity	2	China (1), US (1)
Women only (3 studies)	Smoking and sunbathing	1	Israel
	Diet and physical activity	2	US
Men only (1 study)	Smoking, alcohol use, diet, and physical activity	1	UK
Prison inmates (1 study)	Smoking, alcohol use, illicit drug use, and sexual risk behaviours	1	US
Couples undergoing fertility treatment (1 study)	Unclear	1	Australia
Highly educated adults (1 study)	Smoking, diet, and physical activity	1	Belgium
Armed Forces veterans (1 study)	Diet and physical activity	1	US
TARGETED SUBGROUPS OF THE GENERAL POPULATION (48 STUDIES, WITH SAMPLE SIZES RANGING FROM 20 TO 1,403):			
Overweight/Obese (34 studies)	Diet and physical activity	32	Australia (3), US (17), New Zealand (1), UK (3), Canada (1), Belgium (1), the Netherlands (2), Denmark (1), Japan (2), country not reported (1)
	Physical activity and sedentary behaviours	1	US
	Diet, physical activity, and sedentary behaviours	1	US
Adult drug users (11 studies)	Illicit drug use and sexual risk behaviours	9	Russia (1), US (6), China (1), country not reported (1)
	Alcohol use and illicit drug use	1	US
	Alcohol use, illicit drug use, and sexual risk behaviours	1	US
University students with (or at risk of) problematic substance use (2 studies)	Alcohol use and illicit drug use	2	US (2)
Adult smokers with untreated depression	Smoking and physical activity	1	US

(1 study)			
AT RISK POPULATION (54 STUDIES, WITH SAMPLE SIZES RANGING FROM 18 TO 13,016):			
Cardiovascular disease risk (11 studies)	Diet and physical activity	6	US (5), Japan (1)
	Smoking, diet, and physical activity	1	US
	Smoking, alcohol use, diet, and physical activity	3	Sweden (1), South Korea (1), Denmark (1)
	Unclear	1	US
Diabetes risk (8 studies)	Diet and physical activity	8	The Netherlands (1), US (2), Poland (1), Finland (2), country not reported (2)
Cancer survivors (5 studies)	Diet and physical activity	4	US (2), Australia (1), country not reported (1)
	Smoking, alcohol use, diet, physical activity, and sedentary behaviours	1	Australia
People with hypertension (5 studies)	Diet and physical activity	2	Spain (1), US (1)
	Smoking, alcohol use, diet, and physical activity	1	Australia
	Smoking, diet, and physical activity	1	Italy
	Alcohol use, diet, and physical activity	1	Country not reported
People with, or at risk of metabolic syndrome (5 studies)	Diet and physical activity	5	Australia (1), Italy (1), Romania (1), Norway (1), France (1)
Women with, or at risk of gestational diabetes (3 studies)	Diet and physical activity	3	Australia (1), US (1), China (1)
Other (e.g., people who had undergone a colonoscopy) (13 studies)	Diet and physical activity	7	The Netherlands (1), US (2), Japan (1), UK (1), US, UK and Canada (1), Australia (1)
	Smoking and diet	1	US
	Smoking, diet, and physical activity	3	US (1), the Netherlands (1), country not reported (1)
	Smoking, alcohol use, diet, and physical activity	1	Australia
	Smoking, alcohol use, diet, and sun bathing	1	Spain
A combination of the above (4 studies)	Diet and physical activity	4	US (1), Japan (1), Sweden (1), Australia (1)
WORKSITE STUDIES (36 STUDIES, WITH SAMPLE SIZES RANGING BETWEEN 33 AND 28,000):			
All studies with interventions performed in worksites (36 studies) (Note: These studies did not always provide much detail on the populations involved. Where reported, there was wide variation in the work employees did. Examples included bus driving, office work,	Diet and physical activity	15	Canada (1), Australia (1), the Netherlands (2), country not reported (1), US (8), Japan (1), South Korea (1)
	Diet and sedentary behaviours	1	The Netherlands
	Smoking and diet	4	US
	Smoking and physical activity	2	US
	Smoking, alcohol use, and physical activity	1	Northern Ireland

teaching, hospital work, and construction).	Smoking, diet, and physical activity	6	Canada (2), US (1), the Netherlands (2), country not reported (1)
	Smoking, physical activity, and seat belt use	1	US
	Smoking, alcohol use, diet, and physical activity	1	South Korea
	Smoking, diet, physical activity, and seat belt use	1	US
	Smoking, alcohol use, diet, physical activity, and illicit drug use	1	US
	Unclear	3	US (1), Sweden (1), country not reported (1)

Table 9.2. Intervention aims and methods, and study designs of the mapped studies (221 in total) – presented according to population.

STUDY POPULATION	FOCUS OF THE INTERVENTION	TOTAL NUMBER OF STUDIES	DESIGNS AND COUNTRIES OF STUDIES (NUMBER OF STUDIES PER COUNTRY AND THE TYPE OF INTERVENTION)
GENERAL POPULATION (83 STUDIES, WITH SAMPLE SIZES RANGING FROM 12 TO 5,160):			
General adult population (aged ≥ 16 years) (30 studies)	Health promotion	6	RCTs* : US (1-education and counselling with peer), UK (1-CBT** and nicotine replacement therapy) Other designs*** : New Zealand (1-education, community activities and structural changes), US (1-coaching and home visits), Sweden (1-education and health examinations), Vietnam (1-advertising)
	Weight management	5	RCTs : US (2-education and advice, CBT and goal setting) Other designs : Canada (1-education and CBT), country not reported (1- smartphone application), US (1-prescribed diet and exercise activities)
	Prevention/reduction of risk for chronic disease	19	RCTs : Mauritius (1-structural changes), US (5-education, health coaching, tailored feedback and advice, behaviour change strategies, incentives for healthy behaviours, family history assessment), the Netherlands (3-tailored feedback and action plans, tailored information, tailored motivational interviewing), UK (1-annual health checks), Australia (1-tailored advice), Belgium (1-feedback and advice) Other designs : Turkey (1- education, lifestyle advice), China (1-education), Iran (1-education and structural interventions), Denmark (1-mass communication, group activities), US (1-tailored coaching), the Netherlands (1-mass communication, group activities), UK (1-no intervention details reported)
University students (15 studies)	Health promotion	9	RCTs : Mexico (1-CBT techniques), US (2-tailored education, education plus goal setting and improvement of self-efficacy), New Zealand (1-assessment, feedback and advice), country not reported (2-education and personalised feedback, coaching, health risk appraisal and personalised feedback) Other designs : US (3-education, peer education, social support, and participation in a health fair)
	Prevention/reduction of risk for chronic disease	5	RCTs : US (3-self management skills training, tailored education and feedback, CBT skills training, and group role play) Other designs : Jordan (1-education), US (1-education, structural changes)
	Prevention of initiation of risk behaviours	1	Other designs : US (1- skills and education)
Racial and minority ethnic groups (8 studies)	Health promotion	3	RCTs : US (2- dancing lessons and dietary education, environmental (i.e., social, cultural, physical) and organizational (i.e., policies, practices) changes within church – included education, bulletins, and policy/practices set by pastors) Other designs : US (1-culturally tailored education)
	Weight management	1	Other designs : US (1- education and behavioural strategies.)
	Prevention/reduction of risk for chronic disease	3	RCTs : US (3- education and social support, skills training for behaviour change, and counselling)

	Prevention of initiation of risk behaviours	1	RCTs: US (1-skills training)
Older adults (6 studies)	Health promotion	5	RCTs: US (2- health risk appraisals, tailored recommendations and self-management materials, education, self-recording of behaviours and personalised goals), China (1- education, tailored advice and motivational interviewing), Australia (1- lifestyle recommendations, goal setting, various tools, and telephone and email support from program guides.) Other designs: Taiwan (1- education)
	Prevention/reduction of risk for chronic disease	1	RCTs: US (1- visits to their doctor and counselling)
Homeless /low socio-economic status (6 studies)	Health promotion	3	RCTs: UK (1-environmental changes) Other designs: Chile (1-dietary education and physical activity sessions), UK (1- motivational interviewing)
	Prevention/reduction of risk for chronic disease	3	RCTs: US (1- tailored recommendations for behaviour change, counselling, access to local activities, and education tailored for low literacy audiences) Other designs: Australia (1-motivational interviewing, personalised feedback and advice), the Netherlands (1-large umbrella project with 790 interventions including nutrition parties, televised exercise sessions, and education – results reported at the population level)
Parents with children (3 studies)	Health promotion	3	RCTs: US (1-education, behavioural strategies, telephone support), Australia (1- interactive group education sessions) Other designs: US (1-motivational interviewing, counselling, education and skills training)
Pregnant women (3 studies)	Health promotion	2	RCTs: Australia (1-education and behaviour change strategies) Other designs: The Netherlands (1-education)
	Weight management	1	RCTs: Country not reported (1 – exercise sessions and dietary counselling)
Young adults other than students (aged 16 to 25 years) (2 studies)	Prevention/reduction of risk for chronic disease	1	RCTs: UK (1- motivational interviewing and education)
	Prevention of initiation of risk behaviours	1	RCTs: UK (1- motivational interviewing)
Patients from healthcare practices (2 studies)	Prevention/reduction of risk for chronic disease	2	Other designs: US (1-this paper summarised findings from 10 intervention studies in different areas, all under the same umbrella project. Most incorporated a form of counselling). China (1-counselling).
Women only (3 studies)	Prevention/reduction of risk for chronic disease	2	RCTs: US (1- education and guidance, included goal setting, stimulus control, relapse prevention, and cognitive and motivational techniques) Other designs: Israel (1-education, discussion groups and increased access to doctors for personal consultations)
	Health promotion	1	RCTs: US (1- education and social support from peers via a buddy system)
Men only (1 study)	Prevention/reduction of risk for chronic disease	1	Other designs: UK (1-education, physical assessment, and advice)

Prison inmates (1 study)	Prevention/reduction of risk for chronic disease	1	RCTs: US (1- education)
Couples undergoing fertility treatment (1 study)	Health promotion	1	Other designs: Australia (1-lifestyle assessment and motivational interviewing)
Highly educated adults (1 study)	Prevention/reduction of risk for chronic disease	1	RCTs: Belgium (1- personalised website and coaching)
Armed Forces veterans (1 study)	Health promotion	1	Other designs: US (1-interactive, individual sessions that included skills training and education)
TARGETED SUBGROUPS OF THE GENERAL POPULATION (48 STUDIES, WITH SAMPLE SIZES RANGING FROM 20 TO 1,403):			
Overweight/Obese (34 studies)	Health promotion	1	Other designs: New Zealand (1-education)
	Weight management	31	RCTs: US (14-self-monitoring, goal setting, personalised feedback, motivational interviewing, education, self-control skills training, counselling, tailored recommendations, and behaviour therapy), Australia (2-goal setting, self-monitoring and reinforcement, education, tools and personalised feedback), country not reported (1-tailored feedback and counselling), Belgium (1-advice and counselling), the Netherlands (1-web based application, called 'Healthy Weight Assistant'), UK (2-advice, tools, education and counselling), Japan (2-counselling, exercise sessions, education, self-monitoring and goal setting), Denmark (1-counselling, advice and free membership to fitness centre) Other designs: Australia (1-education and motivational interviewing), UK (1-behaviour change techniques and goal setting), US (2-education, group discussion, record keeping, and computerised dietary assessment), Canada (1-assessment, counselling, tailored diet plan, and a walking program), the Netherlands (1-tailored education) Design not reported: US (1-education and activity materials)
	Prevention/reduction of risk for chronic disease	2	Other designs: US (2- education, supervised physical activity sessions, goal setting, self-monitoring techniques, skills training)
Adult drug users (11 studies)	Prevention/reduction of risk for chronic disease	11	RCTs: US (3-education and counselling, personalised feedback, skills training, goal setting, motivational interviewing), country not reported (1-education, behaviour strategies, skills training, support groups, and counselling) Other designs: Russia (1-peer education and HIV-test counselling), US (5-HIV counselling and testing, legal services, and family, recreational and social activities, tailored education, access to resources, and facilitated discussions), China (1-counselling and peer education)
University students with (or at risk of) problematic substance use (2 studies)	Reduction of risk for substance dependence and other problems (e.g., academic impairment)	2	Other designs: US (2-motivational interviewing, self-monitoring and personalised feedback)
Adult smokers with untreated depression (1 study)	Prevention/reduction of risk for chronic disease	1	RCTs: US (1-CBT-based counselling sessions and activity materials)

AT RISK POPULATION (54 STUDIES, WITH SAMPLE SIZES RANGING FROM 18 TO 13,016):			
Cardiovascular disease risk (11 studies)	Prevention/reduction of risk for chronic disease	10	RCTs: US (4-education, counselling, tailored newsletters, and goal setting), Denmark (1-personalised lifestyle consultation and counselling) Other designs: US (3-education, counselling, supervised physical activity sessions, self-monitoring, group support, lifestyle recommendations), Japan (1-counselling, education and physical activity sessions), Sweden (1-education, advice, group/club activities, individual consultations)
	Health promotion	1	Other designs: South Korea (1-education, counselling and group discussions)
Diabetes risk (8 studies)	Prevention/reduction of risk for chronic disease	8	RCTs: Country not reported (1-no intervention details reported in conference abstract), Finland (1- counselling), US (2-education, behavioural support, motivational interviewing and tailored advice), the Netherlands (1-motivational interviewing) Other designs: Poland (1-education, social support, and motivation sessions), Finland (1-education and counselling), country not reported (1-counselling)
	Health promotion	3	Other designs: US (1- discussions, group activities and exercise classes.)
Cancer survivors (5 studies)	Weight management	1	RCTs: Country not reported (1-advice), Australia (1-health coaching) Other designs: Australia (1-health coaching)
	Prevention/reduction of risk for chronic disease	1	Other designs: US (1-behaviour change classes and counselling)
People with hypertension (5 studies)	Prevention/reduction of risk for chronic disease	4	RCTs: Australia (1-cognitive behaviour change strategies, goal setting, advice, social support, time management), Italy (1-education), country not reported (1-education), Spain (1-education)
	Health promotion	1	RCTs: US (1- automated telephone counselling)
People with, or at risk of metabolic syndrome (5 studies)	Prevention/reduction of risk for chronic disease	4	RCTs: Norway (1-dietary counselling and supervised physical activity sessions), Romania (1- counselling), Italy (1-tailored lifestyle advice) Other designs: France (1-counselling)
	Health promotion	1	RCTs: Australia (1-education, behavioural strategies, peer group support, skills training, physical activity sessions)
Women with, or at risk of gestational diabetes (3 studies)	Prevention/reduction of risk for chronic disease	3	RCTs: US (1-goal setting, counselling, self-monitoring, and education), China (1-tailored advice), Australia (1-motivational interviewing)
Other (e.g., people who had undergone a colonoscopy) (13 studies)	Prevention/reduction of risk for chronic disease	10	RCTs: The Netherlands (1-tailored advice and counselling), UK (1-tailored advice, goal setting and social support), US, UK and Canada (1-tailored advice, personalised record logs, education), Spain (1-education) US (3-counselling, community-based exercise classes, goal setting, support planning with spouses, education, and encouragement to join a smoking cessation program) Other designs: Country not reported (1-counselling), Australia (2-health coaching and use of pedometer, counselling, gym memberships, skills training)
	Weight management	3	RCTs: The Netherlands (1- counselling, self-monitoring, and personalised feedback), Japan (1-education, goal setting, advice and self-monitoring)

			Other designs: US (1-advice, self-regulation skills training and social support)
A combination of the above (4 studies)	Prevention/reduction of risk for chronic disease	4	RCTs: Japan (1-education and goal setting), Sweden (1-supervised physical activity and dietary counselling), US (1-behaviour recommendations), Australia (1-education and goal setting)
WORKSITE STUDIES (36 STUDIES, WITH SAMPLE SIZES RANGING BETWEEN 33 AND 28,000):			
All studies with interventions performed in worksites (36 studies) (Note: These studies did not always provide much detail on the populations involved. Where reported, there was wide variation in the work employees did. Examples included bus driving, office work, teaching, hospital work, and construction).	Health promotion	18	RCTs: US (6-education, tailored goals, self-monitoring, personal support), country not reported (2-education and payroll-based incentive system, no intervention details reported for the other study), Canada (1-email messages promoting healthy behaviours), the Netherlands (1-tailored lifestyle recommendations) Other designs: Northern Ireland (1-lifestyle assessments), (6-incentives, skills training, motivational interviewing, environmental changes, and education), Canada (1-education)
	Weight management	8	RCTs: US (2-Counselling, environmental changes), Australia (1- financial incentives and education), the Netherlands (2-, guideline-based care, counselling) Other designs: US (1-lifestyle recommendations, goal setting, problem solving, education, and a walking program), the Netherlands (1-no intervention details reported), South Korea (1-incentives)
	Prevention/reduction of risk for chronic disease	10	RCTs: US (3-education, skills training, environmental changes, feedback, motivational interviewing), the Netherlands (1-motivational interviewing), Sweden (1-education and counselling) Other designs: Japan (1-counselling, and social and environmental support), country not reported (1-personalised action plan), South Korea (1-education and health behaviour diaries) , US (1-group support, skills training, CBT), Canada (1-goal setting and self-monitoring)

* RCT=Randomised Controlled Trial, ** CBT=Cognitive Behavioural Therapy,

*** Other (non-RCT) study designs included before and after studies, non-randomised controlled trials, case-control studies, a cohort study, and an interrupted time series.

Table 9.3. Populations, risk behaviour combinations and countries of the mapped studies (221 in total) – presented according to study country.

STUDY COUNTRY	RISK BEHAVIOURS TARGETED	TOTAL NUMBER OF STUDIES	STUDY POPULATIONS (NUMBER OF STUDIES PER POPULATION)
US (107 studies)	Diet and physical activity	61	General adult population (7) University students (4) Racial and minority ethnic groups (6) Older adults (1) Homeless/low socioeconomic status (1) Women only (2) Armed Forces veterans (1) Overweight/obese (17) Cardiovascular disease risk (5) Diabetes risk (2) Cancer survivors (2) People with hypertension (1) Women with, or at risk of gestational diabetes (1) Other at risk populations (2) People with a combination of chronic disease risks (1) Worksite interventions (8)
	Illicit drug use and sexual risk behaviours	7	Racial and minority ethnic groups (1) Adult drug users (6)
	Smoking, diet, and physical activity	6	General adult population (2) University students (1) Cardiovascular disease risk (1) Other at risk populations (1) Worksite interventions (1)
	Alcohol use and illicit drug use	5	University students (1) Racial and minority ethnic groups (1) Adult drug users (1) University students with (or at risk of) problematic substance use (2)
	Smoking and diet	5	Other at risk populations (1) Worksite interventions (4)
	Smoking, alcohol use, diet, and physical activity	3	University students (1) Older adults (1) Patients from healthcare practices (1)
	Diet, physical activity, and sedentary behaviours	4	General adult population (1) Parents with children (2) Overweight/obese (1)
	Smoking and physical activity	3	Adults smokers with untreated depression (1)

			Worksite interventions (2)
	Smoking, alcohol use, diet, physical activity, and seat belt use	2	General adult population (1) Older adults (1)
	Alcohol use, illicit drug use, and sexual risk behaviours	2	University students (1) Adult drug users (1)
	Alcohol use and sexual risk behaviours	1	University students
	Alcohol use, diet, illicit drug use, and sexual risk behaviours	1	University students
	Smoking, alcohol use, illicit drug use, and sexual risk behaviours	1	Prison inmates
	Physical activity and sedentary behaviours	1	Overweight/obese
	Smoking, diet, physical activity, and seat belt use	1	Worksite interventions
	Smoking, alcohol use, diet, physical activity, and illicit drug use	1	Worksite interventions
	Smoking, physical activity, and seat belt use	1	Worksite interventions
	Unclear	2	Cardiovascular disease risk (1) Worksite interventions (1)
Australia (18 studies)	Smoking, alcohol use, diet, and physical activity	3	General adult population (1) People with hypertension (1) Other at risk populations (1)
	Smoking, alcohol use, diet, physical activity and sun protection	1	Homeless/low socio-economic status
	Diet and physical activity	12	Older adults (1) Parents with children (1) Pregnant women (1) Overweight/obese (3) Cancer survivors (1) People with, or at risk of metabolic disease (1) Women with, or at risk of gestational diabetes (1) Other at risk populations (1) People with a combination of chronic disease risks (1) Worksite interventions (1)
	Unclear	1	Couples undergoing fertility treatment
	Smoking, alcohol use, diet, physical activity, and sedentary behaviours	1	Cancer survivors
	Diet and physical activity	7	General adult population (1) Overweight/obese (2)
The Netherlands (16 studies)			

			Diabetes risk (1) Other at risk populations (1) Worksite interventions (2)
	Smoking, diet, and physical activity	7	General adult population (2) Homeless/low socio-economic status (1) Pregnant women (1) Other at risk populations (1) Worksite interventions (2)
	Diet and sedentary behaviours	1	Worksite interventions
	Smoking, alcohol use, diet, and sunbathing	1	General adult population
Country not reported (14 studies)	Diet, physical activity, and sedentary behaviours	1	General adult population (1)
	Diet and physical activity	8	University students (2) Pregnant women (1) Overweight/obese (1) Diabetes risk (2) Cancer survivors (1) Worksite interventions (1)
	Illicit drug use and sexual risk behaviours	1	Adult drug users
	Alcohol use, diet, and physical activity	1	People with hypertension
	Smoking, diet, and physical activity	2	Other at risk populations (1) Worksite interventions (1)
	Unclear	1	Worksite interventions
UK (12 studies)	Smoking and physical activity	1	General adult population
	Smoking, diet and physical activity	1	General adult population
	Smoking, alcohol use, diet, and physical activity	2	General adult population (1) Men only (1)
	Diet and physical activity	6	Homeless/low socio-economic status (2) Overweight/obese (3) Other at risk populations (1)
	Alcohol use and illicit drug use	1	Young adults (aged 16-25 years)
	Smoking, alcohol use, and illicit drug use	1	Young adults (aged 16-25 years)
Japan (6 studies)	Diet and physical activity	6	Overweight/obese (2) Cardiovascular disease risk (1) Other at risk populations (1) People with a combination of chronic disease risks (1) Worksite interventions (1)

China (5 studies)	Smoking, alcohol use, diet, and physical activity	2	General adult population (1) Patients from health care practices (1)
	Smoking and diet	1	Older adults
	Illicit drug use and sexual risk behaviours	1	Adult drug users
	Diet and physical activity	1	Women with, or at risk of gestational diabetes
Canada (5 studies)	Diet and physical activity	3	General adult population (1) Overweight/obese (1) Worksite interventions (1)
	Smoking, diet, and physical activity	2	Worksite interventions
New Zealand (3 studies)	Diet and physical activity	2	General adult population (1) Overweight/obese (1)
	Smoking, alcohol use, diet, and physical activity	1	University students
Belgium (3 studies)	Diet and physical activity	2	General adult population (1) Overweight/obese (1)
	Smoking, diet and physical activity	1	Highly educated adults
Denmark (3 studies)	Smoking, diet, and physical activity	1	General adult population
	Diet and physical activity	1	Overweight/obese
	Smoking, alcohol use, diet, and physical activity	1	Cardiovascular disease risk
Sweden (4 studies)	Smoking and diet	1	General adult population
	Smoking, alcohol use, diet, and physical activity	1	Cardiovascular disease risk
	Diet and physical activity	1	People with a combination of chronic disease risks
	Unclear	1	Worksite interventions
South Korea (3 studies)	Smoking, alcohol use, diet, and physical activity	2	Cardiovascular disease risk (1) Worksite interventions (1)
	Diet and physical activity	1	Worksite interventions
Finland (2 studies)	Diet and physical activity	2	Diabetes risk
Spain (2 studies)	Diet and physical activity	1	People with hypertension
	Smoking, alcohol use, diet, and sunbathing	1	Other at risk populations
Italy (2 studies)	Smoking, diet, and physical activity	1	People with hypertension
	Diet and physical activity	1	People with, or at risk of metabolic syndrome
Turkey (1 study)	Smoking, diet, and sedentary behaviours	1	General adult population
Iran (1 study)	Smoking, diet, and physical activity	1	General adult population
Mauritius (1 study)	Smoking, alcohol use, diet, and physical activity	1	General adult population
Vietnam	Smoking, alcohol use, diet, and physical activity	1	General adult population

(1 study)			
Mexico (1 study)	Diet and physical activity	1	University students
Jordan (1 study)	Diet and physical activity	1	University students
Taiwan (1 study)	Diet and physical activity	1	Older adults
Chile (1 study)	Diet and physical activity	1	Homeless/low socio-economic status
Israel (1 study)	Smoking and sunbathing	1	Women only
Poland (1 study)	Diet and physical activity	1	Diabetes risk
Romania (1 study)	Diet and physical activity	1	People with, or at risk of metabolic syndrome
Norway (1 study)	Diet and physical activity	1	People with, or at risk of metabolic syndrome
France (1 study)	Diet and physical activity	1	People with, or at risk of metabolic syndrome
Russia (1 study)	Illicit drug use and sexual risk behaviours	1	Adult drug users
Northern Ireland (1 study)	Smoking, alcohol use, and physical activity	1	Worksite interventions
US, UK, and Canada (1 study)	Diet and physical activity	1	Other at risk populations

Table 9.4. Intervention aims and methods, and study designs of the mapped studies (221 in total) – presented according to study country.

STUDY POPULATION	FOCUS OF THE INTERVENTION	STUDY POPULATIONS (NUMBER OF STUDIES PER POPULATION)	DESIGNS OF STUDIES (NUMBER OF STUDIES) AND THE TYPE OF INTERVENTION
US (107 studies: 69 RCTs, 37 non-RCT designs, and 1 design not reported)	Health promotion	General adult population (2)	RCTs* (1): Education and peer counselling Non-RCT designs** (1): Coaching and home visits
	Health promotion	University students (5)	RCTs (2): Tailored education, education plus goal setting, and improvement of self-efficacy Non-RCT designs (3): Education, peer education, social support, and participation in a health fair
	Health promotion	Racial and minority ethnic groups (3)	RCTs (2): Dancing lessons and dietary education, environmental (i.e., social, cultural, physical) and organizational (i.e., policies, practices) changes within church– included education, bulletins, and policy/practices set by pastors Non-RCT designs (1): Culturally tailored education
	Health promotion	Older adults (2)	RCTs (2): Health risk appraisals, tailored recommendations, and self-management materials, education, self-recording of behaviours and personalised goals
	Health promotion	Parents with children (2)	RCTs (1): Education, behaviour change strategies, and telephone support Non-RCT designs (1): Motivational interviewing, counselling, education, and skills training
	Health promotion	Armed Forces veterans (1)	Non-RCT design: Interactive, individual sessions that included skills training and education
	Health promotion	Women only (1)	RCT: Education and social support from peers via a buddy system
	Health promotion	People with hypertension (1)	RCT: Automated telephone counselling
	Health promotion	Worksite interventions (12)	RCTs (6): Education, tailored goals, self-monitoring, and personal support Non-RCT designs (6): Incentives, skills training, motivational interviewing, environmental changes, and education
	Weight management	General adult population (3)	RCTs (2): Education, advice, CBT***, and goal setting Non-RCT designs (1): Prescribed diet and exercise activities
	Weight management	Racial and minority ethnic groups (1)	Non-RCT design: Education and behavioural strategies

Weight management	Overweight/ obese (16)	RCTs (13): Self-monitoring, goal setting, personalised feedback, motivational interviewing, education, self-control skills training, counselling, tailored recommendations, and behaviour therapy Non-RCT designs (2): Education, group discussion, record keeping, and computerised dietary assessment Design not reported (1): Education and activity materials
Weight management	Cancer survivors (1)	Non-RCT design: Discussions, group activities, and exercise classes
Weight management	Other at risk populations (1)	Non-RCT design: Advice, self-regulation skills training, and social support
Weight management	Worksite interventions (3)	RCTs (2): Counselling and environmental changes Non-RCT designs (1): Lifestyle recommendations, goal setting, problem solving, education, and a walking program
Prevention/reduction of risk for chronic disease	General adult population (6)	RCTs (5): Education, health coaching, tailored feedback and advice, behaviour change strategies, incentives for healthy behaviours, and family history assessment. Non-RCT designs (1): Tailored coaching
Prevention/reduction of risk for chronic disease	University students (4)	RCTs (3): Self-management skills training, tailored education and feedback, CBT skills training, and group role play Non-RCT designs (1): Education and structural changes
Prevention/reduction of risk for chronic disease	Racial and minority ethnic groups (3)	RCTs (3): Education, social support, skills training for behaviour change, and counselling
Prevention/reduction of risk for chronic disease	Older adults (1)	RCT: Visits to doctor and counselling
Prevention/reduction of risk for chronic disease	Homeless/low socio- economic status (1)	RCT: Tailored recommendations for behaviour change, counselling, access to local activities, and education tailored for low literacy audiences
Prevention/reduction of risk for chronic disease	Patients from healthcare practices (1)	Non-RCT design: Summary of findings from 10 intervention studies in different areas, all under the same umbrella project; most included counselling
Prevention/reduction of risk for chronic disease	Women only (1)	RCT: Education and guidance. Included goal setting, stimulus control, relapse prevention, and cognitive and motivational techniques
Prevention/reduction of risk for chronic disease	Prison inmates (1)	RCT: Education
Prevention/reduction of risk for chronic disease	Overweight/ obese (2)	Non-RCT designs (2): Education, supervised physical activity sessions, goal setting, self-monitoring techniques, and skills training

Prevention/reduction of risk for chronic disease	Adult drug users (8)	RCTs (3): Education, counselling, personalised feedback, skills training, goal setting, and motivational interviewing Non-RCT designs (5): HIV counselling and testing, legal services, and family, recreational and social activities
Prevention/reduction of risk for chronic disease	Adult smokers with untreated depression (1)	RCT: CBT based counselling sessions and activity materials
Prevention/reduction of risk for chronic disease	Cardiovascular disease risk (7)	RCTs (4): Education, counselling, tailored newsletters, and goal setting Non-RCT designs (3): Education, counselling, supervised physical activity sessions, self-monitoring, group support, and lifestyle recommendations
Prevention/reduction of risk for chronic disease	Diabetes risk (2)	RCTs (2): Education, behavioural support, motivational interviewing, and tailored advice
Prevention/reduction of risk for chronic disease	Cancer survivors (1)	Non-RCT design: Behaviour change classes and counselling
Prevention/reduction of risk for chronic disease	Women with, or at risk of gestational diabetes (1)	RCT: Goal setting, counselling, self-monitoring, and education
Prevention/reduction of risk for chronic disease	Other at risk populations (3)	RCTs (3): Counselling, community-based exercise classes, goal setting, support planning with spouses, education, and encouragement to join a smoking cessation program
Prevention/reduction of risk for chronic disease	People with a combination of chronic disease risks (1)	RCT: Behaviour recommendations
Prevention/reduction of risk for chronic disease	Worksite interventions (4)	RCTs (3): Education, skills training, environmental changes, feedback, and motivational interviewing Non-RCT designs (1): Group support, skills training, and CBT
Prevention of initiation of risk behaviours	University students (1)	Non-RCT design: Skills and education
	Racial and minority ethnic groups (1)	RCT: Skills training
Reduction of risk for	University students with (or	Non-RCT designs (2): Motivational interviewing, self-monitoring, and personalised

	substance dependence and other problems (e.g., academic impairment)	at risk of) problematic substance use (2)	feedback
Australia (18 studies: 12 RCTs and 6 non-RCT designs)	Health promotion	Older adults (1)	RCT: Lifestyle recommendations, goal setting, various tools, and telephone and email support from program guides.
	Health promotion	Parents with children (1)	RCT: Interactive group education sessions
	Health promotion	Pregnant women (1)	RCT: Education and behaviour change strategies
	Health promotion	Couples undergoing fertility treatment (1)	Non-RCT design: Lifestyle assessment and motivational interviewing
	Health promotion	Cancer survivors (2)	RCT (1): Health coaching Non-RCT designs (1): Health coaching
	Health promotion	People with, or at risk of metabolic disease (1)	RCT: Education, behavioural strategies, peer group support, skills training, and physical activity sessions
	Weight management	Overweight/obese (3)	RCTs (2): Goal setting, self-monitoring and reinforcement, education, tools, and personalised feedback Non-RCT designs (1): Education and motivational interviewing
	Weight management	Worksite interventions (1)	RCT: Financial incentives and education
	Prevention/ reduction of risk for chronic disease	General adult population (1)	RCT: Tailored advice
	Prevention/ reduction of risk for chronic disease	Homeless/low socio-economic status (1)	Non-RCT design: Motivational interviewing, personalised feedback and advice
	Prevention/ reduction of risk for chronic disease	People with hypertension (1)	RCT: Cognitive behaviour change strategies, goal setting, advice, social support, and time management
	Prevention/ reduction of risk for chronic disease	Women with, or at risk of gestational diabetes (1)	RCT: Motivational interviewing
	Prevention/ reduction of risk for chronic disease	Other at risk populations (2)	Non-RCT designs (2): Health coaching, use of pedometer, counselling, gym memberships, and skills training
	Prevention/ reduction of risk for chronic disease	People with a combination of chronic disease risks (1)	RCT: Education and goal setting
The Netherlands	Health promotion	Pregnant women (1)	RCT: Education

(16 studies: 12 RCTs and 4 non-RCT designs)	Health promotion	Worksite interventions (1)	RCT: Tailored lifestyle recommendations
	Weight management	Overweight/ obese (2)	RCTs (1): Web-based application, called 'Healthy Weight Assistant' Non-RCT designs (1): Tailored education
	Weight management	Other at risk populations (1)	RCT: Counselling, self-monitoring, and personalised feedback
	Weight management	Worksite interventions (3)	RCTs (2): Guideline-based care, counselling Non-RCT designs (1): No intervention details reported
	Prevention/reduction of risk for chronic disease	General adult population (4)	RCTs (3): Tailored feedback, action plans, tailored information, and tailored motivational interviewing Non-RCT design (1): Mass communication and group activities
	Prevention/reduction of risk for chronic disease	Homeless/low socio- economic status (1)	Non-RCT design: Large umbrella project with 790 interventions, including nutrition parties, televised exercise sessions and education – results reported at the population level
	Prevention/reduction of risk for chronic disease	Diabetes risk (1)	RCT: Motivational interviewing
	Prevention/reduction of risk for chronic disease	Other at risk populations (1)	RCT: Tailored advice and counselling
	Prevention/reduction of risk for chronic disease	Worksite interventions (1)	RCT: Motivational interviewing
Country not reported (14 studies: 10 RCTs and 4 non-RCT designs)	Health promotion	University students (2)	RCTs (2): Education, personalised feedback, coaching, and health risk appraisal
	Health promotion	Cancer survivors (1)	RCT: Advice
	Health promotion	Worksite interventions (2)	RCT (2): Education and payroll-based incentive system, no intervention details reported for the other study.
	Weight management	General adult population (1)	Non-RCT design: Smartphone application
	Weight management	Pregnant women (1)	RCT: Exercise sessions and dietary counselling
	Weight management	Overweight/ obese (1)	RCTs (1): Tailored feedback and counselling
	Prevention/reduction of risk for chronic disease	Adult drug users (1)	RCT: Education, behavioural strategies, skills training, support groups, and counselling
	Prevention/reduction of risk for chronic disease	Diabetes risk (2)	RCT (1): No intervention details reported in conference abstract Non-RCT design (1): Counselling
	Prevention/reduction of risk	People with hypertension (1)	RCT: Education

UK (12 studies: 8 RCTs and 4 non-RCT designs)	for chronic disease		
	Prevention/reduction of risk for chronic disease	Other at risk populations (1)	Non-RCT design: Counselling
	Prevention/reduction of risk for chronic disease	Worksite interventions (1)	Non-RCT design: Personalised action plan
	Health promotion	General adult population (1)	RCT: CBT and nicotine replacement therapy
	Health promotion	Homeless/low socio-economic status (2)	RCTs (1): Environmental changes Non-RCT designs (1): Motivational interviewing
	Weight management	Overweight/obese (3)	RCTs (2): Advice, tools, education, and counselling Non-RCT designs (1): Behaviour change techniques and goal setting
	Prevention/reduction of risk for chronic disease	General adult population (2)	RCTs (1): Annual health checks Non-RCT designs (1): No intervention details reported
	Prevention/reduction of risk for chronic disease	Young adults (aged 16-25 years) (1)	RCT: Motivational interviewing and education
	Prevention/reduction of risk for chronic disease	Men only (1)	Non-RCT design: Education, physical assessment, and advice
	Prevention/reduction of risk for chronic disease	Other at risk populations (1)	RCT: Tailored advice, goal setting, and social support
Japan (6 studies: 4 RCTs and 2 non-RCT designs)	Prevention of initiation of risk behaviours	Young adults (aged 16-25 years) (1)	RCT: Motivational interviewing
	Weight management	Overweight/obese (2)	RCTs (2): Counselling, exercise sessions, education, self-monitoring, and goal setting
	Weight management	Other at risk populations (1)	RCT: Education, goal setting, advice, and self-monitoring
	Prevention/reduction of risk for chronic disease	Cardiovascular disease risk (1)	Non-RCT design: Counselling, education, and physical activity sessions
	Prevention/reduction of risk for chronic disease	People with a combination of chronic disease risks (1)	RCT: Education and goal setting
China (5 studies: 2 RCTs and 3 non-RCT designs)	Prevention/reduction of risk for chronic disease	Worksite interventions (1)	Non-RCT design: Counselling, and social and environmental support
	Health promotion	Older adults (1)	RCT: Education, tailored advice, and motivational interviewing
	Prevention/reduction of risk for chronic disease	General adult population (1)	Non-RCT design: Education
	Prevention/reduction of risk for chronic disease	Patients from healthcare practices (1)	Non-RCT design: Counselling

Canada (5 studies: 1 RCT and 4 non-RCT designs)	Prevention/reduction of risk for chronic disease	Adult drug users (1)	Non-RCT design: Counselling and peer education
	Prevention/reduction of risk for chronic disease	Women with, or at risk of gestational diabetes (1)	RCT: Tailored advice
	Health promotion	Worksite interventions (2)	RCTs (1): Email messages promoting health behaviours Non-RCT designs (1): Education
	Weight management	General adult population (1)	Non-RCT design: Education and CBT
	Weight management	Overweight/obese (1)	Non-RCT design: Assessment, counselling, tailored diet plan, and a walking program
	Prevention/reduction of risk for chronic disease	Worksite interventions (1)	Non-RCT design: Goal setting and self-monitoring
New Zealand (3 studies: 1 RCT and 2 non-RCT designs)	Health promotion	General adult population (1)	Non-RCT design: Education, community activities, and structural changes
	Health promotion	University students (1)	RCT: Assessment, feedback and advice
	Health promotion	Overweight/obese (1)	Non-RCT design: Education
Belgium (3 studies: All RCTs)	Weight management	Overweight/obese (1)	RCT: Advice and counselling
	Prevention/reduction of risk for chronic disease	General adult population (1)	RCT: Feedback and advice
	Prevention/reduction of risk for chronic disease	Highly educated adults (1)	RCT: Personalised web site and coaching
Denmark (3 studies: 2 RCTs and 1 non-RCT design)	Weight management	Overweight/obese (1)	RCT: Counselling, advice, and free membership to fitness centre
	Prevention/reduction of risk for chronic disease	General adult population (1)	Non-RCT design: Mass communication and group activities
	Prevention/reduction of risk for chronic disease	Cardiovascular disease risk (1)	RCT: Personalised lifestyle consultation and counselling
Sweden (4 studies: 2 RCTs and 2 non-RCT designs)	Health promotion	General adult population (1)	Non-RCT design: Education and health examinations
	Prevention/reduction of risk for chronic disease	Cardiovascular disease risk (1)	Non-RCT design: Education, advice, group/club activities, and individual consultations
	Prevention/reduction of risk for chronic disease	People with a combination of chronic disease risks (1)	RCT: Supervised physical activity and dietary counselling
	Prevention/reduction of risk for chronic disease	Worksite interventions (1)	RCT: Education and counselling
South Korea (3 studies: all non-RCT designs)	Health promotion	Cardiovascular disease risk (1)	Non-RCT design: Education, counselling, and group discussions
	Weight management	Worksite interventions (1)	Non-RCT design: Incentives

	Prevention/reduction of risk for chronic disease	Worksite interventions (1)	Non-RCT design: Education and health behaviour diaries
Finland (2 studies: 1 RCT and 1 non-RCT design)	Prevention/reduction of risk for chronic disease	Diabetes risk (2)	RCTs (1): Counselling Non-RCT designs (1): Education and counselling
Spain (2 studies: both RCTs)	Prevention/reduction of risk for chronic disease	People with hypertension (1)	RCT: Education
	Prevention/reduction of risk for chronic disease	Other at risk populations (1)	RCT: Education
Italy (2 studies: both RCTs)	Prevention/reduction of risk for chronic disease	People with, or at risk of metabolic disease (1)	RCT: Tailored lifestyle advice
	Prevention/reduction of risk for chronic disease	People with hypertension (1)	RCT: Education
Turkey (1 study with a non-RCT design)	Prevention/reduction of risk for chronic disease	General adult population (1)	Non-RCT design: Education and lifestyle advice
Iran (1 study with a non-RCT design)	Prevention/reduction of risk for chronic disease	General adult population (1)	Non-RCT design: Education and structural interventions
Mauritius (1 RCT)	Prevention/reduction of risk for chronic disease	General adult population (1)	RCT: Structural changes
Vietnam (1 study with a non-RCT design)	Health promotion	General adult population (1)	Non-RCT design: Advertising
Mexico (1 RCT)	Health promotion	University students (1)	RCT: CBT techniques
Jordan (1 RCT)	Prevention/reduction of risk for chronic disease	University students (1)	RCT: Education
Taiwan (1 study with a non-RCT design)	Health promotion	Older adults (1)	Non-RCT design: Education
Chile (1 study with a non-RCT design)	Health promotion	Homeless/low socio-economic status (1)	Non-RCT design: Dietary education and physical activity sessions
Israel (1 study with a non-RCT design)	Prevention/reduction of risk for chronic disease	Women only (1)	Non-RCT design: Education, discussion groups and increased access to doctors for personal consultations
Poland (1 study with a non-RCT design)	Prevention/reduction of risk for chronic disease	Diabetes risk (1)	Non-RCT design: Education , social support, and motivation sessions
Romania (1 RCT)	Prevention/reduction of risk for chronic disease	People with, or at risk of metabolic syndrome (1)	RCT: Counselling
Norway (1 RCT)	Prevention/reduction of risk for chronic disease	People with, or at risk of metabolic syndrome (1)	RCT: Dietary counselling and supervised physical activity sessions
France (1 study with a non-RCT design)	Prevention/reduction of risk for chronic disease	People with, or at risk of metabolic syndrome (1)	Non-RCT design: Counselling

Russia (1 study with a non-RCT design)	Prevention/reduction of risk for chronic disease	Adult drug users (1)	Non-RCT design: Peer education and HIV test counselling
Northern Ireland (1 study with a non-RCT design)	Health promotion	Worksite interventions (1)	Non-RCT design: Lifestyle assessments
US, UK and Canada (1 RCT)	Prevention/reduction of risk for chronic disease	Other at risk populations (1)	RCT: Tailored advice, personalised record logs, and education

* RCT=Randomised Controlled Trial, **Other (non-RCT) study designs included before and after studies, non-randomised controlled trials, case-control studies, a cohort study, and an interrupted time series.

*** CBT=Cognitive Behavioural Therapy.

Appendix 10: Review 2 – Search strategy

ASSIA

Via ProQuest

Search date 18th January 2013

881 records identified

(all("behavior* change" NEAR/4 intervention*) OR all("behavior* change" NEAR/4 program*) OR all("behaviour* change" NEAR/4 intervention*) OR all("behaviour* change" NEAR/4 program*) AND pd(>19900101)) OR (all("multiple risk factor" NEAR/4 program*) OR all("multiple risk factor" NEAR/2 intervention*) OR all("multifactorial lifestyle" NEAR/2 program*) OR all("multifactorial lifestyle" NEAR/2 intervention*) AND pd(>19900101)) OR (all("health behavior*" NEAR/4 program*) OR all("health behavior*" NEAR/4 intervention*) OR all("health behaviour*" NEAR/4 program*) OR all("health behaviour*" NEAR/4 intervention*) AND pd(>19900101)) OR (all("multiple health behavior* change intervention*") OR all("multiple health behaviour* change intervention*") OR all("multiple behavior* risk factor* intervention*") OR all("multiple behaviour* risk factor* intervention*") OR all("multiple behavior* risk factor* program*") OR all("multiple behaviour* risk factor* program*") OR all("multiple risk behaviour* intervention*") OR all("multiple risk behavior* intervention*") OR all("multiple risk behaviour* program*") OR all("multiple risk behavior* program*") AND pd(>19900101)) OR (all(lifestyle NEAR/2 intervention*) OR all(lifestyle NEAR/2 program*) OR all("life style" NEAR/2 intervention*) OR all("life style" NEAR/2 program*) AND pd(>19900101))

CENTRAL

Via Wiley

Search date 18th January 2013

1059 records identified

- #1 lifestyle near/2 intervention*:ti,ab,kw or lifestyle near/2 program*:ti,ab,kw or "life style" near/2 intervention*:ti,ab,kw or "life style" near/2 program*:ti,ab,kw from 1990 to 2013, in Trials
- #2 "behavior* change" next intervention*:ti,ab,kw or "behavior* change" next program*:ti,ab,kw or "behaviour* change" next intervention*:ti,ab,kw or "behaviour* change" next program*:ti,ab,kw from 1990 to 2013, in Trials (Word variations have been searched)
- #3 "multiple risk factor" near/2 program*:ti,ab,kw or "multiple risk factor" near/2 intervention*:ti,ab,kw or "multifactorial lifestyle" next intervention*:ti,ab,kw or "multifactorial lifestyle" next program*:ti,ab,kw from 1990 to 2013, in Trials (Word variations have been searched)
- #4 "health behavior*" next program*:ti,ab,kw or "health behavior*" next intervention*:ti,ab,kw or "health behaviour*" next program*:ti,ab,kw or "health behaviour*" next intervention*:ti,ab,kw from 1990 to 2013, in Trials (Word variations have been searched)

- #5 "multiple health behavior* change intervention*":ti,ab,kw or "multiple health behaviour* change intervention*":ti,ab,kw or "multiple behavior* risk factor* intervention*":ti,ab,kw or "multiple behaviour* risk factor* intervention*":ti,ab,kw or "multiple behavior* risk factor* program*":ti,ab,kw from 1990 to 2013, in Trials (Word variations have been searched)
- #6 "multiple behaviour* risk factor* program*":ti,ab,kw or "multiple risk behaviour* intervention*":ti,ab,kw or "multiple risk behaviour* program*":ti,ab,kw or "multiple risk behavior* intervention*":ti,ab,kw or "multiple risk behavior* program*":ti,ab,kw from 1990 to 2013, in Trials (Word variations have been searched)
- #7 #1 or #2 or #3 or #4 or #5 or #6

Embase

Via OVIDSP

Search date 15th January 2013

13,176 records identified

- 1 (health\$ adj2 (diet\$ or eating or food or foods)).ti,ab. (13569)
- 2 (unhealth\$ adj2 (diet\$ or eating or food or foods)).ti,ab. (1543)
- 3 fruit/ or vegetable/ (43569)
- 4 (fruit\$ adj2 (eat or eats or eating or intake or consum\$ or increas\$ or portion\$ or serving\$ or frequenc\$ or number\$ or preference\$ or choice\$)).ti,ab. (6927)
- 5 (vegetable\$ adj2 (eat or eats or eating or intake or consum\$ or increas\$ or portion\$ or serving\$ or frequenc\$ or number\$ or preference\$ or choice\$)).ti,ab. (6322)
- 6 "5 a day".ti,ab. (164)
- 7 "five a day".ti,ab. (40)
- 8 (junk food or fast food).ti,ab. (1914)
- 9 ((decreas\$ or reduc\$ or discourag\$ or limit\$ or lessen or eat\$ less) adj2 (salt or fat)).ti,ab. (11916)
- 10 (food adj (choice\$ or frequenc\$ or select\$)).ti,ab. (10976)
- 11 Feeding Behavior/ (49787)
- 12 eating habit/ or food preference/ (13695)
- 13 diet therapy/ (43181)
- 14 obesity/ (209708)
- 15 or/1-14 (359168)
- 16 (editorial or letter).pt. (1221865)
- 17 15 not 16 (341579)
- 18 limit 17 to yr="1990 -Current" (288201)
- 19 (physical\$ adj3 (fit\$ or train\$ or activ\$ or inactiv\$ or endur\$)).ti,ab. (81313)
- 20 (exercis\$ adj3 (fit\$ or train\$ or activ\$ or endur\$)).ti,ab. (26417)

- 21 ((promot\$ or uptak\$ or encourag\$ or increas\$ or start\$ or adher\$) adj3 (exercis\$ or gym\$ or sport\$ or fitness)).ti,ab. (24891)
- 22 ((decreas\$ or reduc\$ or discourag\$) adj3 (sedentary or deskbound or desk-bound)).ti,ab. (537)
- 23 (sedentary behaviour\$ or sedentary behavior\$ or sedentary lifestyle\$ or sedentariness).ti,ab. (4095)
- 24 sedentary lifestyle/ (2495)
- 25 ((watch\$ or view\$) adj2 (tv or television)).ti,ab. (3213)
- 26 (sport\$ or walk\$ or running or jogging or bicycling or biking or swimming).ti,ab. (179917)
- 27 (active adj (travel\$ or transport\$ or commut\$)).ti,ab. (6569)
- 28 fitness/ or physical activity/ (85130)
- 29 exp Recreation/ or leisure/ (35054)
- 30 physical exercise/ (159644)
- 31 running/ or jogging/ or swimming/ or walking/ (56946)
- 32 or/19-31 (456811)
- 33 (editorial or comment).pt. (419336)
- 34 32 not 33 (449410)
- 35 limit 34 to yr="1990 -Current" (369145)
- 36 exp smoking/ (158022)
- 37 (smoking or antismoking or anti-smoking).ti,ab. (166408)
- 38 (smoker or smokers).ti,ab. (66367)
- 39 tobacco abuse/ or tobacco addiction/ or tobacco dependence/ (11329)
- 40 36 or 37 or 38 or 39 (242549)
- 41 (editorial or comment).pt. (419336)
- 42 40 not 41 (238083)
- 43 limit 42 to yr="1990 -Current" (205675)
- 44 exp Alcohol abuse/ (19451)
- 45 exp Alcohol Intoxication/ (10451)
- 46 exp Alcoholic Beverages/ (17080)
- 47 exp Drinking Behavior/ (33004)
- 48 (beer or wine\$ or cider or alcopop\$ or spirit or spirits).ti,ab. (25379)
- 49 alcohol\$.ti,ab. (271310)
- 50 (drink\$ adj2 (binge or excessive or harm\$ or heavy or misus\$ or abus\$ or consum\$)).ti,ab. (12748)
- 51 (intoxicat\$ or inebriat\$ or drunk\$).ti,ab. (45337)
- 52 44 or 45 or 46 or 47 or 48 or 49 or 50 or 51 (348278)
- 53 (editorial or letter).pt. (1221865)
- 54 52 not 53 (339954)
- 55 limit 54 to yr="1990 -Current" (264679)

56 Unsafe Sex/ (1787)
 57 multiple sexual partner\$.ti,ab. (904)
 58 multiple casual partner\$.ti,ab. (10)
 59 one time sex\$ encounter\$.ti,ab. (4)
 60 one-time sex\$ encounter\$.ti,ab. (4)
 61 (sex\$ adj2 holiday\$).ti,ab. (9)
 62 casual sex\$.ti,ab. (562)
 63 casual partner\$.ti,ab. (759)
 64 non-regular sex\$ partner\$.ti,ab. (25)
 65 non regular sex\$ partner\$.ti,ab. (25)
 66 (unprotected adj2 intercourse).ti,ab. (2026)
 67 (unprotected adj2 sex\$).ti,ab. (2874)
 68 (condomless adj (sex\$ or intercourse)).ti,ab. (7)
 69 (condom free adj (sex\$ or intercourse)).ti,ab. (2)
 70 (RUI or UI).ti,ab. (334)
 71 (barebacking or bareback sex\$ or bugchas\$ or bug chas\$).ti,ab. (76)
 72 anal intercourse.ti,ab. (1706)
 73 anal sex.ti,ab. (1248)
 74 or/56-73 (8581)
 75 sexual behavior/ (76516)
 76 high risk behavior/ (12921)
 77 75 and 76 (3654)
 78 (risk\$ sex\$ behavio\$ or unsafe sex\$).ti,ab. (3475)
 79 74 or 77 or 78 (13138)
 80 (comment or editorial).pt. (419336)
 81 79 not 80 (13018)
 82 limit 81 to yr="1990 -Current" (12731)
 83 exp drug abuse/ (55305)
 84 substance abuse/ (35403)
 85 ((drug\$ or substance\$) adj2 (use\$ or using or abuse\$ or abusing or misuse\$ or misusing)).ti,ab. (164609)
 86 ((heroin or opiate\$ or cocaine or crack) adj2 (use\$ or using or abuse\$ or abusing or misuse\$ or misusing)).ti,ab. (14761)
 87 ((cannabis or marijuana) adj2 (use\$ or using or abuse\$ or abusing or misuse\$ or misusing)).ti,ab. (7674)
 88 ((benzodiazepine\$ or amphetamine\$ or methamphetamine\$ or MDMA or ecstasy) adj2 (use\$ or using or abuse\$ or abusing or misuse\$ or misusing)).ti,ab. (7625)
 89 (solvent\$ adj2 (use\$ or using or abuse\$ or abusing or misuse\$ or misusing)).ti,ab. (7981)

90 street drug\$.ti,ab. (534)
 91 (prescri\$ drug\$ adj2 (use\$ or using or abuse\$ or abusing or misuse\$ or misusing)).ti,ab. (1575)
 92 polydrug use\$.ti,ab. (647)
 93 inject\$ drug use\$.ti,ab. (8306)
 94 (needle\$ adj3 (share\$ or sharing)).ti,ab. (1357)
 95 (syringe\$ adj3 (share\$ or sharing)).ti,ab. (545)
 96 or/83-95 (225114)
 97 (editorial or comment).pt. (419336)
 98 96 not 97 (221774)
 99 limit 98 to yr="1990 -Current" (195517)
 100 sunbathing/ (232)
 101 sunscreen/ or sunburn/ (8806)
 102 (sunbath\$ or sunscreen\$ or sunburn\$ or suntan\$ or sunbed\$).ti,ab. (6729)
 103 (sun bath\$ or sun screen\$ or sun burn\$ or sun tan\$ or sun bed\$).ti,ab. (366)
 104 sun protect\$.ti,ab. (2395)
 105 (tanning adj (bed\$ or salon\$ or studio\$)).ti,ab. (236)
 106 100 or 101 or 102 or 103 or 104 or 105 (11950)
 107 (comment or editorial).pt. (419336)
 108 106 not 107 (11733)
 109 limit 108 to yr="1990 -Current" (10424)
 110 dental health/ or dental caries/ (38716)
 111 mouth hygiene/ or tooth brushing/ (22100)
 112 (dental care or dental health or dental hygiene).ti,ab. (15599)
 113 (oral care or oral health or oral hygiene).ti,ab. (19567)
 114 (gingival care or gingival health or gingival hygiene).ti,ab. (670)
 115 ((unsupervised or irregular\$ or regular\$ or lack or seldom or never or infrequent\$ or frequen\$ or insufficient\$) adj2 (toothbrushing or flossing)).ti,ab. (326)
 116 ((irregular\$ or regular\$ or seldom or lack or never or infrequent\$ or frequen\$) adj3 (dental or dentist\$)).ti,ab. (2593)
 117 ((irregular\$ or regular\$ or seldom or lack or never or infrequent\$ or frequen\$) adj3 dental visit\$).ti,ab. (279)
 118 ((irregular\$ or regular\$ or seldom or lack or never or infrequent\$ or frequen\$) adj3 dental attendance).ti,ab. (84)
 119 (clean\$ teeth adj2 (irregular\$ or regular\$ or infrequent\$ or frequen\$ or seldom or never)).ti,ab. (3)
 120 (brush\$ teeth adj2 (irregular\$ or regular\$ or infrequent\$ or frequen\$ or seldom or never)).ti,ab. (12)

121 ((sweet\$ drink\$ or fizzy drink\$ or sugary snack\$ or sweets or confectionery) adj6 (tooth or teeth or dental or oral or caries or decay)).ti,ab. (161)

122 or/110-121 (76024)

123 (editorial or comment).pt. (419336)

124 122 not 123 (75176)

125 limit 124 to yr="1990 -Current" (45742)

126 patient compliance/ (88311)

127 treatment refusal/ (10800)

128 126 and 127 (1176)

129 (non-adherence adj2 (patient\$ or medication\$ or screen\$ or treatment or therapy or immunisation or immunization or regimen\$ or drug\$)).ti,ab. (1050)

130 (nonadherence adj2 (patient\$ or medication\$ or screen\$ or treatment or therapy or immunisation or immunization or regimen\$ or drug\$)).ti,ab. (1176)

131 (low adherence adj2 (patient\$ or medication\$ or screen\$ or treatment or therapy or immunisation or immunization or regimen\$ or drug\$)).ti,ab. (128)

132 (poor adherence adj2 (patient\$ or medication\$ or screen\$ or treatment or therapy or immunisation or immunization or regimen\$ or drug\$)).ti,ab. (581)

133 ((loss or lack or failure or barrier\$ or impediment\$ or selective or minimal) adj2 adherence).ti,ab. (1601)

134 (non-compliance adj2 (patient\$ or medication\$ or screen\$ or treatment or therapy or immunisation or immunization or regimen\$ or drug\$)).ti,ab. (1064)

135 (noncompliance adj2 (patient\$ or medication\$ or screen\$ or treatment or therapy or immunisation or immunization or regimen\$ or drug\$)).ti,ab. (1437)

136 (low compliance adj2 (patient\$ or medication\$ or screen\$ or treatment or therapy or immunisation or immunization or regimen\$ or drug\$)).ti,ab. (134)

137 (poor compliance adj2 (patient\$ or medication\$ or screen\$ or treatment or therapy or immunisation or immunization or regimen\$ or drug\$)).ti,ab. (630)

138 ((loss or lack or failure or barrier\$ or impediment\$ or selective or minimal) adj2 compliance).ti,ab. (1504)

139 treatment refusal/ (10800)

140 mass screening/ (46649)

141 139 and 140 (60)

142 (non-attend\$ adj3 screen\$).ti,ab. (67)

143 (nonattend\$ adj3 screen\$).ti,ab. (20)

144 (non-attend\$ adj3 appoint\$).ti,ab. (73)

145 (nonattend\$ adj3 appoint\$).ti,ab. (27)

146 (non-attend\$ adj3 (check-up\$ or checkup\$)).ti,ab. (3)

147 (nonattend\$ adj3 (check-up\$ or checkup\$)).ti,ab. (0)

148 (non-attend\$ adj3 (mammogra\$ or smear test\$ or PAP test\$ or breast exam\$ or CBE)).ti,ab.
 (15)
 149 (nonattend\$ adj3 (mammogra\$ or smear test\$ or PAP test\$ or breast exam\$ or CBE)).ti,ab. (5)
 150 128 or 129 or 130 or 131 or 132 or 133 or 134 or 135 or 136 or 137 or 138 or 141 or 142 or
 143 or 144 or 145 or 146 or 147 or 148 or 149 (10157)
 151 (editorial or comment).pt. (419336)
 152 150 not 151 (10098)
 153 limit 152 to yr="1990 -Current" (9496)
 154 seatbelt/ (3537)
 155 (seat belt\$ or seatbelt\$).ti,ab. (2936)
 156 seat restraint\$.ti,ab. (44)
 157 passenger\$ restraint\$.ti,ab. (58)
 158 driver\$ restraint\$.ti,ab. (12)
 159 ((unbelted or unrestrained) adj2 (driver\$ or passenger\$)).ti,ab. (113)
 160 154 or 155 or 156 or 157 or 158 or 159 (4781)
 161 helmet/ (3163)
 162 (cycle helmet\$ or bike helmet\$ or bicycle helmet\$).ti,ab. (554)
 163 161 or 162 (3239)
 164 protective equipment/ (8912)
 165 fire/ or smoke/ (14286)
 166 164 and 165 (133)
 167 (smoke adj (alarm\$ or sensor\$)).ti,ab. (163)
 168 (fire adj (alarm\$ or sensor\$)).ti,ab. (64)
 169 166 or 167 or 168 (328)
 170 drunken driving/ (1767)
 171 (drink\$ adj2 (drive\$ or driving)).ti,ab. (1490)
 172 alcohol impaired driv\$.ti,ab. (227)
 173 170 or 171 or 172 (2911)
 174 160 or 163 or 169 or 173 (10793)
 175 (letter or comment).pt. (802529)
 176 174 not 175 (10247)
 177 limit 176 to yr="1990 -Current" (8410)
 178 pathological gambling/ (4176)
 179 (gambling or gambler).mp. or gamblers.ti,ab. [mp=title, abstract, subject headings, heading
 word, drug trade name, original title, device manufacturer, drug manufacturer, device trade name,
 keyword] (5221)
 180 178 or 179 (5221)
 181 (editorial or comment).pt. (419336)

182 180 not 181 (5091)

183 limit 182 to yr="1990 -Current" (4713)

184 (18 and 35) or (18 and 43) or (18 and 55) or (18 and 82) or (18 and 99) or (18 and 109) or (18 and 125) or (18 and 153) or (18 and 177) or (18 and 183) (65809)

185 (35 and 18) or (35 and 43) or (35 and 55) or (35 and 82) or (35 and 99) or (35 and 109) or (35 and 125) or (35 and 153) or (35 and 177) or (35 and 183) (65478)

186 (43 and 18) or (43 and 35) or (43 and 55) or (43 and 82) or (43 and 99) or (43 and 109) or (43 and 125) or (43 and 153) or (43 and 177) or (43 and 183) (63197)

187 (55 and 18) or (55 and 35) or (55 and 43) or (55 and 82) or (55 and 99) or (55 and 109) or (55 and 125) or (55 and 153) or (55 and 177) or (55 and 183) (74420)

188 (82 and 18) or (82 and 35) or (82 and 43) or (82 and 55) or (82 and 99) or (82 and 109) or (82 and 125) or (82 and 153) or (82 and 177) or (82 and 183) (4969)

189 (99 and 18) or (99 and 35) or (99 and 43) or (99 and 55) or (99 and 82) or (99 and 109) or (99 and 125) or (99 and 153) or (99 and 177) or (99 and 183) (46794)

190 (109 and 18) or (109 and 35) or (109 and 43) or (109 and 55) or (109 and 82) or (109 and 99) or (109 and 125) or (109 and 153) or (109 and 177) or (109 and 183) (1171)

191 (125 and 18) or (125 and 35) or (125 and 43) or (125 and 55) or (125 and 82) or (125 and 99) or (125 and 109) or (125 and 153) or (125 and 177) or (125 and 183) (4714)

192 (153 and 18) or (153 and 35) or (153 and 43) or (153 and 55) or (153 and 82) or (153 and 99) or (153 and 109) or (153 and 125) or (153 and 177) or (153 and 183) (1777)

193 (177 and 18) or (177 and 35) or (177 and 43) or (177 and 55) or (177 and 82) or (177 and 99) or (177 and 109) or (177 and 125) or (177 and 153) or (177 and 183) (3498)

194 (183 and 18) or (183 and 35) or (183 and 43) or (183 and 55) or (183 and 82) or (183 and 99) or (183 and 109) or (183 and 125) or (183 and 153) or (183 and 177) (1665)

195 184 or 185 or 186 or 187 or 188 or 189 or 190 or 191 or 192 or 193 or 194 (151818)

196 animal experiment/ (1555828)

197 195 not 196 (148854)

198 random\$.tw. (776012)

199 placebo\$.mp. (292102)

200 double-blind\$.tw. (133299)

201 198 or 199 or 200 (962134)

202 197 and 201 (18010)

203 trial.ti. (139456)

204 (evaluate\$ or evaluation or evaluating).ti. (425668)

205 evaluation study.ab. (1625)

206 (intervention or program or programme).ti. (152665)

207 interrupted time series.ti,ab. (926)

208 (before-after adj2 study).ti,ab. (574)

209 (before adj3 study).ti,ab. (11759)
 210 experimental study.ti,ab. (40898)
 211 quasi-experimental study.ti,ab. (1302)
 212 (pre post or pre-post).ti,ab. (5371)
 213 203 or 204 or 205 or 206 or 207 or 208 or 209 or 210 or 211 or 212 (752824)
 214 197 and 213 (8912)
 215 202 or 214 (23682)
 216 community.ti,ab. (298184)
 217 community-based.ti,ab. (36552)
 218 (neighbourhood\$ or neighborhood\$).ti,ab. (15933)
 219 urban communities.ti,ab. (1067)
 220 rural communities.ti,ab. (4091)
 221 Rural population/ (27506)
 222 urban population/ (32759)
 223 ((disadvantaged or poor or deprived) adj communities).ti,ab. (775)
 224 (work or worksite or workplace).ti,ab. (629998)
 225 work/ or work environment/ (37858)
 226 (web-based or web or website or online or internet or computer or computer-tailored or computer-based or online or email or telephone).ti,ab. (316028)
 227 exp mass communication/ (330251)
 228 ((parent\$ or family or women\$ or woman\$ or sure start) adj2 (centre\$ or center\$ or co-op or cooperative or clinic\$)).ti,ab. (17334)
 229 health center/ (19307)
 230 (GP practice\$ or general practice or family practice or primary care).ti,ab. (111088)
 231 General Practice/ (66041)
 232 Family Practice/ (66041)
 233 ((emergency or outpatient) adj (department\$ or clinic\$ or ward\$)).ti,ab. (81016)
 234 (accident adj emergency).ti,ab. (269)
 235 (campus\$ or college\$ or classroom\$).ti,ab. (146443)
 236 (church\$ or home\$ or home-based or pharmacy or pharmacies or night club\$ or beer hall\$).ti,ab. (384378)
 237 216 or 217 or 218 or 219 or 220 or 221 or 222 or 223 or 224 or 225 or 226 or 227 or 228 or 229 or 230 or 231 or 232 or 233 or 234 or 235 or 236 (2124840)
 238 215 and 237 (8092)
 239 limit 238 to yr="1990 -Current" (8092)
 240 (lifestyle adj2 (intervention\$ or program\$)).ti,ab. (4374)
 241 (life style adj2 (intervention\$ or program\$)).ti,ab. (242)
 242 (behavior\$ change adj (intervention\$ or program\$)).ti,ab. (392)

243 (behaviour\$ change adj (intervention\$ or program\$)).ti,ab. (222)
 244 (multiple risk factor adj2 (program\$ or intervention\$)).ti,ab. (472)
 245 (multifactorial lifestyle adj (intervention\$ or program\$)).ti,ab. (8)
 246 (health behavior\$ adj (program\$ or intervention\$)).ti,ab. (111)
 247 (health behaviour\$ adj (program\$ or intervention\$)).ti,ab. (31)
 248 multiple health behavior\$ change intervention\$.ti,ab. (4)
 249 multiple health behaviour\$ change intervention\$.ti,ab. (4)
 250 multiple behavior\$ risk factor\$ intervention\$.ti,ab. (1)
 251 multiple behaviour\$ risk factor\$ intervention\$.ti,ab. (0)
 252 multiple behavior\$ risk factor\$ program\$.ti,ab. (0)
 253 multiple behaviour\$ risk factor\$ program\$.ti,ab. (0)
 254 multiple risk behaviour\$ intervention\$.ti,ab. (0)
 255 multiple risk behavior\$ intervention\$.ti,ab. (4)
 256 multiple risk behaviour\$ program\$.ti,ab. (0)
 257 multiple risk behavior\$ program\$.ti,ab. (0)
 258 240 or 241 or 242 or 243 or 244 or 245 or 246 or 247 or 248 or 249 or 250 or 251 or 252 or
 253 or 254 or 255 or 256 or 257 (5775)
 259 239 or 258 (13415)
 260 limit 259 to yr="1990 -Current" (13176)

MEDLINE

Via OvidSP

Search date 15th January 2013

8279 records identified

1 (healthy adj2 (diet\$ or eating)).ti,ab. (4481)
 2 (fruit\$ adj2 (intake or consum\$ or increase or portion\$ or serving\$ or frequenc\$ or number\$ or
 preference\$ or choice\$)).ti,ab. (4760)
 3 (vegetable\$ adj2 (intake or consum\$ or increase or portion\$ or serving\$ or frequenc\$ or
 number\$ or preference\$ or choice\$)).ti,ab. (4803)
 4 "5 a day".ti,ab. (133)
 5 "five a day".ti,ab. (27)
 6 ((food or diet\$) adj (choice\$ or frequenc\$ or intake)).ti,ab. (48817)
 7 Feeding Behavior/ (34992)
 8 food habits/ or food preferences/ (25970)
 9 nutrition therapy/ or exp diet therapy/ or exp diet/ (185426)
 10 obesity/ or overweight/ (114303)
 11 1 or 2 or 3 or 4 or 5 or 6 or 7 or 8 or 9 or 10 (349724)

12 (comment or editorial or letter).pt. (1206498)
 13 11 not 12 (335271)
 14 limit 13 to yr="1990 -Current" (229404)
 15 (physical adj3 (fit\$ or train\$ or activ\$ or endur\$)).ti,ab. (59596)
 16 (exercis\$ adj3 (fit\$ or train\$ or activ\$ or endur\$)).ti,ab. (20958)
 17 ((promot\$ or uptak\$ or encourag\$ or increas\$ or start\$ or adher\$) adj3 (exercis\$ or gym\$ or sport\$ or fitness)).ti,ab. (20665)
 18 ((decreas\$ or reduc\$ or discourag\$) adj3 (sedentary or deskbound)).ti,ab. (424)
 19 (sport\$ or walk\$ or running or jogging or bicycling or biking or swimming).ti,ab. (146110)
 20 (active adj (travel\$ or transport\$ or commut\$)).ti,ab. (6760)
 21 physical fitness/ (20160)
 22 exp Recreation/ (116348)
 23 exp Exercise Therapy/ or exp exercise/ (118491)
 24 running/ or jogging/ or swimming/ or walking/ (39259)
 25 15 or 16 or 17 or 18 or 19 or 20 or 21 or 22 or 23 or 24 (341732)
 26 (letter or editorial or comment).pt. (1206498)
 27 25 not 26 (329528)
 28 limit 27 to yr="1990 -Current" (262773)
 29 exp smoking/ (111314)
 30 (smoking or antismoking or anti-smoking).ti,ab. (133027)
 31 (smoker or smokers).ti,ab. (52919)
 32 tobacco/ or tobacco.ti,ab. (67958)
 33 29 or 30 or 31 or 32 (224900)
 34 (letter or editorial or comment).pt. (1206498)
 35 33 not 34 (215145)
 36 limit 35 to yr="1990 -Current" (172420)
 37 exp Alcohol Drinking/ (46742)
 38 exp Alcoholic Intoxication/ (10467)
 39 exp Alcoholic Beverages/ (12721)
 40 exp Drinking Behavior/ (51989)
 41 (beer or wine\$ or cider or alcopop\$ or spirit or spirits).ti,ab. (20472)
 42 alcohol\$.ti,ab. (212046)
 43 (drink\$ adj2 (binge or excessive or harm\$ or heavy or misus\$ or abus\$ or consum\$)).ti,ab. (9976)
 44 (intoxicat\$ or inebriat\$ or drunk\$).ti,ab. (37775)
 45 37 or 38 or 39 or 40 or 41 or 42 or 43 or 44 (279044)
 46 (comment or editorial or letter).pt. (1206498)
 47 45 not 46 (271011)

48 limit 47 to yr="1990 -Current" (191560)
 49 Unsafe Sex/ (2229)
 50 multiple sexual partner\$.ti,ab. (774)
 51 multiple casual partner\$.ti,ab. (10)
 52 one time sex\$ encounter\$.ti,ab. (3)
 53 one-time sex\$ encounter\$.ti,ab. (3)
 54 (sex\$ adj2 holiday\$).ti,ab. (8)
 55 casual sex\$.ti,ab. (500)
 56 casual partner\$.ti,ab. (665)
 57 non-regular sex\$ partner\$.ti,ab. (22)
 58 non regular sex\$ partner\$.ti,ab. (22)
 59 (unprotected adj2 intercourse).ti,ab. (1910)
 60 (unprotected adj2 sex\$).ti,ab. (2595)
 61 (condomless adj (sex\$ or intercourse)).ti,ab. (10)
 62 (condom free adj (sex\$ or intercourse)).ti,ab. (2)
 63 (RUI or UI).ti,ab. (288)
 64 (barebacking or bareback sex\$ or bugchas\$ or bug chas\$).ti,ab. (68)
 65 anal intercourse.ti,ab. (1539)
 66 anal sex.ti,ab. (1074)
 67 or/49-66 (7982)
 68 sexual behavior/ (38258)
 69 risk taking/ (17004)
 70 68 and 69 (4893)
 71 (risk\$ sex\$ behavio\$ or unsafe sex\$).ti,ab. (2939)
 72 67 or 70 or 71 (12820)
 73 (letter or comment or editorial).pt. (1206498)
 74 72 not 73 (12474)
 75 limit 74 to yr="1990 -Current" (12101)
 76 substance-related disorders/ or inhalant abuse/ or marijuana abuse/ or substance abuse,
 intravenous/ (86397)
 77 Drug Users/ (838)
 78 ((drug\$ or substance\$) adj2 (use\$ or using or abuse\$ or abusing or misuse\$ or misusing)).ti,ab.
 (128121)
 79 ((heroin or opiate\$ or cocaine or crack) adj2 (use\$ or using or abuse\$ or abusing or misuse\$ or
 misusing)).ti,ab. (12026)
 80 ((cannabis or marijuana) adj2 (use\$ or using or abuse\$ or abusing or misuse\$ or
 misusing)).ti,ab. (6159)

81 ((benzodiazepine\$ or amphetamine\$ or methamphetamine\$ or MDMA or ecstasy) adj2 (use\$ or using or abuse\$ or abusing or misuse\$ or misusing)).ti,ab. (5991)

82 (solvent\$ adj2 (use\$ or using or abuse\$ or abusing or misuse\$ or misusing)).ti,ab. (5945)

83 street drug\$.ti,ab. (423)

84 (prescri\$ drug\$ adj2 (use\$ or using or abuse\$ or abusing or misuse\$ or misusing)).ti,ab. (1222)

85 polydrug use\$.ti,ab. (568)

86 inject\$ drug use\$.ti,ab. (7317)

87 (needle adj3 shar\$).ti,ab. (981)

88 (syringe\$ adj3 shar\$).ti,ab. (490)

89 or/76-88 (189083)

90 (letter or editorial or comment).pt. (1206498)

91 89 not 90 (180981)

92 limit 91 to yr="1990 -Current" (142389)

93 sunbathing/ (238)

94 sunscreening agents/ (3593)

95 (sunbath\$ or sunscreen\$ or sunburn\$ or suntan\$ or sunbed\$).ti,ab. (5167)

96 (sun bath\$ or sun screen\$ or sun burn\$ or sun tan\$ or sun bed\$).ti,ab. (260)

97 (sun protect\$ or sun bed\$ or sun tan\$).ti,ab. (1912)

98 (tanning adj (bed\$ or salon\$ or studio\$)).ti,ab. (187)

99 93 or 94 or 95 or 96 or 97 or 98 (7575)

100 (letter or comment or editorial).pt. (1206498)

101 99 not 100 (7068)

102 limit 101 to yr="1990 -Current" (6058)

103 (poor dental care or poor dental health or poor dental hygiene).ti,ab. (148)

104 (poor oral care or poor oral health or poor oral hygiene).ti,ab. (1070)

105 (poor gingival care or poor gingival health or poor gingival hygiene).ti,ab. (4)

106 ((unsupervised or irregular\$ or lack or never or infrequent\$ or insufficient\$) adj2 (toothbrushing or flossing)).ti,ab. (32)

107 ((irregular\$ or lack or never or infrequent\$) adj3 (dental or dentist\$)).ti,ab. (566)

108 ((irregular\$ or lack or never or infrequent\$) adj3 dental visit\$).ti,ab. (35)

109 ((irregular\$ or lack or never or infrequent\$) adj3 dental attendance).ti,ab. (21)

110 (cleaning teeth adj2 (irregular\$ or infrequent\$ or never)).ti,ab. (0)

111 (brushing teeth adj2 (irregular\$ or infrequent\$ or never)).ti,ab. (2)

112 ((sweet\$ drink\$ or fizzy drink\$ or sugary snack\$ or sweets or confectionery) adj6 (tooth or teeth or dental or oral or caries or decay)).ti,ab. (152)

113 or/103-112 (1904)

114 (letter or editorial or comment).pt. (1206498)

115 113 not 114 (1885)

116 limit 115 to yr="1990 -Current" (1669)
 117 patient compliance/ (43324)
 118 treatment refusal/ (10087)
 119 117 and 118 (798)
 120 (non-adherence adj2 (patient\$ or medication\$ or screen\$ or treatment or therapy or immunisation or regimen\$ or drug\$)).ti,ab. (609)
 121 (nonadherence adj2 (patient\$ or medication\$ or screen\$ or treatment or therapy or immunisation or regimen\$ or drug\$)).ti,ab. (862)
 122 (low adherence adj2 (patient\$ or medication\$ or screen\$ or treatment or therapy or immunisation or regimen\$ or drug\$)).ti,ab. (65)
 123 (poor adherence adj2 (patient\$ or medication\$ or screen\$ or treatment or therapy or immunisation or regimen\$ or drug\$)).ti,ab. (372)
 124 ((loss or lack or failure or barrier\$ or impediment\$ or selective or minimal) adj2 adherence).ti,ab. (1133)
 125 (non-compliance adj2 (patient\$ or medication\$ or screen\$ or treatment or therapy or immunisation or regimen\$ or drug\$)).ti,ab. (710)
 126 (noncompliance adj2 (patient\$ or medication\$ or screen\$ or treatment or therapy or immunisation or regimen\$ or drug\$)).ti,ab. (1119)
 127 (low compliance adj2 (patient\$ or medication\$ or screen\$ or treatment or therapy or immunisation or regimen\$ or drug\$)).ti,ab. (90)
 128 (poor compliance adj2 (patient\$ or medication\$ or screen\$ or treatment or therapy or immunisation or regimen\$ or drug\$)).ti,ab. (419)
 129 ((loss or lack or failure or barrier\$ or impediment\$ or selective or minimal) adj2 compliance).ti,ab. (1074)
 130 treatment refusal/ (10087)
 131 mass screening/ (75615)
 132 130 and 131 (131)
 133 (non-attend\$ adj3 screen\$).ti,ab. (52)
 134 (nonattend\$ adj3 screen\$).ti,ab. (18)
 135 (non-attend\$ adj3 appoint\$).ti,ab. (39)
 136 (nonattend\$ adj3 appoint\$).ti,ab. (19)
 137 (non-attend\$ adj3 mammograph\$).ti,ab. (10)
 138 (nonattend\$ adj3 mammograph\$).ti,ab. (5)
 139 119 or 120 or 121 or 122 or 123 or 124 or 125 or 126 or 127 or 128 or 129 or 132 or 133 or 134 or 135 or 136 or 137 or 138 (7135)
 140 (letter or editorial or comment).pt. (1206498)
 141 139 not 140 (6985)
 142 limit 141 to yr="1990 -Current" (6424)

143 seat belts/ (3155)
 144 seat belts.ti,ab. (938)
 145 seat restraints.ti,ab. (22)
 146 passenger\$ restraint\$.ti,ab. (55)
 147 driver\$ restraint\$.ti,ab. (12)
 148 ((unbelted or unrestrained) adj2 (driver\$ or passenger\$)).ti,ab. (108)
 149 143 or 144 or 145 or 146 or 147 or 148 (3551)
 150 head protective devices/ (2271)
 151 (cycle helmet\$ or bike helmet\$ or bicycle helmet\$).ti,ab. (508)
 152 150 or 151 (2371)
 153 protective devices/ (5590)
 154 fires/ or smoke/ (11457)
 155 153 and 154 (160)
 156 (smoke adj (alarm\$ or sensor\$)).ti,ab. (141)
 157 (fire adj (alarm\$ or sensor\$)).ti,ab. (49)
 158 155 or 156 or 157 (296)
 159 automobile driving/ (12384)
 160 alcoholic intoxication/ or alcohol drinking/ (54827)
 161 159 and 160 (2350)
 162 (drink\$ adj2 (drive\$ or driving)).ti,ab. (1211)
 163 alcohol impaired driv\$.ti,ab. (201)
 164 161 or 162 or 163 (2970)
 165 149 or 152 or 158 or 164 (8907)
 166 (editorial or letter or comment).pt. (1206498)
 167 165 not 166 (8121)
 168 limit 167 to yr="1990 -Current" (5884)
 169 Gambling/ (2929)
 170 gambling.ti,ab. (3270)
 171 169 or 170 (3950)
 172 (letter or editorial or comment).pt. (1206498)
 173 171 not 172 (3727)
 174 limit 173 to yr="1990 -Current" (3360)
 175 (14 and 28) or (14 and 36) or (14 and 48) or (14 and 75) or (14 and 92) or (14 and 102) or (14 and 116) or (14 and 142) or (14 and 168) or (14 and 174) (43181)
 176 (28 and 14) or (28 and 36) or (28 and 48) or (28 and 75) or (28 and 92) or (28 and 102) or (28 and 116) or (28 and 142) or (28 and 168) or (28 and 174) (40213)
 177 (36 and 14) or (36 and 28) or (36 and 48) or (36 and 75) or (36 and 92) or (36 and 102) or (36 and 116) or (36 and 142) or (36 and 168) or (36 and 174) (47465)

178 (48 and 14) or (48 and 28) or (48 and 36) or (48 and 75) or (48 and 92) or (48 and 102) or (48 and 116) or (48 and 142) or (48 and 168) or (48 and 174) (58712)

179 (75 and 14) or (75 and 28) or (75 and 36) or (75 and 48) or (75 and 92) or (75 and 102) or (75 and 116) or (75 and 142) or (75 and 168) or (75 and 174) (4991)

180 (92 and 14) or (92 and 28) or (92 and 36) or (92 and 48) or (92 and 75) or (92 and 102) or (92 and 116) or (92 and 142) or (92 and 168) or (92 and 174) (34593)

181 (102 and 14) or (102 and 28) or (102 and 36) or (102 and 48) or (102 and 75) or (102 and 92) or (102 and 116) or (102 and 142) or (102 and 168) or (102 and 174) (748)

182 (116 and 14) or (116 and 28) or (116 and 36) or (116 and 48) or (116 and 75) or (116 and 92) or (116 and 102) or (116 and 142) or (116 and 168) or (116 and 174) (427)

183 (142 and 14) or (142 and 28) or (142 and 36) or (142 and 48) or (142 and 75) or (142 and 92) or (142 and 102) or (142 and 116) or (142 and 168) or (142 and 174) (1119)

184 (168 and 14) or (168 and 28) or (168 and 36) or (168 and 48) or (168 and 75) or (168 and 92) or (168 and 102) or (168 and 116) or (168 and 142) or (168 and 174) (3157)

185 (174 and 14) or (174 and 28) or (174 and 36) or (174 and 48) or (174 and 75) or (174 and 92) or (174 and 102) or (174 and 116) or (174 and 142) or (174 and 168) (1152)

186 175 or 176 or 177 or 178 or 179 or 180 or 181 or 182 or 183 or 184 or 185 (107085)

187 randomized controlled trial.pt. (337493)

188 controlled clinical trial.pt. (84936)

189 randomized.ab. (254740)

190 placebo.ab. (139525)

191 clinical trials as topic.sh. (161725)

192 randomly.ab. (186500)

193 trial.ti. (108691)

194 187 or 188 or 189 or 190 or 191 or 192 or 193 (811148)

195 exp animals/ not humans.sh. (3744372)

196 194 not 195 (749287)

197 186 and 196 (11145)

198 trial.ti. (108691)

199 (evaluate\$ or evaluation or evaluating).ti. (347968)

200 evaluation study.ab. (1233)

201 (intervention or program or programme).ti. (126411)

202 interrupted time series.ti,ab. (775)

203 (before-after adj2 study).ti,ab. (433)

204 (before adj3 study).ti,ab. (8983)

205 experimental study.ti,ab. (36557)

206 quasi-experimental study.ti,ab. (1099)

207 quasi experimental study.ti,ab. (1099)

208 (pre post or pre-post).ti,ab. (3514)
 209 198 or 199 or 200 or 201 or 202 or 203 or 204 or 205 or 206 or 207 or 208 (613434)
 210 186 and 209 (6337)
 211 197 or 210 (14689)
 212 community.ti,ab. (251569)
 213 community-based.ti,ab. (30732)
 214 (neighbourhood\$ or neighborhood\$).ti,ab. (14895)
 215 urban communities.ti,ab. (950)
 216 rural communities.ti,ab. (3664)
 217 Residence Characteristics/ (17196)
 218 ((disadvantaged or poor or deprived) adj communities).ti,ab. (681)
 219 Poverty Areas/ (3826)
 220 (work or worksite or workplace).ti,ab. (521324)
 221 Workplace/ or Employment/ (45082)
 222 (web-based or web or website or online or internet or computer or computer-tailored or computer-based or online or email or telephone).ti,ab. (262762)
 223 Internet/ or Telephone/ or Electronic Mail/ (51839)
 224 ((parent\$ or family or women\$ or woman\$ or sure start) adj2 (centre\$ or center\$ or co-op or cooperative or clinic\$)).ti,ab. (14814)
 225 Community Health Centers/ (5572)
 226 (GP practice\$ or general practice or family practice or primary care).ti,ab. (91024)
 227 General Practice/ or Family Practice/ (60749)
 228 ((emergency or outpatient) adj (department\$ or clinic\$ or ward\$)).ti,ab. (61137)
 229 (accident adj emergency).ti,ab. (232)
 230 (campus\$ or college\$ or classroom\$).ti,ab. (88030)
 231 (church\$ or home\$ or home-based or pharmacy or pharmacies or night club\$ or beer hall\$).ti,ab. (303096)
 232 212 or 213 or 214 or 215 or 216 or 217 or 218 or 219 or 220 or 221 or 222 or 223 or 224 or 225 or 226 or 227 or 228 or 229 or 230 or 231 (1540701)
 233 211 and 232 (4641)
 234 (lifestyle adj2 (intervention\$ or program\$)).ti,ab. (3019)
 235 (life style adj2 (intervention\$ or program\$)).ti,ab. (150)
 236 (behavior\$ change adj (intervention\$ or program\$)).ti,ab. (350)
 237 (behaviour\$ change adj (intervention\$ or program\$)).ti,ab. (175)
 238 (multiple risk factor adj2 (program\$ or intervention\$)).ti,ab. (404)
 239 (multifactorial lifestyle adj (intervention\$ or program\$)).ti,ab. (6)
 240 (health behavior\$ adj (program\$ or intervention\$)).ti,ab. (96)
 241 (health behaviour\$ adj (program\$ or intervention\$)).ti,ab. (23)

242 multiple health behavior\$ change intervention\$.ti,ab. (4)
 243 multiple health behaviour\$ change intervention\$.ti,ab. (3)
 244 multiple behavior\$ risk factor\$ intervention\$.ti,ab. (1)
 245 multiple behaviour\$ risk factor\$ intervention\$.ti,ab. (0)
 246 multiple behavior\$ risk factor\$ program\$.ti,ab. (0)
 247 multiple behaviour\$ risk factor\$ program\$.ti,ab. (0)
 248 multiple risk behaviour\$ intervention\$.ti,ab. (0)
 249 multiple risk behavior\$ intervention\$.ti,ab. (2)
 250 multiple risk behaviour\$ program\$.ti,ab. (0)
 251 multiple risk behavior\$ program\$.ti,ab. (0)
 252 234 or 235 or 236 or 237 or 238 or 239 or 240 or 241 or 242 or 243 or 244 or 245 or 246 or
 247 or 248 or 249 or 250 or 251 (4171)
 253 233 or 252 (8504)
 254 limit 253 to yr="1990 -Current" (8279)

PsycINFO

Via OVIDSP

Search date 15th January 2013

5475 records identified

1 (health\$ adj2 (diet\$ or eating or food or foods)).ti,ab. (3071)
 2 (unhealth\$ adj2 (diet\$ or eating or food or foods)).ti,ab. (668)
 3 (fruit\$ adj2 (eat or eats or eating or intake or consum\$ or increas\$ or portion\$ or serving\$ or
 frequenc\$ or number\$ or preference\$ or choice\$)).ti,ab. (1184)
 4 (vegetable\$ adj2 (eat or eats or eating or intake or consum\$ or increas\$ or portion\$ or serving\$
 or frequenc\$ or number\$ or preference\$ or choice\$)).ti,ab. (1110)
 5 "5 a day".ti,ab. (65)
 6 "five a day".ti,ab. (7)
 7 (junk food or fast food).ti,ab. (717)
 8 ((decreas\$ or reduc\$ or discourag\$ or limit\$ or lessen or eat\$ less) adj2 (salt or fat)).ti,ab. (601)
 9 (food adj (choice\$ or frequenc\$ or select\$)).ti,ab. (1881)
 10 Eating Behavior/ (5722)
 11 food preferences/ (2341)
 12 nutrition/ or diets/ (11048)
 13 obesity/ or overweight/ (12121)
 14 1 or 2 or 3 or 4 or 5 or 6 or 7 or 8 or 9 or 10 or 11 or 12 or 13 (30062)
 15 (comment reply or editorial or letter).dt. (111964)
 16 14 not 15 (28907)

17 limit 16 to yr="1990 -Current" (27666)
 18 (physical\$ adj3 (fit\$ or train\$ or activ\$ or inactiv\$ or endur\$)).ti,ab. (17910)
 19 (exercis\$ adj3 (fit\$ or train\$ or activ\$ or endur\$)).ti,ab. (3182)
 20 ((promot\$ or uptak\$ or encourag\$ or increas\$ or start\$ or adher\$) adj3 (exercis\$ or gym\$ or sport\$ or fitness)).ti,ab. (3250)
 21 ((decreas\$ or reduc\$ or discourag\$) adj3 (sedentary or deskbound)).ti,ab. (138)
 22 (sedentary behaviour\$ or sedentary behavior\$ or sedentary lifestyle\$ or sedentariness).ti,ab. (972)
 23 ((watch\$ or view\$) adj2 (tv or television)).ti,ab. (2645)
 24 (sport\$ or walk\$ or running or jogging or bicycling or biking or swimming).ti,ab. (37788)
 25 (active adj (travel\$ or transport\$ or commut\$)).ti,ab. (247)
 26 physical fitness/ (2316)
 27 exp Recreation/ or leisure time/ (21261)
 28 Exercise/ (11647)
 29 running/ or swimming/ or walking/ (4547)
 30 18 or 19 or 20 or 21 or 22 or 23 or 24 or 25 or 26 or 27 or 28 or 29 (78235)
 31 (letter or editorial or comment reply).dt. (111964)
 32 30 not 31 (75686)
 33 limit 32 to yr="1990 -Current" (72119)
 34 exp tobacco smoking/ (18254)
 35 (smoking or antismoking or anti-smoking).ti,ab. (26507)
 36 (smoker or smokers).ti,ab. (12049)
 37 tobacco.ti,ab. (11640)
 38 34 or 35 or 36 or 37 (33838)
 39 (letter or editorial or comment reply).dt. (111964)
 40 38 not 39 (32291)
 41 limit 40 to yr="1990 -Current" (31091)
 42 exp Alcohol abuse/ (28184)
 43 exp Alcohol Intoxication/ (1644)
 44 exp alcoholism/ (16531)
 45 exp alcohol drinking patterns/ (39297)
 46 (beer or wine\$ or cider or alcopop\$ or spirit or spirits).ti,ab. (8183)
 47 alcohol\$.ti,ab. (70761)
 48 (drink\$ adj2 (binge or excessive or harm\$ or heavy or misus\$ or abus\$ or consum\$)).ti,ab. (6515)
 49 (intoxicat\$ or inebriat\$ or drunk\$).ti,ab. (6330)
 50 42 or 43 or 44 or 45 or 46 or 47 or 48 or 49 (83220)
 51 (comment reply or editorial or letter).dt. (111964)

52 50 not 51 (79882)
 53 limit 52 to yr="1990 -Current" (74048)
 54 sexual risk taking/ (5405)
 55 multiple sexual partner\$.ti,ab. (334)
 56 multiple casual partner\$.ti,ab. (4)
 57 one time sex\$ encounter\$.ti,ab. (5)
 58 one-time sex\$ encounter\$.ti,ab. (5)
 59 (sex\$ adj2 holiday\$).ti,ab. (4)
 60 casual sex\$.ti,ab. (438)
 61 casual partner\$.ti,ab. (423)
 62 non-regular sex\$ partner\$.ti,ab. (9)
 63 non regular sex\$ partner\$.ti,ab. (9)
 64 (unprotected adj2 intercourse).ti,ab. (861)
 65 (unprotected adj2 sex\$).ti,ab. (1647)
 66 (condomless adj (sex\$ or intercourse)).ti,ab. (9)
 67 (condom free adj (sex\$ or intercourse)).ti,ab. (0)
 68 (RUI or UI).ti,ab. (211)
 69 (barebacking or bareback sex\$ or bugchas\$ or bug chas\$).ti,ab. (99)
 70 anal intercourse.ti,ab. (881)
 71 anal sex.ti,ab. (700)
 72 or/54-71 (7568)
 73 (risk\$ sex\$ behavio\$ or unsafe sex\$).ti,ab. (2595)
 74 72 or 73 (8613)
 75 (letter or comment reply or editorial).dt. (111964)
 76 74 not 75 (8354)
 77 limit 76 to yr="1990 -Current" (8300)
 78 exp drug abuse/ (66954)
 79 exp drug dependency/ (16114)
 80 ((drug\$ or substance\$) adj2 (use\$ or using or abuse\$ or abusing or misuse\$ or misusing)).ti,ab. (69183)
 81 ((heroin or opiate\$ or cocaine or crack) adj2 (use\$ or using or abuse\$ or abusing or misuse\$ or misusing)).ti,ab. (7270)
 82 ((cannabis or marijuana) adj2 (use\$ or using or abuse\$ or abusing or misuse\$ or misusing)).ti,ab. (5254)
 83 ((benzodiazepine\$ or amphetamine\$ or methamphetamine\$ or MDMA or ecstasy) adj2 (use\$ or using or abuse\$ or abusing or misuse\$ or misusing)).ti,ab. (3569)
 84 (solvent\$ adj2 (use\$ or using or abuse\$ or abusing or misuse\$ or misusing)).ti,ab. (178)
 85 street drug\$.ti,ab. (210)

86 (prescri\$ drug\$ adj2 (use\$ or using or abuse\$ or abusing or misuse\$ or misusing)).ti,ab. (571)
 87 polydrug use\$.ti,ab. (543)
 88 inject\$ drug use\$.ti,ab. (3215)
 89 (needle\$ adj3 (share\$ or sharing)).ti,ab. (702)
 90 (syringe\$ adj3 (share\$ or sharing)).ti,ab. (241)
 91 or/78-90 (108592)
 92 (letter or editorial or comment reply).dt. (111964)
 93 91 not 92 (103820)
 94 limit 93 to yr="1990 -Current" (97759)
 95 (sunbath\$ or sunscreen\$ or sunburn\$ or suntan\$ or sunbed\$).ti,ab. (284)
 96 (sun bath\$ or sun screen\$ or sun burn\$ or sun tan\$ or sun bed\$).ti,ab. (24)
 97 sun protect\$.ti,ab. (245)
 98 (tanning adj (bed\$ or salon\$ or studio\$)).ti,ab. (23)
 99 95 or 96 or 97 or 98 (427)
 100 (letter or comment reply or editorial).dt. (111964)
 101 99 not 100 (420)
 102 limit 101 to yr="1990 -Current" (418)
 103 dental health/ (168)
 104 oral health/ (369)
 105 (dental care or dental health or dental hygiene).ti,ab. (624)
 106 (oral care or oral health or oral hygiene).ti,ab. (684)
 107 (gingival care or gingival health or gingival hygiene).ti,ab. (1)
 108 ((unsupervised or irregular\$ or regular\$ or seldom or lack or never or infrequent\$ or frequen\$ or insufficient\$) adj2 (toothbrushing or flossing)).ti,ab. (19)
 109 ((irregular\$ or regular\$ or seldom or lack or never or infrequent\$ or frequen\$) adj3 (dental or dentist\$)).ti,ab. (102)
 110 ((irregular\$ or regular\$ or seldom or lack or never or infrequent\$ or frequen\$) adj3 dental visit\$).ti,ab. (13)
 111 ((irregular\$ or regular\$ or seldom or lack or never or infrequent\$ or frequen\$) adj3 dental attendance).ti,ab. (5)
 112 (clean\$ teeth adj2 (irregular\$ or regular\$ or infrequent\$ or frequen\$ or never or seldom)).ti,ab. (0)
 113 (brush\$ teeth adj2 (irregular\$ or regular\$ or infrequent\$ or frequen\$ or never or seldom)).ti,ab. (0)
 114 ((sweet\$ drink\$ or fizzy drink\$ or sugary snack\$ or sweets or confectionery) adj6 (tooth or teeth or dental or oral or caries or decay)).ti,ab. (5)
 115 or/103-114 (1226)
 116 (letter or editorial or comment reply).dt. (111964)

117 115 not 116 (1170)

118 limit 117 to yr="1990 -Current" (1123)

119 (non-adherence adj2 (patient\$ or medication\$ or screen\$ or treatment or therapy or immunisation or immunization or regimen\$ or drug\$)).ti,ab. (281)

120 (nonadherence adj2 (patient\$ or medication\$ or screen\$ or treatment or therapy or immunisation or immunization or regimen\$ or drug\$)).ti,ab. (407)

121 (low adherence adj2 (patient\$ or medication\$ or screen\$ or treatment or therapy or immunisation or immunization or regimen\$ or drug\$)).ti,ab. (17)

122 (poor adherence adj2 (patient\$ or medication\$ or screen\$ or treatment or therapy or immunisation or immunization or regimen\$ or drug\$)).ti,ab. (106)

123 ((loss or lack or failure or barrier\$ or impediment\$ or selective or minimal) adj2 adherence).ti,ab. (378)

124 (non-compliance adj2 (patient\$ or medication\$ or screen\$ or treatment or therapy or immunisation or immunization or regimen\$ or drug\$)).ti,ab. (165)

125 (noncompliance adj2 (patient\$ or medication\$ or screen\$ or treatment or therapy or immunisation or immunization or regimen\$ or drug\$)).ti,ab. (500)

126 (low compliance adj2 (patient\$ or medication\$ or screen\$ or treatment or therapy or immunisation or immunization or regimen\$ or drug\$)).ti,ab. (11)

127 (poor compliance adj2 (patient\$ or medication\$ or screen\$ or treatment or therapy or immunisation or immunization or regimen\$ or drug\$)).ti,ab. (58)

128 ((loss or lack or failure or barrier\$ or impediment\$ or selective or minimal) adj2 compliance).ti,ab. (196)

129 treatment refusal/ (584)

130 screening/ (5614)

131 129 and 130 (2)

132 (non-attend\$ adj3 screen\$).ti,ab. (7)

133 (nonattend\$ adj3 screen\$).ti,ab. (4)

134 (non-attend\$ adj3 appoint\$).ti,ab. (27)

135 (nonattend\$ adj3 appoint\$).ti,ab. (12)

136 (non-attend\$ adj3 (check-up\$ or checkup\$)).ti,ab. (0)

137 (nonattend\$ adj3 (check-up\$ or checkup\$)).ti,ab. (0)

138 (non-attend\$ adj3 (mammograph\$ or smear test\$ or PAP test\$ or breast exam\$ or CBE)).ti,ab. (2)

139 (nonattend\$ adj3 (mammograph\$ or smear test\$ or PAP test\$ or breast exam\$ or CBE)).ti,ab. (1)

140 119 or 120 or 121 or 122 or 123 or 124 or 125 or 126 or 127 or 128 or 131 or 132 or 133 or 134 or 135 or 136 or 137 or 138 or 139 (2094)

141 (letter or editorial or comment reply).dt. (111964)

142 140 not 141 (2005)
 143 limit 142 to yr="1990 -Current" (1946)
 144 safety belts/ (436)
 145 (seatbelt\$ or seat belt\$ or safety belt\$).ti,ab. (775)
 146 seat restraint\$.ti,ab. (3)
 147 passenger\$ restraint\$.ti,ab. (14)
 148 driver\$ restraint\$.ti,ab. (3)
 149 ((unbelted or unrestrained) adj2 (driver\$ or passenger\$)).ti,ab. (24)
 150 144 or 145 or 146 or 147 or 148 or 149 (840)
 151 safety devices/ or protective devices/ (502)
 152 (cycle helmet\$ or bike helmet\$ or bicycle helmet\$).ti,ab. (116)
 153 151 or 152 (544)
 154 fire prevention/ (88)
 155 (smoke adj (alarm\$ or sensor\$)).ti,ab. (37)
 156 (fire adj (alarm\$ or sensor\$)).ti,ab. (23)
 157 154 or 155 or 156 (136)
 158 driving under the influence/ (1499)
 159 (drink\$ adj2 (drive\$ or driving)).ti,ab. (961)
 160 alcohol impaired driv\$.ti,ab. (137)
 161 158 or 159 or 160 (1910)
 162 150 or 153 or 157 or 161 (3255)
 163 (editorial or letter or comment reply).dt. (111964)
 164 162 not 163 (3164)
 165 limit 164 to yr="1990 -Current" (2853)
 166 gambling/ (1943)
 167 (gambling or gambler or gamblers).ti,ab. (5292)
 168 166 or 167 (5658)
 169 (comment reply or editorial or letter).dt. (111964)
 170 168 not 169 (5406)
 171 limit 170 to yr="1990 -Current" (5175)
 172 (17 and 33) or (17 and 41) or (17 and 53) or (17 and 77) or (17 and 94) or (17 and 102) or (17 and 118) or (17 and 143) or (17 and 165) or (17 and 171) (6933)
 173 (33 and 17) or (33 and 41) or (33 and 53) or (33 and 77) or (33 and 94) or (33 and 102) or (33 and 118) or (33 and 143) or (33 and 165) or (33 and 171) (13373)
 174 (41 and 17) or (41 and 33) or (41 and 53) or (41 and 77) or (41 and 94) or (41 and 102) or (41 and 118) or (41 and 143) or (41 and 165) or (41 and 171) (13773)
 175 (53 and 17) or (53 and 33) or (53 and 41) or (53 and 77) or (53 and 94) or (53 and 102) or (53 and 118) or (53 and 143) or (53 and 165) or (53 and 171) (47329)

176 (77 and 17) or (77 and 33) or (77 and 41) or (77 and 53) or (77 and 94) or (77 and 102) or (77 and 118) or (77 and 143) or (77 and 165) or (77 and 171) (3571)

177 (94 and 17) or (94 and 33) or (94 and 41) or (94 and 53) or (94 and 77) or (94 and 102) or (94 and 118) or (94 and 143) or (94 and 165) or (94 and 171) (47282)

178 (102 and 17) or (102 and 33) or (102 and 41) or (102 and 53) or (102 and 77) or (102 and 94) or (102 and 118) or (102 and 143) or (102 and 165) or (102 and 171) (79)

179 (118 and 17) or (118 and 33) or (118 and 41) or (118 and 53) or (118 and 77) or (118 and 94) or (118 and 102) or (118 and 143) or (118 and 165) or (118 and 171) (245)

180 (143 and 17) or (143 and 33) or (143 and 41) or (143 and 53) or (143 and 77) or (143 and 94) or (143 and 102) or (143 and 118) or (143 and 165) or (143 and 171) (486)

181 (165 and 17) or (165 and 33) or (165 and 41) or (165 and 53) or (165 and 77) or (165 and 94) or (165 and 102) or (165 and 118) or (165 and 143) or (165 and 171) (1759)

182 (171 and 17) or (171 and 33) or (171 and 41) or (171 and 53) or (171 and 77) or (171 and 94) or (171 and 102) or (171 and 118) or (171 and 143) or (171 and 165) (4271)

183 172 or 173 or 174 or 175 or 176 or 177 or 178 or 179 or 180 or 181 or 182 (63941)

184 double-blind.tw. (13750)

185 random\$ assigned.tw. (18337)

186 control.tw. (222575)

187 184 or 185 or 186 (244674)

188 183 and 187 (9254)

189 trial.ti. (13244)

190 (evaluate\$ or evaluation or evaluating).ti. (36745)

191 Intervention/ (27354)

192 evaluation study.ab. (613)

193 (intervention or program or programme).ti. (49212)

194 interrupted time series.ti,ab. (335)

195 (before-after adj2 study).ti,ab. (60)

196 (before adj3 study).ti,ab. (1163)

197 experimental study.ti,ab. (4247)

198 quasi-experimental study.ti,ab. (919)

199 quasi experimental study.ti,ab. (919)

200 (pre post or pre-post).ti,ab. (2762)

201 189 or 190 or 191 or 192 or 193 or 194 or 195 or 196 or 197 or 198 or 199 or 200 (116491)

202 183 and 201 (5289)

203 188 or 202 (13013)

204 Communities/ (16750)

205 (community or community-based).ti,ab. (128499)

206 Neighborhoods/ (3829)

207 (neighbourhood\$ or neighborhood\$).ti,ab. (10622)
 208 Urban Environments/ (13493)
 209 urban communit\$.ti,ab. (1366)
 210 Rural Environments/ (9373)
 211 rural communit\$.ti,ab. (2355)
 212 ((disadvantaged or poor or deprived) adj (communit\$ or area\$)).ti,ab. (984)
 213 (work or worksite or workplace).ti,ab. (251850)
 214 Working Conditions/ (13618)
 215 (web-based or web or website or online or internet or computer or computer-tailored or computer-based or online or email or telephone).ti,ab. (98209)
 216 Internet/ or Telephone Systems/ or Computer Mediated Communications/ (20445)
 217 ((parent\$ or family or women\$ or woman\$ or sure start) adj2 (centre\$ or center\$ or co-op or cooperative or clinic\$)).ti,ab. (5994)
 218 (GP practice\$ or general practice or family practice or primary care).ti,ab. (19777)
 219 General Practitioners/ or Family Physicians/ (4816)
 220 ((emergency or outpatient) adj (department\$ or clinic\$ or ward\$)).ti,ab. (7328)
 221 (accident adj emergency).ti,ab. (20)
 222 (campus\$ or college\$ or classroom\$).ti,ab. (108780)
 223 (church\$ or home\$ or home-based or pharmacy or pharmacies or night club\$ or beer hall\$).ti,ab. (90039)
 224 204 or 205 or 206 or 207 or 208 or 209 or 210 or 211 or 212 or 213 or 214 or 215 or 216 or 217 or 218 or 219 or 220 or 221 or 222 or 223 (627627)
 225 203 and 224 (4301)
 226 (lifestyle adj2 (intervention\$ or program\$)).ti,ab. (757)
 227 (life style adj2 (intervention\$ or program\$)).ti,ab. (27)
 228 (behavior\$ change adj (intervention\$ or program\$)).ti,ab. (337)
 229 (behaviour\$ change adj (intervention\$ or program\$)).ti,ab. (84)
 230 (multiple risk factor adj2 (program\$ or intervention\$)).ti,ab. (26)
 231 (multifactorial lifestyle adj (intervention\$ or program\$)).ti,ab. (2)
 232 (health behavior\$ adj (program\$ or intervention\$)).ti,ab. (89)
 233 (health behaviour\$ adj (program\$ or intervention\$)).ti,ab. (11)
 234 multiple health behavior\$ change intervention\$.ti,ab. (2)
 235 multiple health behaviour\$ change intervention\$.ti,ab. (1)
 236 multiple behavior\$ risk factor\$ intervention\$.ti,ab. (1)
 237 multiple behaviour\$ risk factor\$ intervention\$.ti,ab. (0)
 238 multiple behavior\$ risk factor\$ program\$.ti,ab. (0)
 239 multiple behaviour\$ risk factor\$ program\$.ti,ab. (0)
 240 multiple risk behaviour\$ intervention\$.ti,ab. (0)

241 multiple risk behavior\$ intervention\$.ti,ab. (1)
 242 multiple risk behaviour\$ program\$.ti,ab. (0)
 243 multiple risk behavior\$ program\$.ti,ab. (0)
 244 226 or 227 or 228 or 229 or 230 or 231 or 232 or 233 or 234 or 235 or 236 or 237 or 238 or
 239 or 240 or 241 or 242 or 243 (1303)
 245 225 or 244 (5502)
 246 limit 245 to yr="1990 -Current" (5475)

PubMed

Via <http://www.ncbi.nlm.nih.gov/pubmed/>

Search date: 16th May

Records identified = 2063, 475 records for years 2012 to 2013

An abbreviated search (as below) was carried out to identify any recently published studies to supplement the original MEDLINE search

((((((((((((((((((("lifestyle intervention"[Title/Abstract]) OR "lifestyle program"[Title/Abstract]) OR "life style intervention"[Title/Abstract]) OR "life style program"[Title/Abstract]) OR "behavior* change intervention"[Title/Abstract]) OR "behavior* change program"[Title/Abstract]) OR "behaviour* change intervention"[Title/Abstract]) OR "behaviour* change program"[Title/Abstract]) OR "multiple risk factor program"[Title/Abstract]) OR "multiple risk factor intervention"[Title/Abstract]) OR "multifactorial lifestyle intervention"[Title/Abstract]) OR "multifactorial lifestyle program"[Title/Abstract]) OR "health behavior* program"[Title/Abstract]) OR "health behavior* intervention"[Title/Abstract]) OR "health behaviour* program"[Title/Abstract]) OR "health behaviour* intervention"[Title/Abstract]) OR "multiple health behavior* change intervention"[Title/Abstract]) OR "multiple health behaviour* change intervention"[Title/Abstract]) OR "multiple behavior* risk factor* intervention"[Title/Abstract]) OR "multiple behaviour* risk factor* intervention"[Title/Abstract]) OR "multiple behavior* risk factor* program"[Title/Abstract]) OR "multiple behaviour* risk factor* program"[Title/Abstract]) OR "multiple risk behaviour* intervention"[Title/Abstract]) OR "multiple risk behavior* intervention"[Title/Abstract]) OR "multiple risk behaviour\$ program"[Title/Abstract]) OR "multiple risk behavior* program"[Title/Abstract])

Science Citation Index

Via Web of Science

Search date 17th January 2013

7048 records identified

4 **7,048** #3 OR #2 OR #1

Databases=SCI-EXPANDED Timespan=1990-02-01 - 2013-01-17

Lemmatization=Off

3 5 TS=("multiple health behavior* change intervention*") OR TS=("multiple health behaviour* change intervention*") OR TS=("multiple behavior* risk factor* intervention*") OR TS=("multiple behaviour* risk factor* intervention*") OR TS=("multiple behavior* risk factor* program*") OR TS=("multiple behaviour* risk factor* program*") OR TS=("multiple risk behaviour* intervention*") OR TS=("multiple risk behavior* intervention*") OR TS=("multiple risk behaviour* program*") OR TS=("multiple risk behavior* program*")

Databases=SCI-EXPANDED Timespan=1990-02-01 - 2013-01-17

Lemmatization=Off

2 **1,289** Topic=("multiple risk factor" NEAR/2 program*) OR Topic=("multiple risk factor" NEAR/2 intervention*) OR Topic=("multifactorial lifestyle" NEAR intervention*) OR Topic=("multifactorial lifestyle" NEAR program*) OR Topic=("health behavior*" NEAR program*) OR Topic=("health behavior*" NEAR intervention*) OR Topic=("health behaviour*" NEAR program*) OR Topic=("health behaviour*" NEAR intervention*)

Databases=SCI-EXPANDED Timespan=1990-02-01 - 2013-01-17

Lemmatization=Off

1 **6,031** TS=(lifestyle NEAR/2 intervention*) OR TS=(lifestyle NEAR/2 program*) OR TS=("life style" NEAR/2 intervention*) OR TS=("life style" NEAR/2 program*) OR TS=("behavior* change" NEAR intervention*) OR TS=("behavior* change" NEAR program*) OR TS=("behaviour* change" NEAR intervention*) OR TS=("behaviour* change" NEAR program*)

Databases=SCI-EXPANDED Timespan=1990-02-01 - 2013-01-17

Lemmatization=Off

Appendix 11: Review 2 – Data extraction template

EndNote ID:	Date form completed:	
First author:	Year of study:	Data extractor:

1. General Information

Publication type	Journal Article <input type="checkbox"/> Abstract <input type="checkbox"/> Other (specify e.g. report) _____
Country of study:	

2. Study Eligibility

Study characteristics																																														
Type of study	<input type="checkbox"/> Randomised Controlled Trial (RCT) <input type="checkbox"/> Cluster Randomised Controlled Trial (cluster RCT)	<input type="checkbox"/> Other design (specify): _____																																												
	Comments (e.g., it links to another study/studies):																																													
	<i>Does the study design meet the criteria for inclusion?</i> Yes <input type="checkbox"/> No <input type="checkbox"/> → Exclude Unclear <input type="checkbox"/>																																													
Participants	Are the participants all aged 16 years or over? Yes <input type="checkbox"/> No <input type="checkbox"/>																																													
	Do participants come from the general adult population? Yes <input type="checkbox"/> No <input type="checkbox"/> OR Do the participants come from one of the non-targeted subgroups of the general population below? (e.g., no screening has been performed to assess their eligibility): <table border="0"> <tr><td>University students</td><td>Yes <input type="checkbox"/></td><td>No <input type="checkbox"/></td></tr> <tr><td>Black and minority ethnic groups</td><td>Yes <input type="checkbox"/></td><td>No <input type="checkbox"/></td></tr> <tr><td>Older adults</td><td>Yes <input type="checkbox"/></td><td>No <input type="checkbox"/></td></tr> <tr><td>Homeless/low socioeconomic status</td><td>Yes <input type="checkbox"/></td><td>No <input type="checkbox"/></td></tr> <tr><td>Parents with children</td><td>Yes <input type="checkbox"/></td><td>No <input type="checkbox"/></td></tr> <tr><td>Pregnant women</td><td>Yes <input type="checkbox"/></td><td>No <input type="checkbox"/></td></tr> <tr><td>Young people (aged 16 to 22 years)</td><td>Yes <input type="checkbox"/></td><td>No <input type="checkbox"/></td></tr> <tr><td>Patients from healthcare practices</td><td>Yes <input type="checkbox"/></td><td>No <input type="checkbox"/></td></tr> <tr><td>Women</td><td>Yes <input type="checkbox"/></td><td>No <input type="checkbox"/></td></tr> <tr><td>Men</td><td>Yes <input type="checkbox"/></td><td>No <input type="checkbox"/></td></tr> <tr><td>Prison inmates</td><td>Yes <input type="checkbox"/></td><td>No <input type="checkbox"/></td></tr> <tr><td>Couples undergoing fertility treatment</td><td>Yes <input type="checkbox"/></td><td>No <input type="checkbox"/></td></tr> <tr><td>Highly educated adults</td><td>Yes <input type="checkbox"/></td><td>No <input type="checkbox"/></td></tr> <tr><td>Armed Forces veterans</td><td>Yes <input type="checkbox"/></td><td>No <input type="checkbox"/></td></tr> </table> OR Do the participants come from one of the targeted subgroups of the general population below? (e.g., a form of screening has been performed to assess participants' eligibility): <table border="0"> <tr><td>Overweight/obese</td><td>Yes <input type="checkbox"/></td><td>No <input type="checkbox"/></td></tr> </table>		University students	Yes <input type="checkbox"/>	No <input type="checkbox"/>	Black and minority ethnic groups	Yes <input type="checkbox"/>	No <input type="checkbox"/>	Older adults	Yes <input type="checkbox"/>	No <input type="checkbox"/>	Homeless/low socioeconomic status	Yes <input type="checkbox"/>	No <input type="checkbox"/>	Parents with children	Yes <input type="checkbox"/>	No <input type="checkbox"/>	Pregnant women	Yes <input type="checkbox"/>	No <input type="checkbox"/>	Young people (aged 16 to 22 years)	Yes <input type="checkbox"/>	No <input type="checkbox"/>	Patients from healthcare practices	Yes <input type="checkbox"/>	No <input type="checkbox"/>	Women	Yes <input type="checkbox"/>	No <input type="checkbox"/>	Men	Yes <input type="checkbox"/>	No <input type="checkbox"/>	Prison inmates	Yes <input type="checkbox"/>	No <input type="checkbox"/>	Couples undergoing fertility treatment	Yes <input type="checkbox"/>	No <input type="checkbox"/>	Highly educated adults	Yes <input type="checkbox"/>	No <input type="checkbox"/>	Armed Forces veterans	Yes <input type="checkbox"/>	No <input type="checkbox"/>	Overweight/obese	Yes <input type="checkbox"/>
University students	Yes <input type="checkbox"/>	No <input type="checkbox"/>																																												
Black and minority ethnic groups	Yes <input type="checkbox"/>	No <input type="checkbox"/>																																												
Older adults	Yes <input type="checkbox"/>	No <input type="checkbox"/>																																												
Homeless/low socioeconomic status	Yes <input type="checkbox"/>	No <input type="checkbox"/>																																												
Parents with children	Yes <input type="checkbox"/>	No <input type="checkbox"/>																																												
Pregnant women	Yes <input type="checkbox"/>	No <input type="checkbox"/>																																												
Young people (aged 16 to 22 years)	Yes <input type="checkbox"/>	No <input type="checkbox"/>																																												
Patients from healthcare practices	Yes <input type="checkbox"/>	No <input type="checkbox"/>																																												
Women	Yes <input type="checkbox"/>	No <input type="checkbox"/>																																												
Men	Yes <input type="checkbox"/>	No <input type="checkbox"/>																																												
Prison inmates	Yes <input type="checkbox"/>	No <input type="checkbox"/>																																												
Couples undergoing fertility treatment	Yes <input type="checkbox"/>	No <input type="checkbox"/>																																												
Highly educated adults	Yes <input type="checkbox"/>	No <input type="checkbox"/>																																												
Armed Forces veterans	Yes <input type="checkbox"/>	No <input type="checkbox"/>																																												
Overweight/obese	Yes <input type="checkbox"/>	No <input type="checkbox"/>																																												

	Adult drug users	Yes <input type="checkbox"/>	No <input type="checkbox"/>
	University students with (or at risk of) problematic substance use	Yes <input type="checkbox"/>	No <input type="checkbox"/>
	Adult smokers with untreated depression	Yes <input type="checkbox"/>	No <input type="checkbox"/>
OR			
Do participants come from another population? (e.g., clinical population, populations with biological/genetic risks for chronic disease, workplace populations)			
		Yes <input type="checkbox"/>	No <input type="checkbox"/>
Do the participants meet the criteria for inclusion?			
		Yes <input type="checkbox"/>	No <input type="checkbox"/> → Exclude Unclear <input type="checkbox"/>

Types of intervention	Did the study deliver any of these types of interventions?		
	Behavioural	Yes <input type="checkbox"/>	No <input type="checkbox"/>
	Pharmacological	Yes <input type="checkbox"/>	No <input type="checkbox"/>
	A combination of the above	Yes <input type="checkbox"/>	No <input type="checkbox"/>
Did the intervention aim to change at least two risk behaviours? Yes <input type="checkbox"/> No <input type="checkbox"/>			
Which of the following risk behaviours did the intervention aim to change?			
Smoking <input type="checkbox"/>			
Alcohol use <input type="checkbox"/>			
Dietary behaviours <input type="checkbox"/>			
Physical activity levels <input type="checkbox"/>			
Sedentary behaviours <input type="checkbox"/>			
Sexual risk behaviours <input type="checkbox"/>			
Illicit drug use <input type="checkbox"/>			
Other <input type="checkbox"/> (please specify below):			
Does the intervention meet the criteria for inclusion?		Yes <input type="checkbox"/>	No <input type="checkbox"/> → Exclude Unclear <input type="checkbox"/>
Types of outcome measures	Does the study report the changes in the risk behaviours measured, following the intervention?		
	Yes <input type="checkbox"/> No <input type="checkbox"/> Unclear <input type="checkbox"/>		
Do the outcome measures meet the criteria for inclusion?		Yes <input type="checkbox"/> No <input type="checkbox"/> → Exclude Unclear <input type="checkbox"/>	

Summary of Assessment for Inclusion

Include in review <input type="checkbox"/>		Exclude from review <input type="checkbox"/>	
Independently assessed, and then compared? Yes <input type="checkbox"/> No <input type="checkbox"/>		Differences resolved Yes <input type="checkbox"/> No <input type="checkbox"/>	
Request further details from authors? Yes <input type="checkbox"/> No <input type="checkbox"/>		Contact details of authors:	

Notes:

DO NOT PROCEED IF PAPER EXCLUDED FROM REVIEW

3. Study details

Study intention	Descriptions as stated in the report/paper
Aim of intervention	Delete/circle where appropriate: <i>Health promotion/ Weight management/ Prevention or reduction of risk for chronic disease/ Prevention of initiation of risk behaviours/ Reduction of risk for substance dependence and other problems</i>
Start and end date of the study	Start date (month, year): End date (month, year): No dates reported <input type="checkbox"/>
Total study duration	

Methods	Descriptions as stated in the report/paper
Method/s of recruitment of participants (How were potential participants approached and invited to participate? Where were participants recruited from? Does this differ from the intervention setting?)	
Inclusion/exclusion criteria for participation in study	
Total number of intervention groups	
What was the unit of randomisation? Allocation by individuals or cluster/groups	
What was the unit of analysis? Is this the same as the unit of randomisation?	Delete/circle where appropriate (Yes/No/Unclear)
Statistical methods used and appropriateness of these methods	(Check with your statistician if unsure about appropriateness)

Results

Participants <i>Include if relevant</i>	Include information for each group (i.e. intervention and controls) under study
• What percentage of selected individuals agreed to participate?	
• Total number randomised (or total pop. at start of study for NRCTs)	
• Number allocated to each intervention group (no. of individuals)	
• For cluster trials, number of clusters, number of people per cluster	
• Where there any significant baseline imbalances?	Yes <input type="checkbox"/> No <input type="checkbox"/> Unclear <input type="checkbox"/>

	Details:
<ul style="list-style-type: none"> Number and reason for (and socio-demographic differences of) withdrawals and exclusions for each intervention group 	
<ul style="list-style-type: none"> Were patients who entered the study adequately accounted for? 	
<ul style="list-style-type: none"> What percentage of patients completed the study? 	
<ul style="list-style-type: none"> What percentage of participants received the allocated intervention or exposure of interest? 	
<ul style="list-style-type: none"> Is the analysis performed by intervention allocation status (intention to treat) rather than the actual intervention received? Have any attempts been made to impute missing data? 	
<ul style="list-style-type: none"> Age (median, mean and range if possible) 	
<ul style="list-style-type: none"> Sex 	
<ul style="list-style-type: none"> Race/Ethnicity 	
<ul style="list-style-type: none"> Screening criteria (targeted subgroups only, e.g., BMI measurement) 	
<ul style="list-style-type: none"> Other socio-demographics (e.g., Educational level, literacy level, socio-economic status, first language. Also consider possible proxies for these e.g., low baseline nutritional status) 	

Intervention Group 1

(copy and paste table for each Intervention group)

Group name:	<i>(State brief name for this intervention group.)</i>
<ul style="list-style-type: none"> Setting <i>e.g., multicentre, university teaching hospitals, rural, metropolitan, school, workplace, community, GP clinic, etc.</i> 	
<ul style="list-style-type: none"> Theoretical basis 	
<ul style="list-style-type: none"> Content (list the strategies intended and delivered) 	
<ul style="list-style-type: none"> Delivery (e.g., Stages [sequential or simultaneous], timing, 	

frequency, duration, intensity, fidelity – process indicators)	
• Acceptance (e.g., any qualitative data regarding patient's acceptance, adherence, and experiences relating to the intervention)	
• Providers (who, number, education/training in intervention delivery, ethnicity etc. if potentially relevant to acceptance and uptake by participants)	
Duration of intervention	
Duration of follow-up	
Subgroups	<i>Enter a description of any intervention subgroups from this report to be analysed in the review.</i>
What are the moderators/mediators of risk behaviour changes stated in the study?	
Do the authors describe any political or organisational context?	<i>List relevant dot points</i>
Were any partnerships referred to?	<i>List these as dot points</i>
Was a process evaluation conducted?	<i>What components were included in the process evaluation? (e.g., frequency, consistency, implemented as intended etc)</i>
Control/comparison (what information is provided about what the control or comparison group received?)	<i>Enter a description of what was provided for the control group, if applicable</i>

Outcomes

(This table is set up for 2 outcome measure to save spaces, copy and paste table as often as required)

Question	Outcome 1	Page/ Para/ Figure #	Outcome 2
Was there an analytic framework applied (e.g. logic model, conceptual framework)?			
Risk behaviour outcome definitions (including units of measurement):			
Level/s at which the outcomes were measured:	Individual <input type="checkbox"/> Group <input type="checkbox"/> Community <input type="checkbox"/> Population <input type="checkbox"/>		
Time points measured			

Time points reported			
Was the data collected from the same individuals or redrawn from the population / community for each time point?	The same individuals <input type="checkbox"/> Redrawn from the population/ community for each time point? <input type="checkbox"/>		
For measurement scales – upper and lower limits and indicate whether high or low score is good			
How was the data collected?	Telephone survey <input type="checkbox"/> Mail survey <input type="checkbox"/> In person by trained assessor <input type="checkbox"/> Routinely collected data <input type="checkbox"/> Other (please specify) <input type="checkbox"/>		
How was the outcome reported?	Self <input type="checkbox"/> Study assessor <input type="checkbox"/>		
Is this outcome/tool validated?			
...And was it used as validated?			

Results

Copy and paste the appropriate table for each outcome and subgroup at each timepoint, including baseline

For RCT

Dichotomous outcome

Comparison				
Outcome				
Subgroup				
Timepoint				
Results	Intervention		Comparison	
	Events	No. participants	Events	No. participants
No. of missing participants and reasons				
Any other results reported				
Reanalysis required? (specify - (e.g. correlation adjustment)				
Reanalysis possible?	Yes <input type="checkbox"/> No <input type="checkbox"/> Unclear <input type="checkbox"/>			
Reanalysed results				

For RCT

Continuous outcome

Comparison						
Outcome						
Subgroup						
Timepoint						
Post-intervention or change from baseline?						
Results	Intervention			Comparison		
	Mean	SD (or other variance)	No. participants	Mean	SD (or other variance)	No. participants
No. missing participants and reasons						
Any other results reported						
Reanalysis required? (specify)						
Reanalysis possible?	Yes <input type="checkbox"/> No <input type="checkbox"/> Unclear <input type="checkbox"/>					
Reanalysed results						

For RCT

Generic inverse variance method

Comparison				
Outcome				
Subgroup				
Timepoint				
Results	Effect estimate	SE (or other variance)	Intervention no.	Control no.
No. missing participants and reasons				
Any other results reported				
Reanalysis required? (specify)				
Reanalysis possible?	Yes <input type="checkbox"/> No <input type="checkbox"/> Unclear <input type="checkbox"/>			
Reanalysed results				

Other relevant information

Were outcomes relating to unintended effects of the intervention described? Include any data for these in the outcomes tables above	
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Potential for author conflict <i>i.e.</i> , evidence that author or data collectors would benefit if results favoured the intervention under study or the control	
Key conclusions of the study authors	
Could the inclusion of this study potentially bias the generalisability of the review?	
Is there potential for differences in relative effects between advantaged and disadvantaged populations within studies? (particularly studies of the general adult population)	
Issues affecting directness (Note any aspects of population, intervention, etc, that affect this study's direct applicability to the review question)	
References to other relevant studies	
Additional notes by review authors	
Correspondence required for further study information (from whom, what and when)	

Appendix 12: Review 2 – Methods used to transform data for meta-analyses

Where studies reported data for multiple intervention groups and one control group, the data for the intervention groups were entered separately into the meta-analysis using methods described in various meta-analysis texts (e.g. Cochrane Collaboration, 2012). With dichotomous data, the control group data were split according to the number of intervention groups. E.g., if there were two intervention groups, and the number of people not achieving the recommended threshold in the control group was 20 out of 40, this was entered as 10 out of 20 for each of the two pair-wise comparisons. With continuous data, the control group data was entered identically for each pair-wise comparison, except the control group total was divided according to the number of intervention groups (e.g., halved if there were two intervention groups, split into three if there were three intervention groups, and so on). Equally, if a study reported having multiple control groups and one intervention group, the data were divided in the same way across the comparisons with the intervention group data instead.

Some studies reported the same behaviours using different outcome measures. These were mostly reported in relation to diet (e.g., reporting of fruit intake and vegetable intake separately) and physical activity (e.g., separate reporting for strength exercise, walking, moderate intensity physical activity, vigorous intensity physical activity). In these instances we applied one of the three following methods: 1) Used the result for the outcome that was considered most representative of the risk behaviour (e.g., using data for saturated fat intake instead of total fat intake), 2) Used the outcome that most other studies in the meta-analysis had used (e.g., percentage of energy from fat instead of grams of fat per day), or 3) Combined the outcomes which had been most frequently reported and considered to be one outcome by other studies (e.g., moderate and vigorous intensity physical activity, or fruit and vegetable intake). For the third method, outcomes were combined by first calculating a combined mean (i.e., the average of the two mean values) for continuous data, or a log odds ratio for dichotomous data. We then estimated the variance of this combined mean using the following formula (Borenstein *et al.*, 2009):

$$V_{\bar{Y}} = \frac{1}{4} (V_{Y_1} + V_{Y_2} + 2r\sqrt{V_{Y_1}}\sqrt{V_{Y_2}})$$

For the combining of fruit and vegetable intake outcomes, a correlation co-efficient (*r*) of 0.179 was used, as identified from the data set of one of the studies included in the review (Kypri *et al.*, 2005). For the combining of physical activity outcomes, a previously reported correlation co-efficient value could not be found so a value of 0.5 was used.

Appendix 13: Review 2 – Reasons for exclusions of full texts

Table 13.1. Reasons for exclusions of full texts

First author (year of publication)	Reason for exclusion
Jacobs (2004)	Did not study a general (non-targeted) population
Marsden (2006)	Did not study a general (non-targeted) population
Culos-Reed (2007)	Did not study a general (non-targeted) population
Wylie-Rosett (2001)	Did not study a general (non-targeted) population
Brody (2013)	Family-based intervention
French (2011)	Family-based intervention
Bartlett (2013)	Some participants only had one risk behaviour at baseline.
Fries (1993)	Insufficient data
Hui (2006)	Insufficient data
Phillips (2012)	Insufficient data
Wellman (2007)	Insufficient data
Marrone (2010)	Insufficient information to ascertain eligibility
Peeler (2001)	Insufficient information to ascertain eligibility
Lee (2011)	Not an intervention for multiple risk behaviours
Prochaska (2012)	Not an intervention for multiple risk behaviours
Blalock (2002)	Only one risk behaviour outcome measured and reported
Greaney et al., 2008 and Greene et al., 2008 (both reporting results from the same intervention)	Combined data from single and multiple risk behaviour intervention groups for analyses for each risk behaviour. Not possible to separate groups' data and re-analyse.
Salamone (1999)	Provided data that we had already included in the review from another paper on the same study.
Abu-Moghli (2010)	Not an RCT
Ametrano (1992)	Not an RCT
Arikan (2011)	Not an RCT
Backman (2011)	Not an RCT
Baxter (1997)	Not an RCT
Biger (1994)	Not an RCT
Bonevski (2012)	Not an RCT
Coppell (2009)	Not an RCT
Dismuke (1990)	Not an RCT
Dowse (1995)	Not an RCT
Fernald (2012)	Not an RCT
Gibbins (1993)	Not an RCT
Gongyuan (2011)	Not an RCT
Goodman (1995)	Not an RCT
Hager (2012)	Not an RCT
Hijazi (2012)	Not an RCT
Homan (2010)	Not an RCT
Hsu (2010)	Not an RCT
Huang (2011)	Not an RCT
Kegler (2012)	Not an RCT
Kelishadi (2011)	Not an RCT
Kim (2008)	Not an RCT
Lee (2009)	Not an RCT
Lingfors (2001)	Not an RCT
Luepker (1994)	Not an RCT
Nguyen (2012)	Not an RCT
Osler (1993)	Not an RCT
Petrofsky, 2004	Not an RCT
Taveras (2011)	Not an RCT
van Dongen (2012)	Not an RCT
Vio (2011)	Not an RCT
Wendel-Vos (2009)	Not an RCT
White (2009)	Not an RCT
Whittle (2010)	Not an RCT

Appendix 14: Review 2 – Characteristics of the included studies

Table 14.1. Characteristics of the included studies (50 in total)

First author (Year of publication), country	Study design, sample size, setting	Participant characteristics	Content of the interventions	Intervention function/s (Behaviour Change Wheel definitions) and intervention delivery	Intervention duration/ frequency, and length of follow-up	Risk behaviour outcomes: outcome measures	Other outcomes related to disease risk
Aldana <i>et al.</i> (2006) USA	RCT N=348 Community	General adult population (mean age=50 years, range=24-81). Predominantly White (94%), with an annual income of \$60,000 or more (50%). Most had completed high school or gone to university (96%).	Intervention (n=174). Educational lectures on impact of lifestyle on risk of chronic disease; were structured according to the health belief and transtheoretical models. Participants were given goals and received educational materials. Had access to shopping tours and cooking demonstrations. Control/comparison group (n=174): Appeared as though they were wait list controls.	Education, Training Delivered by: Dietitians and medical professionals	Duration: 4 weeks Frequency: 4 sessions a week Length of follow-up: 6 months	Diet: mean daily intake of calories; percentage of calories from fat/carbohydrates/protein; servings (grams) of fruits, vegetables, meat, whole grains, different types of fat, and sodium. Physical activity: mean total steps/week	Weight (kg), BMI*, body fat (%), systolic and diastolic blood pressure, resting heart rate, levels of blood glucose, cholesterol, high and low density lipoprotein, triglycerides, and C-reactive protein.
Braithwaite <i>et al.</i> (2005) USA	Cluster RCT N=114 Prison	Prison inmates (mean age=35 years, range=19- 59). Mean years of incarceration = 9 years. Mostly African American (68.7%) or White (25.8%), with no qualifications (37%) or completed high school	a) Didactic group (n=37): received standard education on HIV and substance abuse, presented using videos and other forms of didactic presentation. b) Peer negative group (n=38): received	Education, training, modelling Delivered by: 'Facilitators' or other prisoners (HIV positive or negative peers).	Duration: 6 weeks Frequency: 12 sessions Length of follow-up: 3 and 6 months following release from	Sexual risk behaviour: Mean number of partners with whom participants had oral, anal or vaginal sex prior to incarceration and three months after release. Illicit drug use: Mean frequency of cannabis use prior to incarceration (time responses ranged from daily	None

		(35%).	<p>education intervention on HIV and substance abuse, delivered by HIV negative peers. Included goal setting, skill building, role playing, and discussions.</p> <p>c) Peer positive group (n=16): received same intervention as peer negative group, except it was delivered by HIV-positive peers.</p> <p>Control/comparison group n=23. Received standard education on HIV and substance abuse, presented using video.</p>		prison.	<p>to never).</p> <p>Alcohol use, Smoking (no outcomes reported for these last two).</p> <p>Note: A 'substance use' variable was also measured (cannabis, cocaine and alcohol use).</p>	
Burke <i>et al.</i> (2013)	RCT N=478	Older adults with low to middle income	Intervention group (n=248): received booklet with recommendations on physical activity and nutrition (based on social cognitive theory and the precede-proceed model). Goal setting was encouraged. Also received an exercise chart, calendar, bi-monthly newsletter, resistance band, pedometer, and telephone/email contact guides (usually	Enablement, education	Duration: 6 months	Diet: mean scores for fibre intake, fat intake, and fat avoidance. Consumption of fruit and vegetables (at least 2 servings 3-7 days a week) (yes/no).	None
Australia	Mailed materials to homes.	Mean age=66 years, (SD not reported). Forty-six per cent had completed high school, 19% had a university qualification. 65% struggled financially sometimes, 21% struggled financially always.		Delivered by: Health Science students, with expertise in physical activity, nutrition, and health promotion. Known as 'guides.'	<p>Frequency: Usually 6-10 phone calls/ 2-5 emails</p> <p>Length of follow-up: Endpoint of intervention</p>	<p>Physical activity: At least 10 minutes participation in strength exercise, walking, moderate activity, and vigorous activity (yes/no).</p> <p>Sedentary behaviour: mean sitting time (minutes).</p>	

			6 to 10 phone calls or 2 to 5 emails). Control/comparison group (n=230): Received no intervention.				
Burton (1995) <i>et al.</i> USA	RCT N=4,195 Primary care settings	Older adults (aged 65 years or older). Mostly White (86%). In total, 13% were below the poverty level.	Intervention (n=2,105): Two preventive exams. Included complete history and physical exam, screening and immunization, review of lifestyle health behaviours emotional distress, injury/falls prevention, and sleep problems. Additional follow up counselling visit within 6 months for health behaviour review and further counselling if needed. Control/comparison group (n=2,090): received a pamphlet describing good health practices. Immunisations were limited to pneumovax inoculations and hepatitis B.	Enablement, education Delivered by: Primary care physicians	Duration: 2 years Frequency: one visit per year Length of follow-up: Endpoint of intervention	Smoking: any current cigarette, cigar, or pipe smoking (yes/no) Alcohol use: any positive response to the CAGE questionnaire. Sedentary behaviour: performing physical activities such as walking, gardening, etc, less than three times a week (yes/no).	None
Campbell <i>et al.</i> (2004) USA	Cluster RCT N=850 African American churches	Members of African American churches (Mean age=52 years, SD not reported). Ninety-nine per cent were African American.	a) Lay health advisor intervention (n=123): Theory-based training was given to lay advisors for them to disseminate at interpersonal, social	Education, training, modelling (all received by both interventions). Persuasion (tailored print communication intervention only) Environmental	Duration: 9 months Length of follow-up: 3 months	Diet: meeting 5-a-day recommendation (yes/no). Also measured mean daily servings of fruits and vegetables, and mean daily calories from fat.	None

		<p>Approximately 25% had some education beyond high school, and approximately 40% were obese.</p>	<p>and church levels.</p> <p>b) Tailored print and video intervention (n=159): Theory-based materials (computer-tailored newsletters and videotapes) given to participants to read/watch at home.</p> <p>c) Combined (n=176): Combination of the two interventions above. Based on social cognitive theory, stages of change, health belief model, social support models</p> <p>Control/comparison group (n=129): received health education sessions, and speakers on topics of their choice not related to study objectives e.g., child care.</p>	<p>restructuring, enablement (lay health advisor intervention only)</p> <p>Delivered by: Lay health advisors (church members who were trained to conduct the intervention).</p>		<p>Physical activity: meeting physical activity recommendations (yes/no). Mean levels of moderate/vigorous activity (hours/week).</p>	
<p>Campo <i>et al.</i> (2012)</p> <p>Spain</p>	<p>Cluster RCT N=169</p> <p>Community health centres</p>	<p>General adult population</p> <p>Mean age=56 years in the intervention group and 55 years in the control group; (SDs not reported).</p>	<p>Intervention (n=94): Attended a health workshop focused on biological, psychological and social factors that influence health and wellness. Included presentations, handouts, and group discussion. Based on a</p>	<p>Education, training, enablement</p> <p>Delivered by: The researchers</p>	<p>Duration: 8 weeks</p> <p>Frequency: Once a week (90 minutes)</p> <p>Length of follow-up: 6 months</p>	<p>Diet: mean score for adherence to a Mediterranean diet.</p> <p>Physical activity: mean total minutes of physical activity per week (total, vigorous, moderate, walking).</p>	<p>None</p>

			conceptual model by Henderson ('Virginia nursing'), which defines the person as a whole according to 14 life activities. Control/comparison group (n=75): No intervention received.				
de Vries <i>et al.</i> (2008) Netherlands	RCT N=1,331 Mailed materials to homes.	General adult population Mean age=49 years (range=18-65). Nearly half (49%) had a college or university degree, 39% had completed high school, and 12% had vocational training or no education.	Intervention (n=608): received three tailored letters which promoted behaviour change related to smoking, nutrition, and physical activity. Participants were divided into two experimental groups with one group (n=289) receiving another tailored letter and the other group (n=319) receiving additional information about why and how to make an action plan. Based on social cognitive theory, health belief model, trans-theoretic model, precaution adoption model, goal setting theories. Control/comparison group (n=723): three untailored letters relating to the same behaviours.	Persuasion Delivered by: No one, materials were mailed to homes.	Duration: 9 months Length of follow-up: endpoint of the intervention	Smoking: compliance with guidelines (i.e., non-smoking), and mean change from baseline in the percentage of smokers. Diet: compliance with guidelines and mean change from baseline for fat intake, fruit intake, and vegetable intake. Physical activity: compliance with guidelines and mean change from baseline in physical activity.	None

Diez <i>et al.</i> (2012) Mexico	RCT N=134 University	University students Mean age=18 years (range=17-23). All Hispanic (100%); most had a medium (63.9%) or low (26.4%) socio-economic level.	Intervention (n=67): didactic style, presented information and techniques relating to skills, modification of cognitions, and incorporation of health promoting behaviours in lifestyles. Based on the health promotion model (which was based on social learning theory and expectancy-value theory). Control/comparison group (n=67): received no intervention.	Education, training Delivered by: Trained psychologists	Duration: 1 week Length of follow-up: 3 months	Diet and physical activity: both measured using scores from the Health-Promoting Lifestyle Profile-II scale.	None
Emmons <i>et al.</i> (2005) USA	Cluster RCT N=2,219 Health centre	General adult population. Most were White (Intervention group =72.9%, Control group =50.6%) or Black (Intervention group =15.4%, Control group =27.4%), and were working class (Intervention group: 42.5%, Control group =46.1%), or a professional/manager (Intervention group =46.3%, Control group =42.9%).	Intervention (n=1,088): received counselling session, using motivational interviewing. Follow-up telephone counselling sessions were performed. Tailored materials written for low literacy and multi-cultural audiences were also provided, along with information on local resources available. Used a social-contextual approach seeking to go beyond standard behavioural and psychological theoretical literature.	Education, persuasion, enablement Delivered by: health advisers with diverse racial/ethnic and socio-economic backgrounds, who were bilingual in Spanish.	Duration: Not reported Length of follow-up: 8 months	Diet: at least 5 daily servings of fruits/vegetables and at least 3 servings of red meat per week (yes/no) Mean servings per day/week were also recorded. Physical activity: for at least 2.5 hours per week. Mean hours per week were also recorded.	None

			Control/comparison group (n=1,131): received no intervention.				
Franko <i>et al.</i> (2008) USA	RCT N=606 University	University students. Mean age was 20 years (SD not reported). More than half were female (56%) and White (58%).	a) Experimental I: n=203 b) Experimental II: n=207: Received computer-delivered information on risk behaviours and goal setting. Control/comparison group (n=196): Interactive anatomy education website over 2 weeks.	Education Delivered by: Computer	Duration: Experimental I =2 weeks Experimental II =2 weeks plus a booster 3 weeks later Length of follow-up: 6 months	Diet: mean daily servings of fruits and vegetables. Physical activity: mean for total MET** minutes/week.	None
Gow <i>et al.</i> (2010) USA	RCT N=159 University	University students. Mean age=18 years (SD not reported). Over half were White (54%); others were African American (22%), Asian (11%), Hispanic (3%) or Other (11%).	a) Internet intervention (n=40): received education on obesity increasing physical activity, reducing sedentary behaviour, healthy body image, and a motivation online course. b) Feedback intervention (n=39): measured weight weekly and posted on 'Blackboard.' Provided with a graph and caloric equivalent change over time. c) Combined intervention (n=40):	Education (Internet and combined intervention groups), persuasion, training Delivered by: Computer	Duration: 6 weeks Frequency: 6 weekly sessions Length of follow-up: 3 months (insufficient data for analysis, post-intervention data used instead).	Smoking: mean number of cigarettes smoked in a day. Diet: mean scores for intake of fat, fibre, and fruit and vegetables. Used the Block Screener Questionnaire. Physical activity: mean total score from the International Physical Activity Questionnaire (IPAQ) in the past 7 days.	Weight (lbs), BMI.

			received both of the interventions above. Control/comparison group (n=40): received no intervention.				
Greene <i>et al.</i> (2012) USA	RCT N=1,689 University	University students. Mean age was 19 years (range: 18-24). Most were male (65%) and White (79%).	Intervention (n=830): one online lesson was provided each week. The focus was on eating competence, encouragement of sustained enjoyable physical activity, improvement of self-efficacy, and weekly goal setting. Based on educational models, e.g., Dick and Carey's System of Instructional Design, and Keller's Instructional Motivational Model. Control/comparison group (n=859): received no intervention.	Education, training Delivered by: Computer	Duration: 10 weeks Frequency: Once per week (for approximately 15 minutes). Length of follow-up: Endpoint of intervention and 15 months	Diet: mean intake of fruits and vegetables (cups/day) Physical activity: mean for total MET minutes/week.	Weight (lbs), BMI, waist circumference, estimated VO ² max, general health (including stress).
Hillier <i>et al.</i> (2012) UK	Cluster RCT N=128 Community (health service drop-in centre, participants' homes, university, local community)	Adults with low-socio-economic status Mean age=42 years (SD not reported). Most were female (77%), White (88%), and had high school or higher level educational qualifications (94%).	Intervention (n=69): Based on theory of planned behaviour and social cognitive theory. Received a brief face-to-face intervention using negotiation techniques. Participants were asked to make two specific pledges to related to food and physical	Persuasion, training, modelling Delivered by: Trained lifestyle helpers (students).	Duration: 30-45 minutes (intervention), or 15-30 minutes (control). Frequency: 1 session Length of	Diet: mean number of fruit and vegetable portions and percentage of energy from fat. Physical activity: mean minutes of moderate intensity physical activity per day.	Weight (kg), BMI, waist circumference.

	centre)		activity. Control/comparison group (n=59): received standard advice.		follow-up: 12 months.		
Hivert <i>et al.</i> (2007) Canada	RCT N=115 University	University students. Mean age=20 years (SD=0.2). Most were female (82%) and White (93%).	Intervention (n=58): received education and advice on problem solving, goal setting, monitoring strategies in relation to healthy lifestyle behaviour change. The students delivering the intervention were offered as role models to promote healthy lifestyles. Control/comparison group (n=57): received no intervention.	Education, training, modelling Delivered by: An endocrinology student and a physical education graduate student.	Duration: 2 years Frequency: one 45-minute seminar every 2 weeks, and then every month (after first 2 months). Length of follow-up: Endpoint of the intervention	Diet: mean calorie intake (kcal/day) Physical activity: mean level of physical activity (kcal/kg/year)	Weight (kg), BMI.
Hui <i>et al.</i> (2012) Canada	RCT N=224 Community gyms	Pregnant women. 21% were Canadian aboriginals with first nation status. The mean family annual income was \$49,718.	Intervention (n=112): received supervised exercise classes, an exercise video to use at home, an activity logbook, and a dietary interview and counselling. Control/comparison group (n=112): received standard prenatal care and a package of information on physical activity and nutrition for a healthy pregnancy from Health Canada.	Education, training, enablement Delivered by: Licensed fitness trainers and a registered dietician	Duration: 2 months Length of follow-up: Endpoint of intervention	Diet: mean values for total calories; ratios for carbohydrates, protein and fat; starch; and intakes for very lean meat, lean meat, medium-fat meat, high-fat meat, vegetables, fruits, skim milk, 1-2% fat milk, whole fat milk, and oils and fats. Physical activity: mean scores from the PARMed-X form for Pregnancy.	Excessive weight gain according to Institute of Medicine guidelines, BMI, baby birth weight, prevalence of gestational diabetes.

Jackson <i>et al.</i> (2011) USA	RCT N=321 Pre-natal care practices.	Pregnant women with low socio-economic status. Most were Hispanic (41%) or African American (24%). Just over half had attended some, or completed college (53%) and most were receiving Medicaid due to a low income (85%).	Intervention (n=158): received brief counselling messages about diet, exercise, and weight gain. Based on the principles of motivational interviewing. At the end of each session, the clinician gave a summary of the participant's risk profile. An educational worksheet was also provided. Control/comparison group (n=163): received usual care.	Education, Persuasion Delivered by: An actor-portrayed Video doctor, and the clinician of the participant.	Duration: One 10-15 minute session. Length of follow-up: 4 weeks	Diet: mean changes from baseline in the number of servings of fruits/vegetables, whole grains, and high fat meats per week. Physical activity: mean changes from baseline in minutes of exercise per week, sufficient exercise (≥ 30 minutes per day, most days of the week). Also reported number of people who met recommendations for sufficient exercise levels.	None
Jacobs <i>et al.</i> (2011) Belgium	RCT N=314 Online intervention	General adult population.	Intervention (n=208): received coaching, which used an autonomy-supportive interpersonal style (avoiding controlling language, taking the perspective of the individual). Included information on individual lifestyle factors (fat intake, fruit and vegetable intake, physical activity, smoking), behaviour change techniques (e.g. self-monitoring), and tailored advice. Based on theory of planned behaviour and self-determination theory.	Education, persuasion, training Delivered by: Computer and a qualified health psychologist.	Duration not reported. Length of follow-up: 6 and 12 months	Diet: Mean percentage change in number of people meeting recommendations for fruit and vegetable intake, and saturated fat intake (yes/no). Physical activity: mean percentage change in number of people meeting recommendations for physical activity (yes/no).	Weight (kg), BMI.

			<p>Delivered via email, regular mail, telephone, face-to-face, or none (according to preference).</p> <p>Control/comparison group (n=106): received usual care.</p>				
<p>Jeffery <i>et al.</i> (1999)</p> <p>USA</p>	<p>RCT N=1,226</p> <p>Community and participants' homes</p>	<p>General adult population.</p> <p>Mean age =38 years (SD not reported). Most were female (80%), and White (over 85% in each study group). Half were married.</p>	<p>a) Education intervention (n=197): received newsletters on lifestyle behaviours and related issues. Weight control education programs and activities (e.g., free 1-month gym membership) were also offered.</p> <p>b) Education and incentive intervention (n=198): received same intervention as above but also had their name entered into a \$100 lottery draw every month.</p> <p>Control/comparison group (n=414): appeared as though they received no intervention.</p>	<p>Education, Enablement, Incentivisation (education and incentive intervention only)</p> <p>Delivered by: Materials were mailed to participants' homes. Face-to-face sessions were delivered by trained nutritionists.</p>	<p>Duration: 3 years</p> <p>Frequency: Newsletters delivered monthly. Weight control programs offered twice in first year.</p> <p>Length of follow-up: Endpoint of the intervention.</p>	<p>Diet: mean change s from baseline in energy intake (kcal/day) and fat intake (% of energy).</p> <p>Physical activity: mean change from baseline in number of METs/week.</p>	<p>Weight (kg)</p>
<p>Keyserling <i>et al.</i> (2008)</p> <p>USA</p>	<p>RCT N=236</p> <p>Health centre</p>	<p>Women from lower-income populations.</p> <p>White 58%, African</p>	<p>Enhanced intervention (n=118): received education, verbal positive reinforcement,</p>	<p>Education, persuasion, training, enablement</p>	<p>Duration: 6 months (2 individual counselling</p>	<p>Diet: mean total score on the Diet Risk Assessment.</p> <p>Physical activity: moderate</p>	<p>Systolic and diastolic blood pressure, total cholesterol, high-</p>

		American 41%. Currently employed 59%, at least high school qualification 79%	performed goal setting, self-monitoring, problem solving, etc. Control/comparison group (n=118): American Heart Association pamphlets on diet and physical activity posted to participants.	Delivered by: Health counsellors, community health advisors (peer counsellors)	sessions, 3 group sessions, 3 phone calls from a peer counsellor, and 6 months maintenance) Length of follow-up: 6 and 12 months	physical activity (mean minutes/day) measured by accelerometer and self-report.	and low-density lipoprotein levels, weight (lbs).
Kreuter <i>et al.</i> (1996) USA	RCT N=1,317 Mailed materials to homes.	General adult population. Mean age=40 years (SD not reported). Most were female (65%), White (85%). Mean years of education=14 (SD not reported).	a) Typical health risk appraisal (n=427): received risk information, which listed the participant's health risk behaviours, and included graphic illustrations of the behaviours most important to change and their 10 year mortality risk. Also received present and ideal levels of four health status indicators. b) Enhanced health risk appraisal (n=427): received risk information and individually tailored behaviour change information. Control/comparison group (n=463): received no information.	Education (both interventions), training (enhanced feedback intervention only) Delivered by: Materials were mailed.	Duration: 4 weeks Length of follow-up: 6 months	Smoking: quitting smoking (yes/no) Diet: reduction of dietary fat intake (yes/no) Physical activity: aerobic exercise 3 times weekly (yes/no) Seat belt use: regular use (yes/no) Screening examinations (pap smear, cholesterol test, mammogram): Attendance rates (%)	None

Kypri (2005) <i>et al.</i>	RCT N=218	University students. Mean age = 20 years (range: 17-24). Just over half were male (51%). Most were White European (75%)	All groups received a blood pressure measurement at baseline. Assessment and feedback (n=72): Completed assessment on risk behaviours targeted. This group also received feedback on behaviours, based on health authority recommendations and social norms and self-comparisons. Assessment only (n=74): Completed assessment on risk behaviours targeted. Control/comparison group (n=72): received no intervention.	Education Delivered by: Computer	Duration: single internet session Length of follow-up: 6 weeks	Smoking: current smoking (yes/no) Alcohol use: drank more than 4 (women) or more than 6 (men) drinks in the last 4 weeks (yes/no). Diet: at least 2 servings of fruit and 3 servings of vegetables per day (yes/no) Physical activity: completed at least 2.5 hours of moderate physical activity or at least 1 hour of vigorous activity in the past 7 days (yes/no).	None
Lachausse <i>et al.</i> (2012)	RCT N=358	University students. Mean age = 25 years (SD not reported). Most were Hispanic (44%), White (21%) or African American (19%).	a) Internet-based intervention (n=106): received individual feedback on risk behaviours, and education on nutrition and physical activity. b) On-campus intervention (n=70): addressed issues in weight management and stress, and provided education on nutrition and physical	Education (both interventions), training (on-campus course only) Delivered by: A full-time faculty member in health education and promotion, or computer.	Duration: 12 weeks Frequency: At least 2 hours per week during the intervention period. Length of follow-up: 2 weeks	Diet: mean fruit and vegetable consumption (using scores from the Center for Disease Control and Prevention's Youth Risk Behavior Survey) Physical activity: mean levels of aerobic exercise (using scores from the same survey above).	BMI

			activity. Control/comparison group (n=136): received no intervention.				
Lee <i>et al.</i> (2011) Australia	RCT N=248 Participants' homes (telephone calls and mailed materials)	Older adults. Mean age in both study groups ranged from 72 to 73 years. Most were female (over 60% in both groups) and had completed high school (≥90% in both groups).	Intervention (n=114): received interactive booklet targeted at this age group. Included advice and information on the two lifestyle behaviours. Participants were encouraged to set goals and record progress. Also received telephone support based on motivational interviewing, and a pedometer. Control/comparison group (n=134): received no intervention	Education, persuasion, training Delivered by: mail (materials designed by dietitians and physical activity specialists) and final year dietetics students (telephone support).	Duration: 12 weeks Frequency: One telephone call, lasting 8-10 minutes. Length of follow-up: Endpoint of the intervention	Diet: mean scores on the Fat and Fibre Barometer, in relation to fat and fibre intake over various time points. Physical activity: frequency of recreation exercise walking and errand walking (both measures in mean total minutes per week).	None
Leigh <i>et al.</i> (1992) USA	Cluster RCT N=2,106 Mailed materials to homes.	Older adults. Mean ages in the groups were 68 years (SDs not reported). Just over half were female (range across groups: 52-55 %). Mean highest education grade level in both groups was 13 (SD not reported).	Intervention (n=1,089): received lifestyle questionnaires, serial personal health risk reports, individualised recommendation letters, newsletters, and a self-management book. Following baseline, the reports and letters were based on change scores over time.	Education Delivered by: Materials mailed to homes.	Duration: 12 months Length of follow-up: Endpoint of the intervention	Smoking: mean difference between groups in number of cigarettes smoked (packs/day). Alcohol use: mean difference in number of alcoholic drinks/day Diet: mean differences in servings/week for: Fat, salt, wholegrain bread, wholegrain cereals, fruits, vegetables, fibre, calcium,	Psychological measures (tension, anger, use of tranquilisers, stress, etc), arthritis, disability/illness, cholesterol, weight (lbs), blood pressure, health risk, global health status.

			<p>Control/comparison group 1 (n=1,017): received no intervention.</p> <p>Control/comparison group 2 (n=1,907): were not made aware of the program. This group was monitored for insurance claims experience only.</p>			<p>red meat, eggs, cheese, and butter.</p> <p>Physical activity: mean difference in totals for exercise and walking (both measured in minutes/week).</p> <p>Regular seat belt use (% of the time): mean differences.</p>	
<p>Leslie <i>et al.</i> (2012)</p> <p>UK</p>	<p>Cluster RCT</p> <p>N=83</p>	<p>People participating in community-based group behavioural counselling sessions for smoking cessation in greater Glasgow.</p> <p>Mean age=50 years; most were female (75%).</p>	<p>Intervention (n=40): Attended smoking cessation sessions (81% also received varenicline or patches). Also received nutritional advice over five weeks (e.g., fruit and vegetable intake, reducing fat intake, portion control), and information about the benefits of physical activity. Five follow-up sessions were also provided. All sessions included advice/information, group discussion, and peer support. Participants also received Healthy Living packs (e.g., recipe cards, dietary information, an activity pack, pedometer).</p> <p>Control/comparison</p>	<p>Education, Enablement, Modelling</p> <p>Delivered by: smoking cessation advisors who received 3-day nutrition and behavioural change training</p>	<p>Duration: 5 weeks</p> <p>Length of follow up: 6 months</p>	<p>Smoking: current smoking (yes/no)</p> <p>Diet: Increased intake in fruits and vegetables; cereal; potatoes, rice or pasta; oil rich fish. Decreased intake of sweet foods; chips; and crisps and savoury snacks.</p>	<p>Changes in body weight (kg), waist circumference (cm), and BMI.</p>

			group (n=43): received same smoking cessation sessions. In total, 86% also received varenicline or patches. Usual care (seven weeks of group sessions) was received. At the time of the study, nutrition/diet was not formally addressed. Advice on physical activity was provided in one session.				
Lombard <i>et al.</i> (2009) Australia	Cluster RCT N=250 Meetings held in primary schools	Parents with children. Mean age=40 years (SD not reported). Most had an annual income of \$AUS 40,000 or more (66%). Most had completed year 12 or higher (74%).	Intervention (n=127): based on the Social Cognitive theory. Participated in group sessions with evidence based messages and clear goals on diet, physical activity, and behaviour change. Self-monitoring of weight was encouraged, as was participation in walking groups. A pedometer was provided and participants were offered ongoing support once a month via text messages, phone calls, or email. Control/comparison group (n=123): received a single 30-minute non-interactive health	Education, training, enablement Delivered by: A dietician.	Duration: 4 months Frequency: Three 1-hour group sessions and one review session. Length of follow-up: Endpoint of the intervention	Diet: mean scores from the Fat Behavior Questionnaire, relating to fat intake. Physical activity: used the IPAQ to assess mean total minutes of walking METs, moderate intensity METs, and vigorous intensity METs per week.	Weight (kg), stages of behaviour change and self-efficacy for changing the behaviours.

			education lecture and a leaflet based on Australian dietary guidelines. Also received a pedometer. No further support provided.				
McCambridge <i>et al.</i> (2011) UK	Cluster RCT N=416 Further education colleges	University students. Most were Black (46-48% in both groups) or White (24-27%) in both groups.	Intervention (n=206): Used motivational interviewing techniques to try and motivate participants to change their risk behaviours. Control/comparison group (n=210): received a drug awareness intervention, based on college-based practitioners' usual practice.	Persuasion Delivered by: Trained researchers and college-based practitioners.	Duration: 1 hour Frequency: 1 session Length of follow-up: 12 months	Smoking: mean 30-day frequency, mean number of cigarettes smoked per day, mean nicotine dependence score. Alcohol use: mean 30-day frequency, mean units drunk in the past week, mean score on the Alcohol Use Disorders Identification Test (AUDIT). Illicit drug use: mean 30-day frequency, mean joints smoked in the past week, mean dependence score.	None
Oenema <i>et al.</i> (2008) Netherlands	RCT N=2,159 Online intervention	General adult population. Most were Native Dutch (96%). Most had a medium (32%) or high level of education (41%).	Intervention (n=1,080): Based on the Precaution Adoption Process Model (PAPM) and the Stage Model. The saturated fat and physical activity modules provided normative and personal behavioural feedback to improve awareness. Recommendations were given for these behaviours. Control/comparison	Education, training, persuasion Delivered by: Computer	Duration: 1 month Length of follow-up: Endpoint of the intervention	Diet: saturated fat intake (assessed using a food frequency questionnaire) Physical activity: engaged in at least 30 minutes of walking (high pace) or moderate or vigorous intensity activity on 5 or more days of the week (yes/no) Smoking: self-reported status as a current smoker or an ex-smoker (who had quit in the past two years).	None

			group (n=1,079): received no intervention.				
OXCHECK study group (1995) UK	RCT N=5,559 Five general practices in Luton and Dunstable	Patients from primary care practices.	All participants received a health check at baseline and the endpoint (4 years later). Intervention (n=2,776): received a) annual health examinations b) a single return visit at three years. Health checks included completion of medical history, a lifestyle questionnaire, and a structured dietary assessment. Nurses were trained to use a patient-centred communication style. Control/comparison group (n=2,783): received no intervention.	Education Delivered by: Nurses.	Duration: 4 years Frequency: Annual check- ups, or a single check-up at 3 years. Length of follow-up: Endpoint of the intervention	Smoking: smoking any form of tobacco at least daily (yes/no). Alcohol use: weekly intake of >21 units (men) or >14 units (women) (yes/no). Diet: use full cream milk, or use butter/hard margarine (yes/no). Physical activity: vigorous exercise less than once a month (yes/no).	BMI, total cholesterol, blood pressure.
Parekh <i>et al.</i> (2012) Australia	RCT N=1,711 Received mailed information (home-based)	Patients from primary care practices. Mean baseline BMI was in the overweight range, (26.4, SD=5.4). Most were employed (over 60% in both groups), married or living as married (70% or more in both groups) and had reached a	Intervention (n=868): Based on the Events of Instruction framework and the 'Elaboration Likelihood Model.' Completed baseline assessment. Received information related to the 10 health behaviours comprising the Prudence Score, and	Education Delivered by: The researchers	Duration: 10 days Frequency: received one set of materials and feedback 10 days later. Length of follow-up: 3 months	Smoking: current smoking (yes/no). Alcohol use: not meeting guidelines for alcohol intake (yes/no). Diet: not meeting guideline recommendations for intake of fish, spread, salt, fruit/vegetables, meat and milk (yes/no).	Weight (unit not reported)

		tertiary Education level (>50% in both groups).	received personalised computer-tailored feedback and advice. Control/comparison group (n=843): received the same as the intervention group except the information related to five health protective behaviours not included in the Prudence Score (sun protection, updating tetanus vaccination, mammogram and Pap smear).			Physical activity: not meeting guidelines for physical activity (yes/no).	
Peragallo <i>et al.</i> (2012) USA	RCT N=548 Community	Black and minority ethnic groups (Hispanic women). Most women had been born in Colombia (34%), Cuba (13%), Peru (8%), the U.S (8%) or the Dominican Republic (6%). Mean education time was between 13 and 14 years in both groups. Less than half were employed (32-34% in both groups). Most had an income of less than \$2000 per month (>65% in both groups). Most lived with a partner (>65% in both groups) and less than half had health insurance (<45%	Intervention (n=274): Based on the social cognitive theory and Freire's pedagogy. HIV risk reduction intervention that was culturally tailored for Hispanic women. Included group sessions with structured activities that would promote self-efficacy for behaviour change. Role play, participatory sessions, videos and discussions were used to build skills. At the 6-month follow-up, women in SEPA were invited to a booster session to discuss topics related to the	Education, training, enablement Delivered by: Bilingual and bicultural Hispanic female facilitators with a range of education.	Duration: 10 hours altogether Frequency: Five sessions (2 hours each) Length of follow-up: 12 months	Alcohol use: got drunk in the past three months (yes/no). Sexual risk behaviour: no use of a condom (yes/no).	Chlamydia infection, intimate partner violence.

		in both groups).	HIV intervention. Control/comparison group (n=274): received a condensed version of the intervention after the final 12-month assessment.				
Rauh <i>et al.</i> (2013) Germany	Cluster RCT N=250 Gynaecological practices.	Pregnant women. Mean age ranged from 31 to 32 years in the study groups. Most were married (58% in both groups) and had graduated from high school (over 60% in both groups).	Intervention (n=167): received individual counselling. This included personalised feedback and advice on the two lifestyle behaviours and weight gain monitoring. Behavioural goals were set, based on baseline data and preferences of the women. Control/comparison group (n=83): usual pre-natal care (this included information about a healthy lifestyle during pregnancy).	Education, training Delivered by: Trained researchers	Duration: Delivered at 20 th and 30 th weeks of gestation Frequency: One 60-minute session and one 30-minute session Length of follow-up: Up to the 38 th week of gestation	Diet: mean energy intake (kcal/day), assessed using 7-day dietary records. Physical activity: median METs (in minutes per week). Assessed using the IPAQ questionnaire.	Inadequate gestational weight gain, weight retention 4 months postpartum, birth weight, birth length, development of gestational diabetes mellitus or impaired glucose intolerance. Also gestational weight gain (kg)
Resnicow <i>et al.</i> (2005) USA	Cluster RCT N=906 Church community and participants' homes	African-American church members. Mean age was 46 years (SD=13). Most were female (76%), and living with a partner/spouse (53%). Most had an annual household income of \$40,000 or more (62%), and had	a) Self-help intervention (n=335): received culturally targeted materials. This included video using biblical and spiritual themes to motivate healthy eating, a healthy eating cookbook, an exercise video, an exercise	Education, persuasion, training, environmental re-structuring, modelling Delivered by: A liason assisted with participant recruitment and retention. The	Duration: not reported. The motivational interviewing was conducted up to 40 weeks. Frequency: 4 motivational telephone calls	Diet: mean servings of fruit/vegetables per day. Physical activity: mean level of activity (minutes per week). Presented as for all activities, >3 METs, and exercise items.	None

		attended some, or completed college (71%).	<p>guide, and an audiocassette of gospel music.</p> <p>b) Self-help and motivational interviewing intervention (n=304): received the same intervention as above but also received telephone support (based on motivational interviewing), which was performed using a semi-structured protocol.</p> <p>Control/comparison group (n=267): received standard intervention of similar intensity/type; received the culturally tailored materials after the final assessment.</p>	motivational interviewing was delivered by trained master's/doctoral level psychologists.	were made. Length of follow-up: 1 year from baseline.		
Ruffin <i>et al.</i> (2011) USA	Cluster RCT N=3,786 Healthcare practices.	<p>Patients from primary care practices.</p> <p>Most were White (91%), married or living with a partner (79% and 80% in both groups). Most had an annual household income of more than \$75,000 (>60% in both groups), and had health insurance (96% and 97% in both groups).</p>	Intervention (n=2,364): involved an interactive online tool that collects and records family history of 6 common diseases and prevention-relevant habits (physical activity, diet, etc). The software generates a 3-tiered risk assessment based on this input and provides tailored preventive health	<p>Education</p> <p>Delivered by: Computer (Physicians and site co-ordinators supervised).</p>	<p>Duration: One session (exact duration not reported).</p> <p>Length of follow-up: 6 months</p>	<p>Smoking: Current smoking (yes/no)</p> <p>Diet: Not meeting the recommendations for 5 or more servings of fruits/vegetables per day (yes/no).</p> <p>Physical activity: 5-6 times a week for 30 or more minutes each time (yes/no0.</p>	Blood pressure, blood cholesterol level, blood glucose levels.

			messages to the user. Control/comparison group (n=1,422): Wait list controls.				
Sallit <i>et al.</i> (2008) USA	RCT N=216 Conference room (location not reported)	Women only. Mean age=34 years (SD not reported). Most were White (73%), had graduated from university (52%) and had an income of more than \$50,000 a year (51%).	Intervention (n=125): received education for nutrition. Also included goal setting, problem solving, and relapse prevention. Based on social cognitive theory. Control/comparison group (n=91): received no intervention.	Education, persuasion, training Delivered by: Graduate students	Duration: 12 weeks Frequency: One session per week Length of follow-up: 9 months	Smoking: mean number of cigarettes smoked per day. Diet: mean scores on the Healthy Eating Index.	Weight (lbs), BMI
Sikkema <i>et al.</i> (1995) USA	RCT N=55 Group sessions (setting not specified - assuming university campus)	University students. Most were White (75%). Of those in a relationship, the length of time ranged from 1 to 10 months, with a mean of 4.63 months (SD=2.60)	Intervention (n=28): received cognitive behavioural therapy in risk behaviour education, behavioural self-management, assertiveness training, decision making, safer-sex negotiation, condom use, and maintenance of risk reduction behaviours. Delivered in group sessions. Control/comparison group (n=27): received a brief educational intervention (one 90-minute lecture) without behavioural procedures for actual training and practice of	Education (both interventions), training, modelling (both relevant to skills training intervention only) Delivered by: A female doctoral student	Duration: 4 weeks Frequency: Once a week (sessions lasted 75-90 minutes). Length of follow-up: 4 weeks	Alcohol use: mean representing four or more alcoholic drinks on one occasion in the past two weeks. Sexual risk behaviour: mean representing sexual intercourse without a condom in the past two weeks. Illicit drug use: mean representing any drug use (cannabis, cocaine) over the past two weeks.	HIV knowledge, self-efficacy for low-risk behaviours, assertiveness, and total vulnerability (self and others).

			skills.				
Simkin-Silverman <i>et al.</i> (1998) USA	RCT N=535 Group meetings (location not reported), assessments were performed at university clinics.	Women only. Participants were predominantly White (no details reported). Most were married (74%), educated beyond high school (85%) and employed for wages (86%).	Intervention (n=260): Phase 1: The first 20 weeks included regular group meetings, with a meal plan adapted to the study goals. Also received education and guidance relating to physical activity. Women self-monitored their physical activity daily over the first 6 months. Phase 2: received refresher programs on nutrition, weight control, and physical activity. All received mail and telephone contact on a regular basis. Incentives and lotteries for healthy lifestyle prizes were offered to enhance attendance and return of data. Control/comparison group (n=275): received assessment only.	Education, persuasion, training, modelling, enablement. Delivered by: Behavioural psychologists and nutritionists	Duration: 54 months Length of follow-up: Endpoint of the intervention	Diet: means for daily calorie intake, dietary calcium (mg per day), supplemental calcium (mg per day), and mean changes from baseline in total dietary fat (grams per day) (this data was reported the for the subgroup of White women only). Physical activity: means for kcal/day spent on walking flights of stairs, walking blocks, sports, and overall activity. Also presented data for an activity monitor used at endpoint (counts per hour).	Weight (lbs), body fat distribution, body composition, blood pressure, lipids, and glucose.
Spring <i>et al.</i> (2012) USA	RCT N=204 Setting not reported, although throughout the	General adult population. Most participants were White (53.4%) or Black (23%). Most (74%) had a university degree.	Intervention, consisted of the following separate groups: (1) increase fruit/vegetable intake and physical activity (n=48)	Education, incentivisation, training, enablement Delivered by: Coaches (bachelor's-level research	Duration: 3 weeks Frequency: not reported Length of	Diet: mean servings of fruit/vegetables per day, and daily percentage of calories from fat. Physical activity: means for physical activity levels	None

	intervention participants provided data through email and telephone contact.		<p>(2) decrease fat and sedentary leisure (n=53) (3) decrease fat and increase physical activity (n= 47) (4) increase fruit/vegetable intake and decrease sedentary leisure (n=56)</p> <p>Intervention was based on the behavioural choice theory. Received tailored behavioural strategies based on baseline data. Participants were expected to reach behavioural targets during treatment week 2 and to maintain them during week 3. Could earn monetary incentives for meeting the goals for both targeted behaviours during the treatment phase, and for uploading data during follow-up times.</p> <p>Control/comparison group: There was no control group.</p>	assistants)	follow-up: 20 weeks	<p>(minutes) per day.</p> <p>Sedentary behaviour: means for sedentary leisure (minutes) per day.</p>	
Staten <i>et al.</i> (2004) USA	RCT N=361 The	General adult population. Most were Hispanic	<p>Interventions (n totals not reported):</p> <p>1. PC group: received</p>	Education, enablement (both received by the PC+HE and PC+HE+CHW interventions only),	Duration: 12 months Length of	Diet: intake of 5 or more servings of fruit/vegetables per day (yes/no). Also reported means for daily	Height, weight (kg), BMI, waist circumference, systolic blood

	interventions were carried out in the clinics, classrooms and through the post.	(74%). The mean annual household income was \$9,737, (SD=4919). Most preferred to speak/use Spanish (63%) language. Some had completed high school (36%), and some were employed (35%). Almost half lived with a spouse or companion (48%) at the time of the study.	health education brochures, had discussions with nurse practitioners about benefits and barriers associated with behaviour change, and received tailored advice about how to change the risk behaviours. 2. PC+HE group: Received the same but also received two health education classes and a monthly health newsletter for 12 months. 3. PC+HE+CHW group: Received same but also received social support from community health workers. Control/comparison group (n total not reported): The PC group acted as the control group.	environmental restructuring (the PC+HE+CHW intervention only) Delivered by: trained clinic technicians, nurse practitioners, project staff and community health workers.	follow-up: Endpoint of the intervention	servings of fruit/vegetables. Physical activity: participating in ≥150 minutes per week (yes/no). Also reported means for moderate-to-vigorous intensity physical activity (minutes per week).	pressure, diastolic blood pressure, total cholesterol, glucose, and triglycerides.
Ussher <i>et al.</i> (2003) UK	RCT N=299 Community-based stop smoking clinic	General adult population Mean ages ranged from 42 to 44 years in both groups (SDs were both 11.1). Most were White (87.9%), employed (67.2%), and married	Intervention group (n=154): received a smoking cessation programme (including nicotine replacement therapy) plus brief exercise counselling. In the first counselling session participants	Education, training, enablement Delivered by: Smoking cessation counsellors and researchers	Duration: 7 weeks Frequency: Individually-based weekly sessions (lasting 15-20 minutes each)	Smoking: continuous smoking abstinence (yes/no) (confirmed by self-report and expired CO concentration). Physical activity: means for hours (in the past week) of moderate/vigorous physical	Weight (kg) and body fat gain (%)

		(52.5%). Mean length of education was 12.8 years (SD=3.1) 1.	received 5 minutes of cognitive-behavioural exercise counselling with decision balance sheets, goal-setting, relapse prevention planning and self-monitoring. Control/comparison group (n=145): received the same smoking cessation programme, but instead of brief exercise counselling, they received health education advice.		Length of follow-up: 2 weeks (outcomes were reported for the endpoint of the intervention).	activity and vigorous physical activity only, mean daily METs, and mean days (in the past week) with 30 minutes or more of moderate/vigorous physical activity.	
van Assema <i>et al.</i> (1994) Netherlands	Cluster RCT N=1,506 The community: included print media, small group activities, lectures, printed materials posted out, and workplace cafeterias.	General adult population (no other details reported).	Intervention group (n total not reported): Based on the Transtheoretical Model and the Model of Behavioral Change. Included newspaper articles and advertisements on the risk behaviours, small group activities (e.g., stop smoking courses, a cooking course), lectures on nutrition, self-help manuals on stopping smoking or eating less fat, letters with suggestions to cafes and discotheques about availability of alcohol-free drinks) and other activities	Education, environmental restructuring, enablement Delivered by: Local coordinators in communities were employed to communicate with local government, the health sector, etc.	Duration: 12 months Length of follow-up: 6 months	Smoking: current smoking (yes/no). Alcohol use: drinking ≥6 glasses of alcohol on a single day at least once a month during the last six months (yes/no). Also reported mean weekly consumption of alcohol (glasses per week). Diet: mean score for fat intake (used a food frequency questionnaire). Use of sunbeds: use of a solarium at least once during the past year (yes/no).	None

			(e.g., advice/healthy recipes to workplace cafeterias). Control/comparison group (n total not reported): received no intervention.				
van Keulen <i>et al.</i> (2011) Netherlands	RCT N=1,629 Participants' homes (contacted by telephone or mailing)	Patients from primary care practices (mean age=57 years, SD=7.13). Half of the participants (52%) were hypertensive, over 90% were natives of Netherlands, over half were classified as having a low education level, and the majority were married/cohabitating. Less than half were in a paid job and a small proportion were diabetic (full data presented in supplementary material).	Intervention groups: a) Tailored print communication (TPC) (n=405) b) Tailored motivational interviewing (TMI) (n=407) c) Combined intervention (n=408) Based on focus group interviews, prior effective theory-based computer-tailored interventions, the I-Change Model and Control Theory. TPC participants received four tailored letters on physical activity and fruit and vegetable consumption. TMI participants received four telephone calls based on motivational interviewing (same behaviours as TPC). Combined intervention participants received	Education (all interventions), persuasion (telephone motivational interviewing intervention only) Delivered by: Motivational interviews were led by university students.	Duration: 43 weeks Length of follow-up: Up to 73 weeks.	Diet: means for fruit intake (servings per day) and vegetable intake (grams per day). Physical activity: mean levels of physical activity (hours per week).	None

			<p>two tailored print letters and two telephone motivational interviews addressing the same two behavioural topics.</p> <p>Control/comparison group (n=409): After the intervention period, control participants received one tailored letter addressing physical activity and fruit and vegetable consumption.</p>				
<p>Vandelanotte <i>et al.</i> (2005 and 2008)</p> <p>Belgium</p>	<p>RCT N=567</p> <p>University computer lab</p>	<p>General adult population.</p> <p>Mean, values for the overall sample were reported for the following: Height (m) = 170.1, SD=8.7 Weight (kg) = 71.3, SD=14.5 BMI (kg/metre squared) = 24.5, SD=4.1 College or university degree = 69.6% Employed = 86.3%</p>	<p>Intervention groups:</p> <ol style="list-style-type: none"> 1. Sequential - physical activity intervention, then fat intake intervention (n=180) 2. Sequential - fat intake intervention, then physical activity intervention (n=197) 3. Simultaneous (both interventions received at same time) (n=190). <p>Partly based on the theory of planned behaviour, and the transtheoretical model. Tailored feedback was provided; consisted of a general introduction, normative feedback relating to PA and fat intake of the</p>	<p>Education</p> <p>Delivered by: Computer</p>	<p>Duration: Two 50-minute sessions</p> <p>Length of follow-up: None. The intervention itself lasted up to 6 months (because the first sequential intervention was performed at 3 months, the second at 6 months.</p>	<p>Diet: means for total fat intake (grams per day) and percentage of daily energy from fat.</p> <p>Physical activity: means (minutes per week) for total physical activity and moderate and high intensity physical activity.</p> <p>In the 2008 paper, they presented results for behaviours as follows:</p> <ul style="list-style-type: none"> -No change (yes/no). -Changed fat intake (reduction of at least 5% of energy derived from total fat intake) (yes/no). -Changed physical activity (increase of at least 60 mins of moderate and high intensity PA per week) 	None

			<p>participant to (current recommendations) and tips and suggestions on how to change the two behaviours.</p> <p>Control/comparison group (n=204): Wait list controls.</p>			<p>(yes/no). -Changed both behaviours (yes/no)</p>	
<p>Walker <i>et al.</i> (2009)</p> <p>USA</p>	<p>Cluster RCT N=225</p> <p>Community (baseline assessments at research offices; all materials mailed to participants).</p>	<p>Women aged 50-69 years, residing in rural Midwestern areas.</p> <p>Mean age was 58 years in both study groups (SDs of 5.4 and 5.7). Most were White non-Hispanic (over 89% in both groups), married (over 67% in both groups), had attended some college or more (over 70% in both groups), and were employed (over 67% in both groups).</p>	<p>Intervention (n=115): based on the Health Promotion Model. Received computer-generated newsletters tailored to the participants. Included advice about the desired behavioural changes. Participants committed to an action plan with self-identified goals for behaviour change. Also received various tools to assist with behaviour change (e.g., food pyramid magnets).</p> <p>Control/comparison group (n=110): received the same intervention but the newsletters were generic, not tailored. No action plan was made.</p>	<p>Education, training, enablement</p> <p>Delivered by: All intervention materials sent to participants' homes and assessments were performed online at the research offices. A research nurse performed biomarker assessments.</p>	<p>Duration: 12 months</p> <p>Frequency: Newsletters provided once every 2 weeks, and then once every 4 weeks (after 6 months).</p> <p>Length of follow-up: 12 months</p>	<p>Diet: at least 2 servings of fruit daily (yes/no), at least 3 servings of vegetables daily (yes/no), at least 3 servings of whole grains daily (yes/no), not >30 % calories from fat daily (yes/no), and <10% calories from saturated fat daily (yes/no). Also reported means for these daily behaviours.</p> <p>Physical activity: at least 150 minutes of moderate or greater intensity activity weekly (yes/no), at least 210 minutes of moderate or greater intensity activity weekly (yes/no). Also reported means for moderate intensity physical activity, stretching exercise and strength exercise (minutes per week), kcals expended per day, sit-and-reach (cm), and timed chairstands (seconds).</p>	<p>BMI, VO₂ max, flexibility, lower body muscular strength, systolic and diastolic blood pressure, % body fat, and levels of total cholesterol, triglycerides, and high-density and low-density lipoprotein. cholesterol.</p>
<p>Weisman <i>et al.</i> (2011)</p>	<p>RCT N=292</p>	<p>Women with low socio-economic status (intervention group)</p>	<p>Intervention group (n=473): Based on the social</p>	<p>Education, incentivisation, training</p>	<p>Duration: 12 weeks</p>	<p>Diet: daily fruit and veg consumption in a typical week (at least one serving</p>	<p>Weight (lbs), BMI, pregnancy weight gain (lbs), and</p>

USA	Community settings (no further detail given)	mean age=28 years, SD=5; control group mean age=26 years, SD=4.7). At 12 months follow-up, most remaining participants were White and non-Hispanic (>85% in both groups). Most were married (>50% in both groups), had attended some college, or graduated from college (>65% in both groups), and were considered poor or near poor (>55% in both groups).	cognitive approach. Group meetings focused on modifying poor nutrition, low physical activity, tobacco and alcohol use and exposure, unhealthy coping with stress, gynecologic infections, and inadequate pregnancy planning or spacing. Intended to motivate women through social support from peers and the lay group facilitators. Control/comparison group (n=219): No details reported.	Delivered by: Lay group facilitators	Frequency: 6 sessions Length of follow-up: Up to 12 months	daily: yes/no). Physical activity: meeting recommended physical activity levels (yes/no).	pregnancy weight gain after controlling for pre-pregnancy obesity. Also assessed whether women read food labels for nutritional values and whether they used daily multivitamins with folic acid.
Werch <i>et al.</i> (2007) USA	RCT N=155 University health care clinic	University students. Mean age was 19 years (SD=1). Most were female (66%), and of White (52%) or another non-Black ethnicity (37%).	All interventions were based on the Behaviour Image Model and Prospect theory. Contract intervention (n=51): Received a contract to improve one of the lifestyle behaviours in the next week. Were given a 12-week calendar log to check off behaviour change goals achieved each week. Consultation	Education, persuasion (both: consultation/combined groups only), training, enablement (both: contract/combined groups only) Delivered by: Trained research staff, acting as fitness specialists	Duration: 1 session, lasting about 25 minutes. Length of follow-up: 4 weeks	Smoking: means for length of cigarette use, 30-day cigarettes frequency, and 30-day cigarette quantity. Alcohol use: means for length of alcohol use, 30-day frequency, and 30-day quantity. Diet: means representing past 7-day servings of fruit/vegetables, and frequency of eating foods containing good carbohydrates and good fats. Physical activity: means for	Quantity of sleep, satisfaction with sleep, health-related quality of life, self control, stress management, and specific health goals.

			<p>intervention (n=52): received tailored, scripted messages using a consultation protocol. This provided tailored content for each risk behaviour and their relation to salient image.</p> <p>Combined intervention (n=52): received the consultation and then the contract with calendar log.</p> <p>Control/comparison group: There was no control group.</p>			<p>length of physical activity, 30-day vigorous intensity physical activity, 30-day moderate intensity physical activity, 7-day strenuous physical activity, 7-day moderate intensity physical activity.</p> <p>Illicit drug use: means for length of cannabis use, 30-day frequency, and 30-day quantity.</p> <p>Drink driving: means representing frequency of riding with a drinking driver and driving while drinking (unclear whether this was assessed for the past 30 days or not).</p>	
<p>Werch <i>et al.</i> (2010)</p> <p>USA</p>	<p>RCT N=303</p> <p>University</p>	<p>University students (mean age=19 years, SD=1.12).</p> <p>Most were Caucasian (71.6%), and lived in a co-ed residence hall (44.8%) or off-campus housing (38.5%).</p>	<p>Intervention group (n total not reported): One-on-one consultation provided content tailored to current health behaviours. Used a consultation protocol with scripted messages. Students were asked to select at least one goal to improve in the next week, including: 1) increase physical activity and exercise, 2) decrease alcohol use, 3) decrease cigarette use, and 4) increase</p>	<p>Education, persuasion, training</p> <p>Delivered by: Trained fitness specialists</p>	<p>Duration: 25 minutes</p> <p>Length of follow-up: 3 months and 12 months</p>	<p>Alcohol use: means for length of alcohol use, heavy use of alcohol (one occasion: ≥5 drinks if male, ≥5 drinks if female), 30-day frequency, and 30-day quantity.</p> <p>Physical activity: mean number of days (in the past 30 days) where moderate intensity physical activity was performed for at least 30 minutes.</p> <p>Illicit drug use: means for length of cannabis use, heavy use of cannabis ("getting really high or stoned"), 30-day frequency,</p>	<p>Sleep and health-related quality of life.</p>

			<p>other fitness behaviours (i.e., nutrition, stress management, and sleep).</p> <p>Control/comparison group (n total not reported): Received a commercially available brochure titled "Fitness" (Krames, 2001). Were asked to read the brochure in the same quiet, private office where the brief interventions had been conducted.</p>			<p>and 30-day quantity.</p> <p>Drink driving: means representing frequency of driving after drinking alcohol in the past 30 days.</p>	
<p>Wilcox <i>et al.</i> (2013)</p> <p>USA</p>	<p>Cluster RCT N=1,257</p> <p>Church setting</p>	<p>Black and minority ethnic groups (mean age=54 years, SD=14)</p> <p>Most were African-American/Black (99.4%). 76% were male, and other socio-demographic characteristics were equally distributed (e.g., marital status, education, annual income, employment, etc).</p>	<p>Intervention group, Intervention (n=38 churches, 749 participants): Churches implemented physical activity and healthy eating activities. Core activities included distribution of bulletin inserts, messages shared from the pulpit, educational materials, creation of a bulletin board, and suggestions regarding physical activity and healthy eating policy/practices that the pastor could set. Each church formed a committee for the program, which developed an action</p>	<p>Education, environmental restructuring, modelling, enablement</p> <p>Delivered by: Committees formed within churches (i.e., lay members)</p>	<p>Duration: 15 months</p> <p>Length of follow-up: Endpoint of the intervention</p>	<p>Diet: mean servings of fruit/vegetables (cups per day), and mean scores for fat- and fibre-related behaviours.</p> <p>Physical activity: means representing total and leisure time moderate- to vigorous-intensity physical activity (hours per week).</p>	<p>Blood pressure</p>

			<p>plan to support behaviour change. Based on social cognitive theory.</p> <p>Control/comparison group, n=36 churches (508 participants): wait list controls.</p>				
<p>Wilkinson <i>et al.</i> (2012)</p> <p>Australia</p>	<p>RCT N=360</p> <p>A maternity hospital in Queensland</p>	<p>Pregnant women (mean age=29.3 years, SD=4.9)</p> <p>Mean BMI was 25.0 (SD=5.4), and over 90% were married. All were recruited at around 14 weeks of pregnancy.</p>	<p>Intervention (n=178): Used reliable screening tools to identify women at risk of not meeting health behaviour guidelines for pregnancy, and gave them nutrition and physical activity information and behaviour change strategies (e.g., goal setting, self-monitoring). Links to more specialised services in supporting behaviour change were also provided. Based on an evidence-based self-management framework.</p> <p>Control/comparison group (n=182): Usual nutrition care and a booklet containing information and guidance about health behaviours.</p>	<p>Education, training, enablement</p> <p>Delivered by: Maternity dietitians</p>	<p>Duration: one 60-minute session</p> <p>Length of follow-up: 12 weeks post-service entry (around 26 weeks of pregnancy)</p>	<p>Smoking: percentage of women smoking before and during pregnancy.</p> <p>Diet: percentage of women meeting pregnancy guidelines for fruit/vegetable intake. Also reported mean servings of fruit/vegetables per day and mean scores representing total diet quality, fat intake and fibre intake.</p> <p>Physical activity: percentage of women meeting pregnancy guidelines for physical activity. Also reported median for weekly minutes of physical activity.</p>	None
Yanek <i>et al.</i> (2001)	Cluster RCT N=267	African American women aged 40 years	All interventions were based on a community	Education, training,	Duration: 20 weeks	Diet: mean changes from baseline in calories	Systolic and diastolic blood

USA	Community (churches).	<p>and over.</p> <p>Mean ages in the study groups ranged from 52 to 54 years (SDs ranged from 9 to 10). Most had completed between 13 and 14 years of education, and were currently employed (range 74-76%). Some were married (range 30-42%).</p>	<p>action and social marketing model. All education was based on social learning theory.</p> <p>Standard intervention (n=188): sessions included weigh-ins, group discussion, a 30-45 minute nutrition education module, and a 30-minute session of moderate intensity exercise.</p> <p>Spiritual intervention (n=188): received the same sessions as the standard intervention group. Sessions also incorporated group prayers and health messages enriched with Scripture. Pastors offered tips on lifestyle behaviours and church bulletins included information on the behaviours, accompanied by salient scriptures.</p> <p>Control/comparison group (n=74): received tailored information on the behaviours, and a toolbox with feedback on screening results (including self-</p>	<p>environmental restructuring (spiritual intervention only), modelling, enablement</p> <p>Delivered by: Female African American health educators from the study staff, pastors and trained church lay leaders.</p>	<p>Frequency: Sessions were held on a weekly basis. (continued to be offered after the 20 week period to intervention participants).</p> <p>Length of follow-up: 12 months</p>	<p>consumed per day, percentage of daily energy from fat, and sodium consumed (mg per day).</p> <p>Physical activity: mean change from baseline in energy expenditure (calories per day).</p>	<p>pressure, waist (inches), body fat (%), low- and high-density lipoprotein cholesterol levels. Also weight (lbs) and BMI.</p>
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			monitoring materials, etc)				
Zhou <i>et al.</i> (2010) China	Cluster RCT N=2,441 Home visits by a village doctor.	Older adults (mean age in both groups=72 years, SD=7.4). Nearly half were female (48.5%), and just over half were male (51.5%). Most were Han Chinese (98.5% of the intervention group, 99.1% of the control group). Most were illiterate (74.4 % in the intervention group, 64.8% in the control group).	Intervention (n=1,082): Doctors made home visits to participants. Health behavioural prescriptions were given to participants, along with advice on how to implement it. Motivational interviewing techniques were used. Based on the Transtheoretical Model. Control/comparison group (n=991): received no home visits. Both groups received a community health campaign (spread of health-related information by local mass media).	Education, persuasion, enablement Delivered by: Village doctors (dispatched by the community health service centre).	Duration: 9 months Length of follow-up: Endpoint of the intervention	Smoking: smoked at least one cigarette per day for >1 year (yes/no). Alcohol use: consumed at least one alcoholic drink per day for >3 months (yes/no). Diet: ate fresh fruit/vegetables more than once per day for ≥3 months (yes/no), ate brined vegetables more than once a day for ≥3 months (yes/no), salt intake (defined as heavy: >20 grams per day, moderate: >12 grams per day, or light: <12 grams per day). Physical activity: Physical activity more than twice a week ≥3 months (yes/no). The results for this outcome were not reported.	Quality of life, stages of behaviour change, and perceived health status.

Appendix 15: Review 2 – Quality assessment results

	Random sequence generation (selection bias)	Allocation concealment (selection bias)	Blinding of participants and personnel (performance bias)	Blinding of outcome assessment (detection bias)	Incomplete outcome data (attrition bias)	Selective reporting (reporting bias)	Other bias
Aldana 2006	?	?	?	?	?	?	?
Braithwaite 2006	?	?	?	?	?	?	?
Burke 2013	?	?	?	?	?	?	?
Burton 1995	?	?	?	?	?	?	?
Campbell 2004	?	?	?	?	?	?	?
Campo 2012	?	?	?	?	?	?	?
De Vries 2008	?	?	?	?	?	?	?
Diez 2012	?	?	?	?	?	?	?
Emmons 2005	?	?	?	?	?	?	?
Franke 2008	?	?	?	?	?	?	?
Gow 2010	?	?	?	?	?	?	?
Greene 2012	?	?	?	?	?	?	?
Hillier 2012	?	?	?	?	?	?	?
Hivert 2007	?	?	?	?	?	?	?
Hui 2011	?	?	?	?	?	?	?
Jackson 2011	?	?	?	?	?	?	?
Jacobs 2011	?	?	?	?	?	?	?
Jeffery 1999	?	?	?	?	?	?	?
Keyserling 2008	?	?	?	?	?	?	?
Kreuter 1996	?	?	?	?	?	?	?
Kypri 2005	?	?	?	?	?	?	?
Lachausse 2012	?	?	?	?	?	?	?
Lee 2011	?	?	?	?	?	?	?
Leigh 1992	?	?	?	?	?	?	?
Leslie 2012	?	?	?	?	?	?	?
Lombard 2009	?	?	?	?	?	?	?
McCambridge 2011	?	?	?	?	?	?	?
Oenema 2008	?	?	?	?	?	?	?
OXCHECK study group 1995	?	?	?	?	?	?	?
Parekh 2012	?	?	?	?	?	?	?
Peragallo 2012	?	?	?	?	?	?	?
Rauh 2013	?	?	?	?	?	?	?
Resnicow 2005	?	?	?	?	?	?	?
Ruffin 2011	?	?	?	?	?	?	?
Salit 2008	?	?	?	?	?	?	?
Siddkema 1995	?	?	?	?	?	?	?
Simkin-Silverman 1998	?	?	?	?	?	?	?
Spring 2012	?	?	?	?	?	?	?
Staten 2004	?	?	?	?	?	?	?
Ussher 2003	?	?	?	?	?	?	?
Van Assema 2004	?	?	?	?	?	?	?
Vandelanotte 200	?	?	?	?	?	?	?
Van Keulen 2011	?	?	?	?	?	?	?
Walker 2009	?	?	?	?	?	?	?
Weisman 2011	?	?	?	?	?	?	?
Werch 2007	?	?	?	?	?	?	?
Werch 2010	?	?	?	?	?	?	?
Wilcox 2013	?	?	?	?	?	?	?
Wilkinson 2012	?	?	?	?	?	?	?
Yanek 2001	?	?	?	?	?	?	?
Zhou 2010	?	?	?	?	?	?	?

Figure 15.1. Quality assessment results for the included studies (50 in total)

Appendix 16: Review 2 – Forest plots for the main (univariate) meta-analyses

Dichotomous data

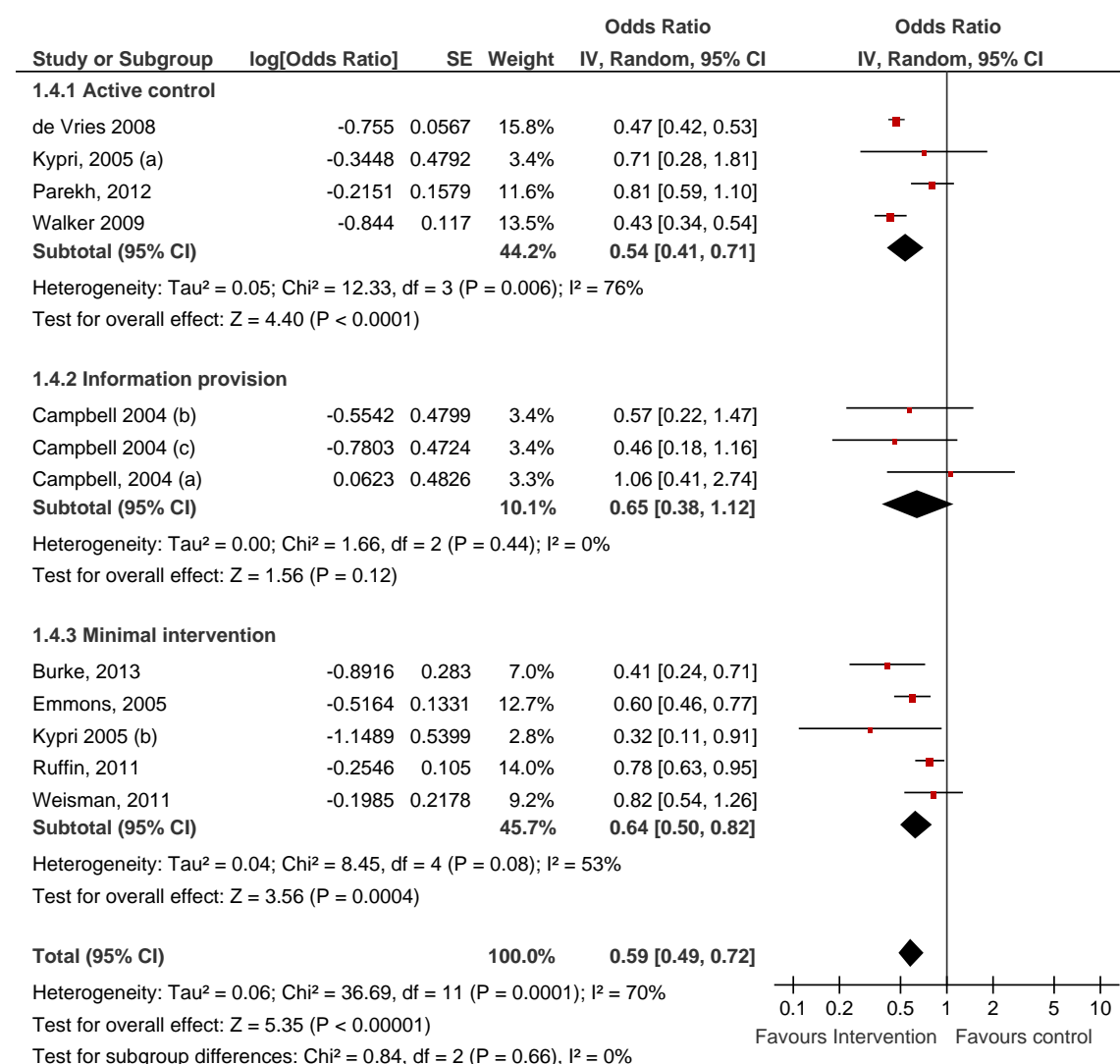


Figure 16.1. Odds ratios for people adhering to fruit and vegetable intake recommendations at final assessment times.

Note: The two comparisons for Kypri *et al.* involved the same intervention group but different control groups: (a) an active control (assessment only), (b) a minimal intervention control group. The three comparisons for Campbell *et al.* all involved the same control group but different intervention groups: (a) lay health advisor intervention, (b) tailored print and video intervention, (c) combined intervention.

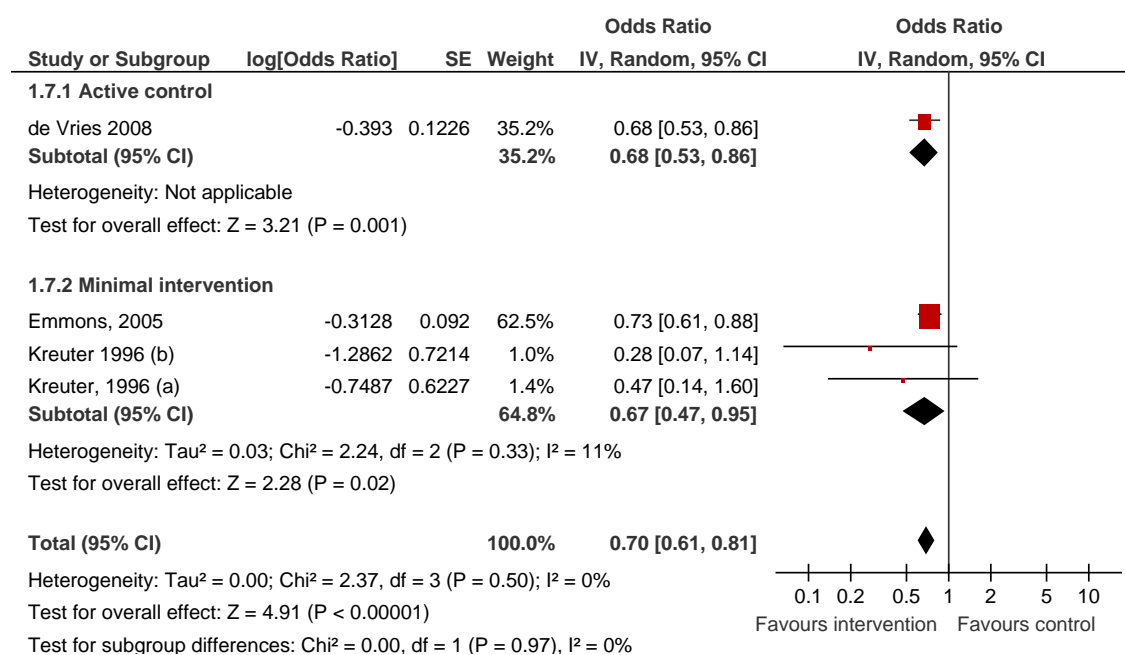


Figure 16.2. Odds ratios for people adhering to fat/meat/dairy intake recommendations at final assessment times.

Note: The two comparisons for Kreuter *et al.* involved the same control group but different intervention groups: (a) typical health risk appraisal, (b) enhanced health risk appraisal.

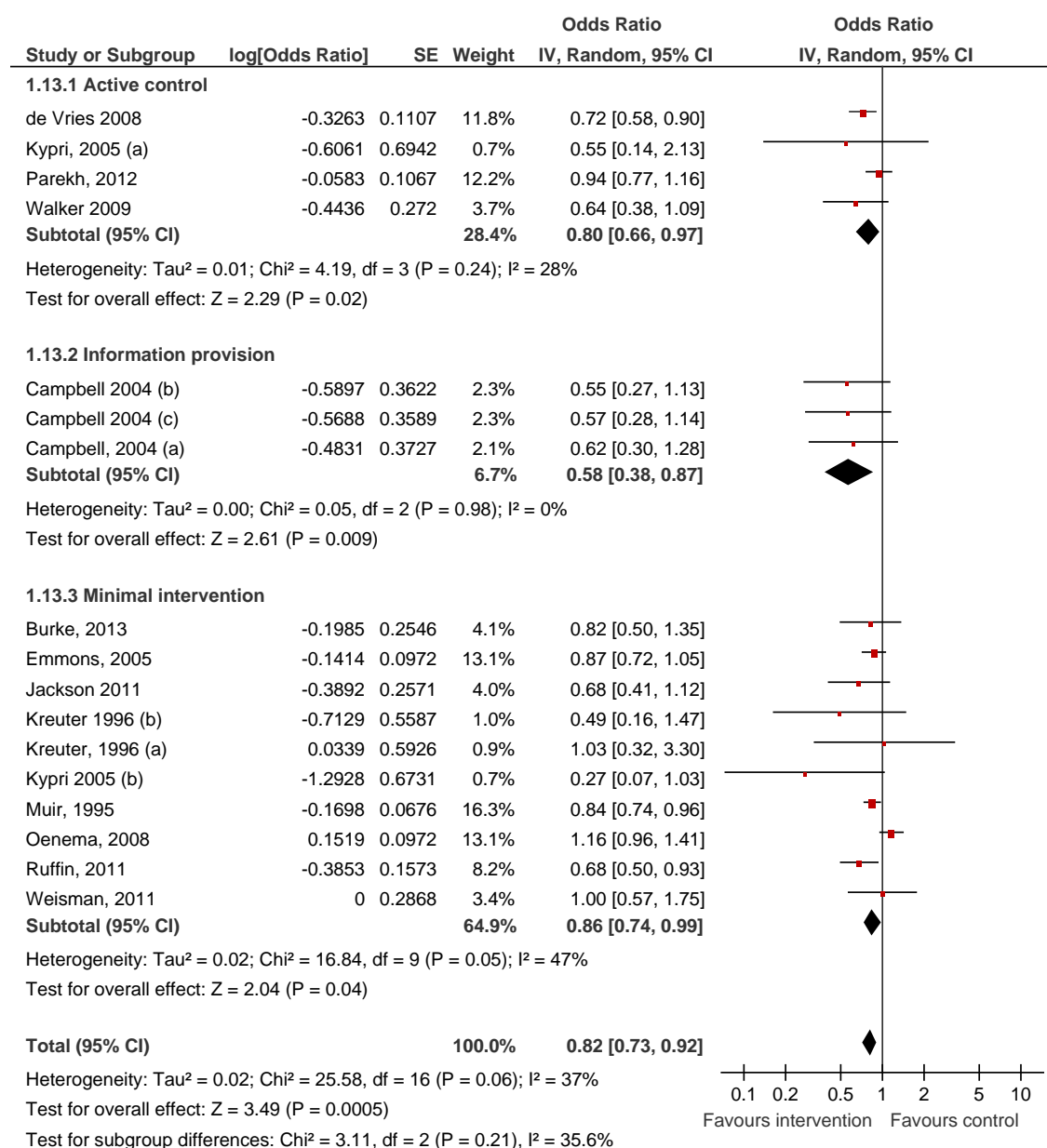


Figure 16.3. Odds ratios for people adhering to physical activity level recommendations at final assessment times.

Note: The two comparisons for Kypri *et al.* involved the same intervention group but different control groups: (a) an active control (assessment only), (b) a minimal intervention control group. Two studies in this meta-analysis each reported multiple comparisons involving one control group and a different intervention group each time. In Campbell *et al.* the intervention groups were: (a) lay health advisor intervention, (b) tailored print and video intervention, (c) combined intervention. The intervention groups in Kreuter *et al.* were (a) typical health risk appraisal, (b) enhanced health risk appraisal.

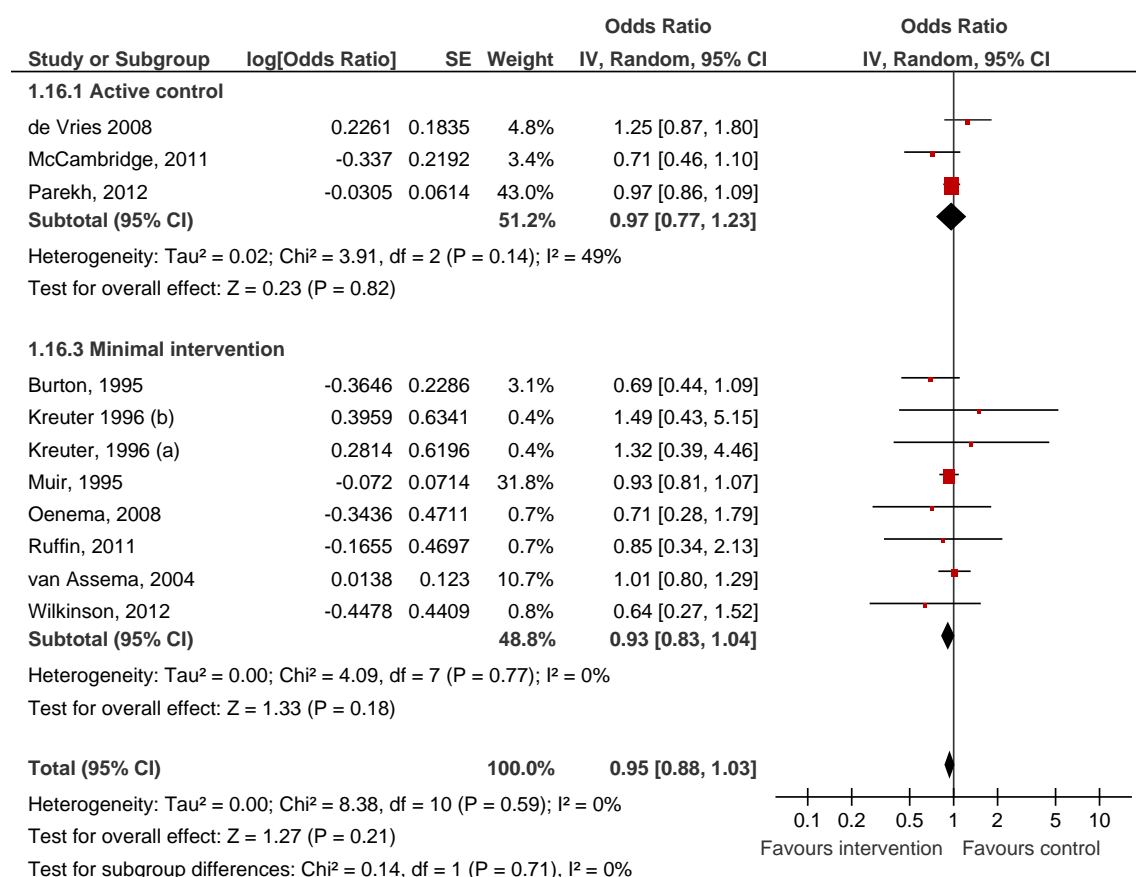


Figure 16.4. Odds ratios for people adhering to non-smoking recommendations at final assessment times.

Note: The two comparisons for Kreuter *et al.* involved the same control group but different intervention groups: (a) typical health risk appraisal, (b) enhanced health risk appraisal.

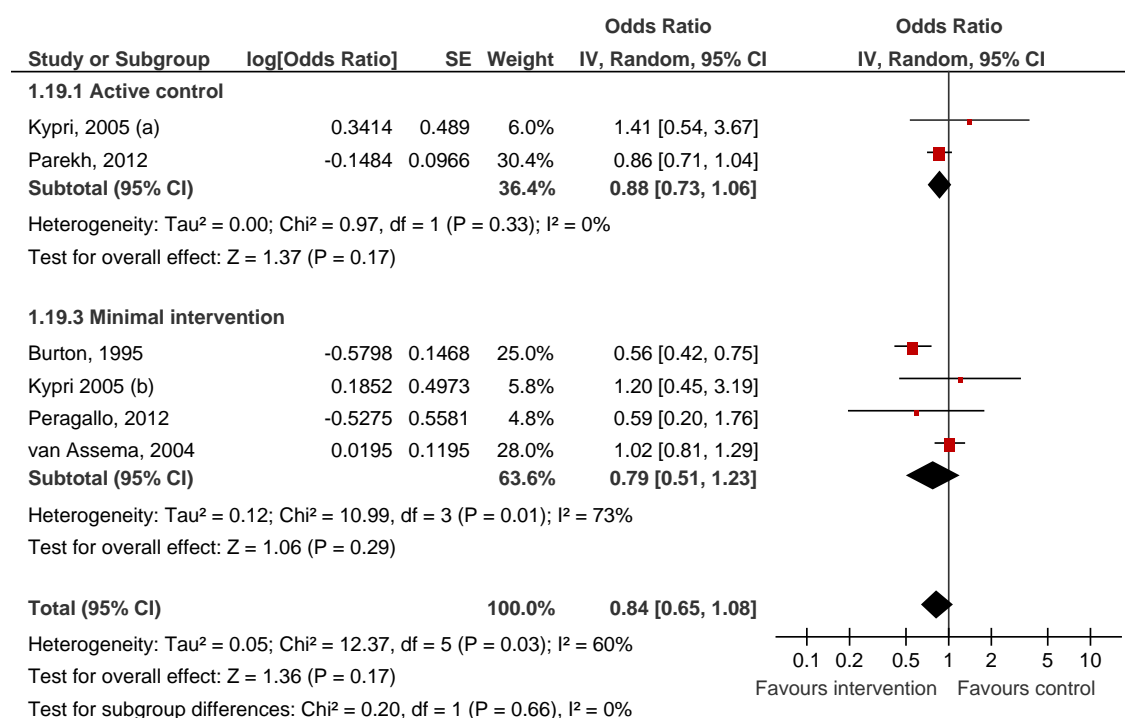


Figure 16.5. Odds ratios for people adhering to alcohol intake recommendations at final assessment times.

Note: The two comparisons for Kypri *et al.* involved the same intervention group but different control groups: (a) an active control (assessment only), (b) a minimal intervention control group.

Continuous data

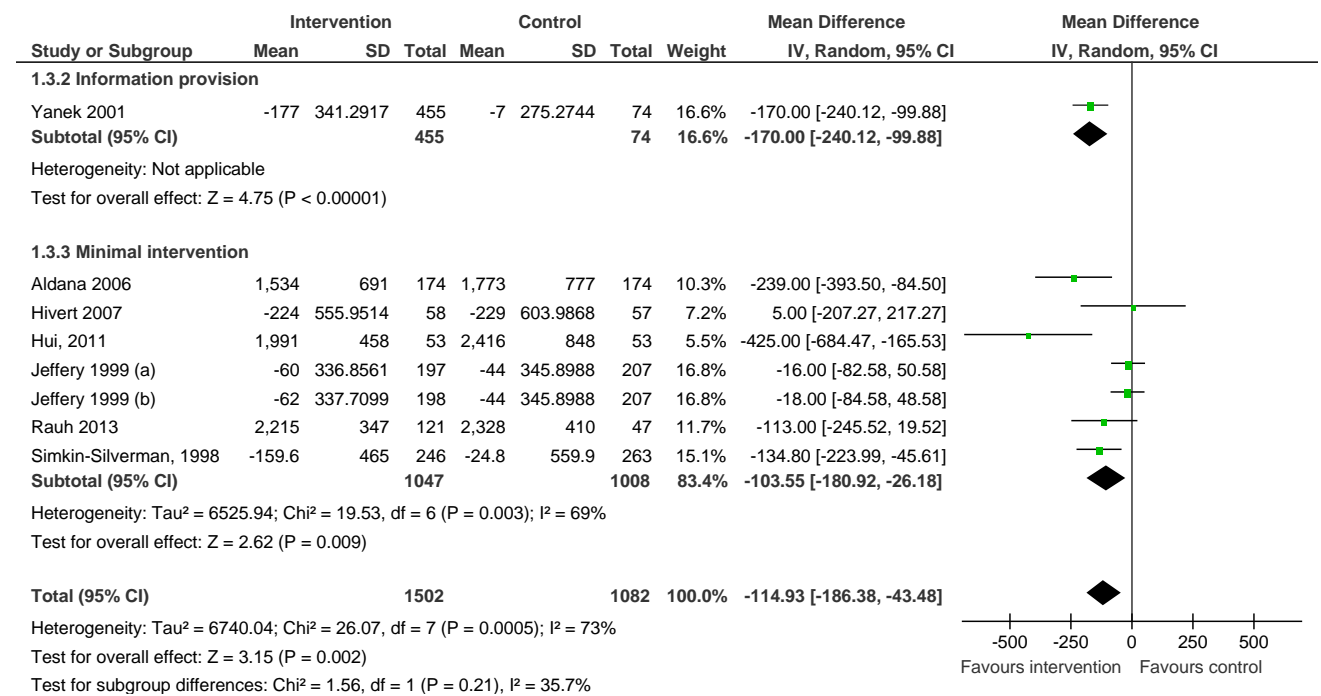


Figure 16.6. Differences between groups in average calorie intake at final assessment times.

Note: The two comparisons for Jeffery *et al.* involved the same control group but different intervention groups: (a) education intervention, (b) education and incentive intervention.

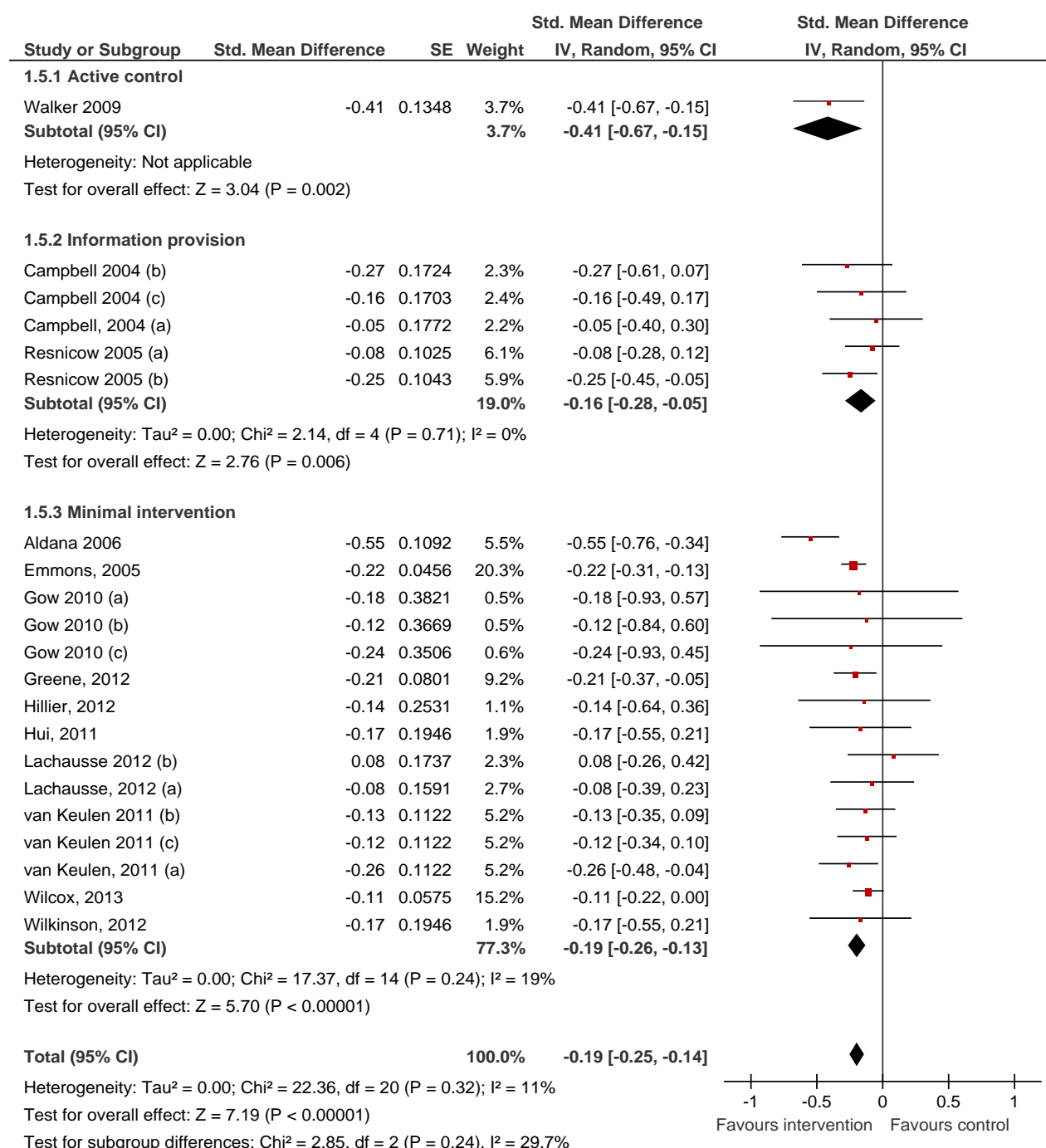


Figure 16.7. Differences between groups in average fruit and vegetable intake at final assessment times.

Note: Five studies in this meta-analysis each reported multiple comparisons involving one control group and a different intervention group each time. In Campbell *et al.* the intervention groups were: (a) lay health advisor intervention, (b) tailored print and video intervention, (c) combined intervention. The groups for Resnicow *et al.* were: (a) self-help intervention, (b) self-help intervention plus motivational interviewing. The groups for Gow *et al.* were: (a) Internet intervention, (b) feedback intervention, (c) combined intervention. Intervention groups in Lachausse *et al.* were: (a) Internet intervention, (b) on-campus intervention. Groups for van Keulen *et al.* included: (a) tailored print communication intervention, (b) tailored motivational interviewing intervention, (c) combined intervention.

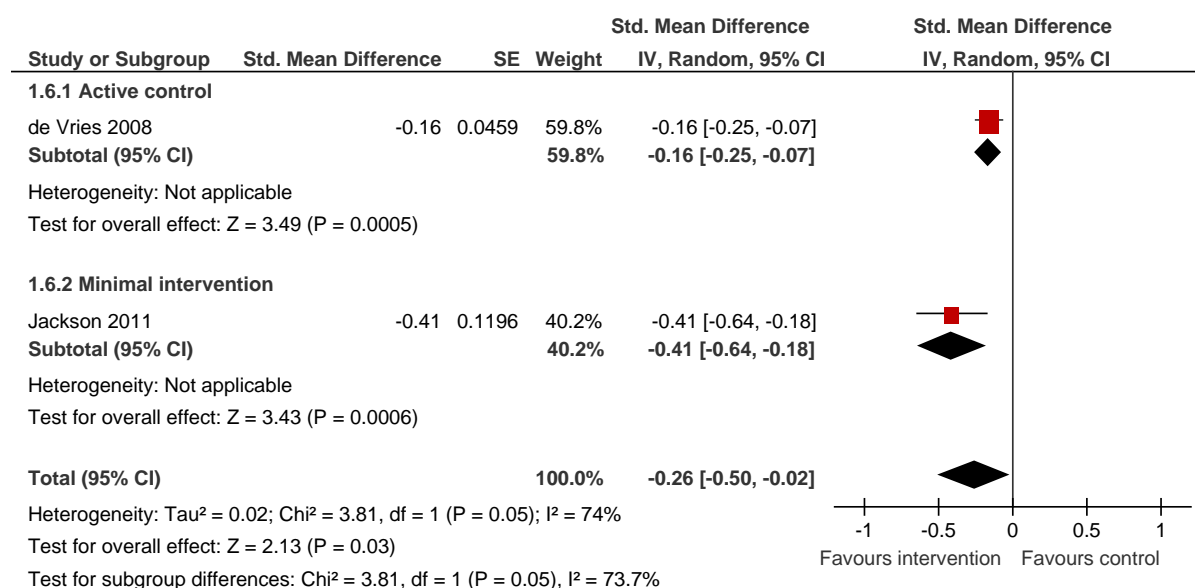


Figure 16.8. Differences between groups in mean changes from baseline in average fruit and vegetable intake.

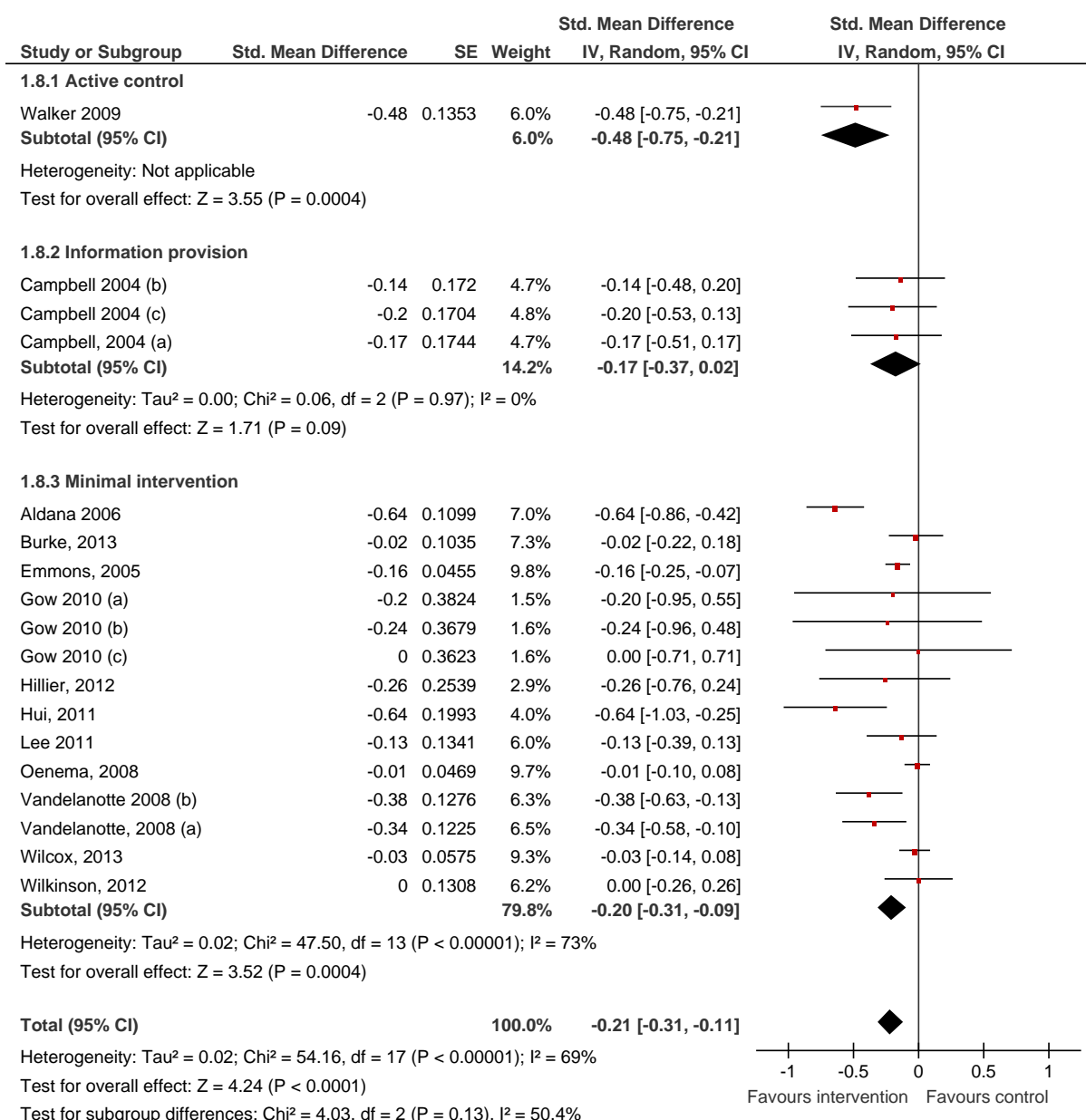


Figure 16.9. Differences between groups in average fat/meat/dairy intake at final assessment times.

Note: Three studies in this meta-analysis each reported multiple comparisons involving one control group and a different intervention group each time. In Campbell *et al.* the intervention groups were: (a) lay health advisor intervention, (b) tailored print and video intervention, (c) combined intervention. The groups for Gow *et al.* were: (a) Internet intervention, (b) feedback intervention, (c) combined intervention. Intervention groups in Vandelanotte *et al.* were: (a) sequential intervention, (b) simultaneous intervention.

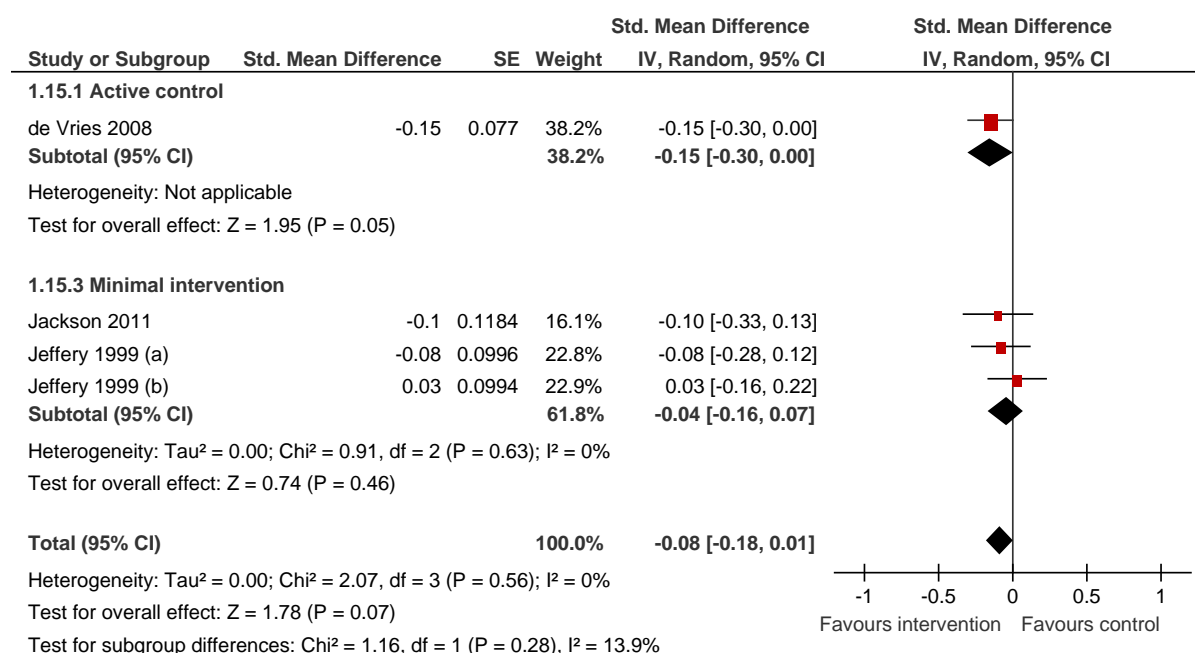


Figure 16.10. Differences between groups in mean changes from baseline in average fat/meat/dairy intake.

Note: The two comparisons for Jeffery *et al.* involved the same control group but different intervention groups: (a) education intervention, (b) education and incentive intervention.

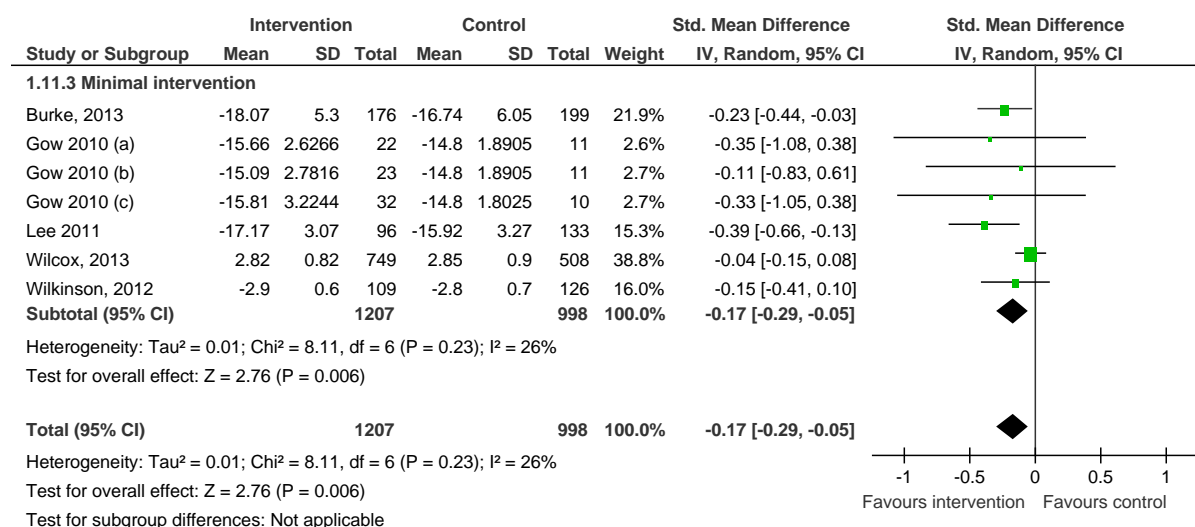


Figure 16.11. Differences between groups in average fibre intake at final assessment times.

Note: The three comparisons for Gow *et al.* involved the same control group but different intervention groups: (a) Internet intervention, (b) feedback intervention, (c) combined intervention.

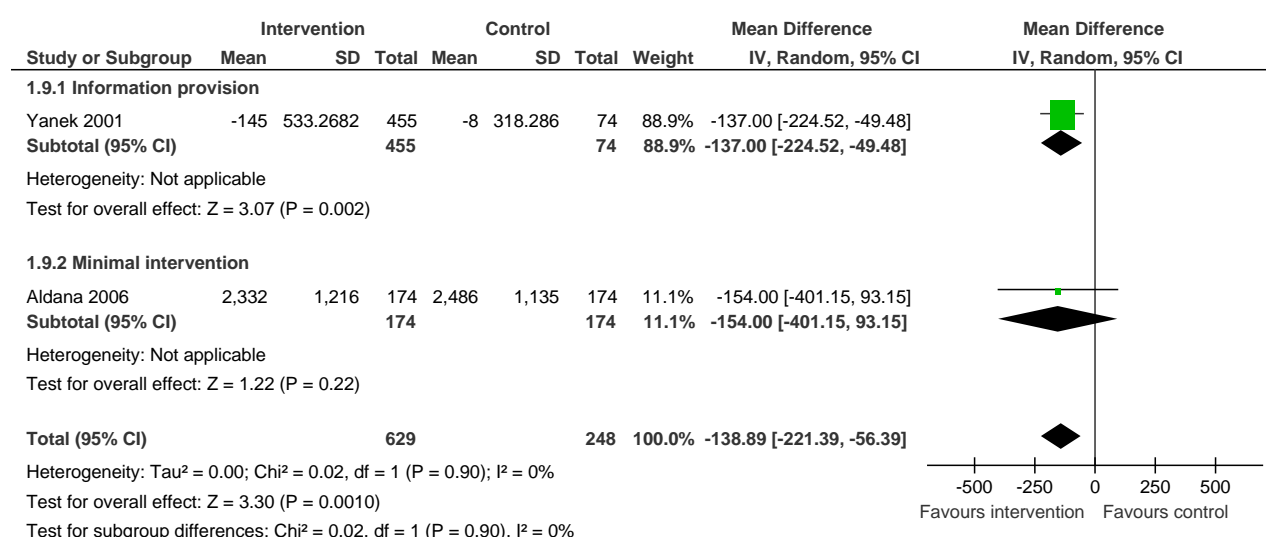


Figure 16.12. Differences between groups in average sodium intake at final assessment times.

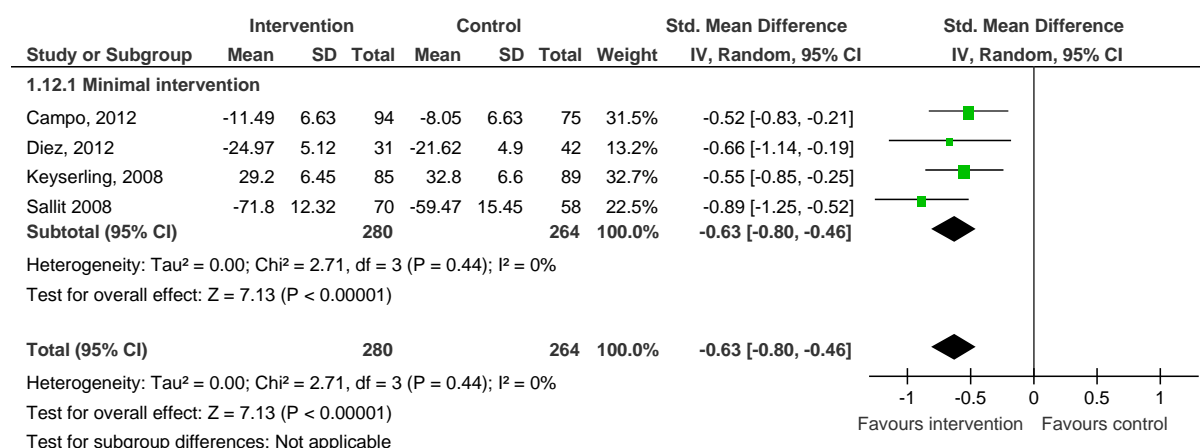


Figure 16.13. Differences between groups in average diet scores at final assessment times.

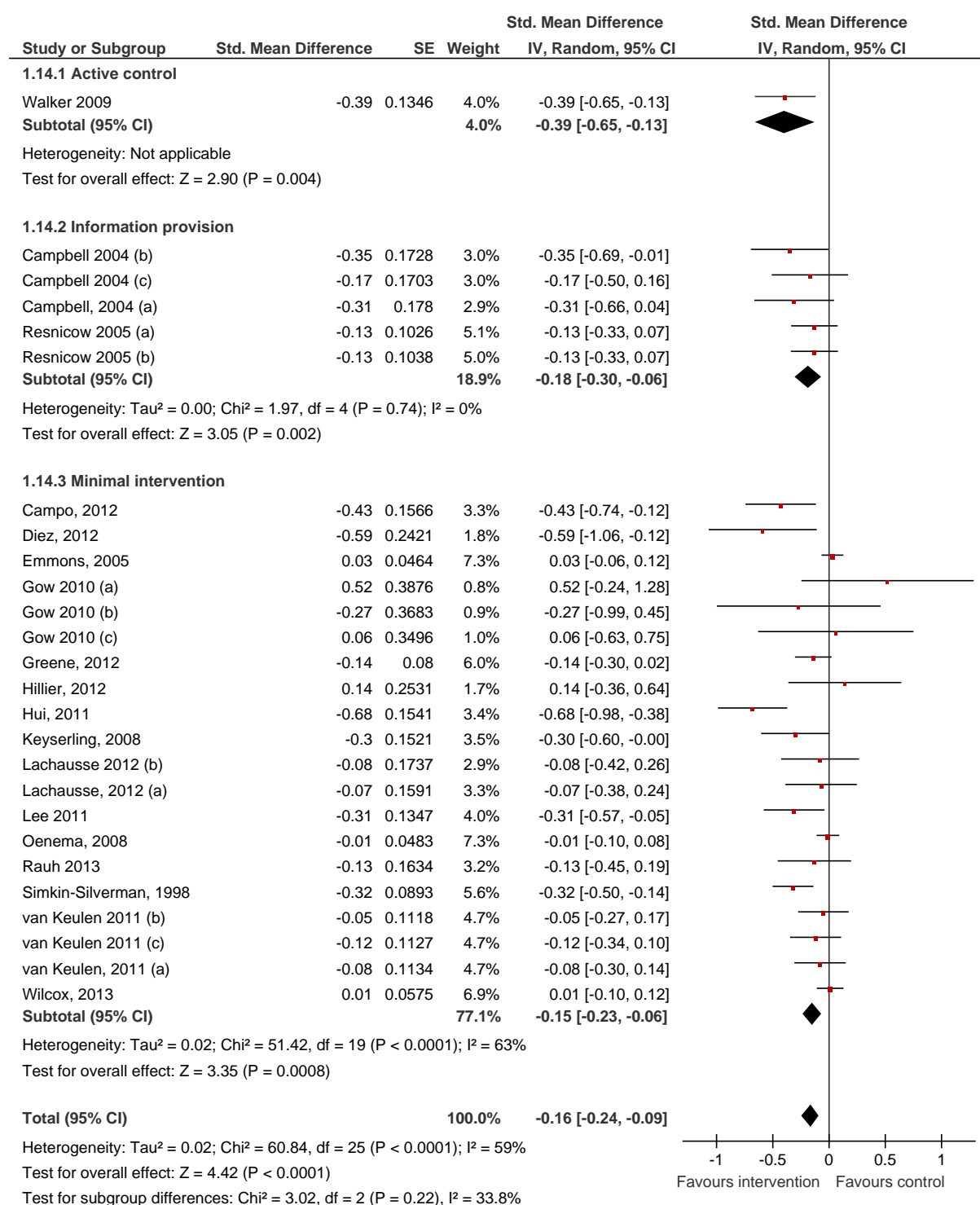


Figure 16.14. Differences between groups in average physical activity levels at final assessment times.

Note: Five studies in this meta-analysis each reported multiple comparisons involving one control group and a different intervention group each time. In Campbell *et al.* the intervention groups were: (a) lay health advisor intervention, (b) tailored print and video intervention, (c) combined intervention. The groups for Resnicow *et al.* were: (a) self-help intervention and (b) self-help intervention plus motivational interviewing. The groups for Gow *et al.* were: (a) Internet intervention, (b) feedback intervention, (c) combined intervention. Intervention groups in Lachausse *et al.* were: (a) Internet intervention, (b) on-campus intervention. Groups for van Keulen *et al.* included: (a) tailored print communication intervention, (b) tailored motivational interviewing intervention, (c) combined intervention.

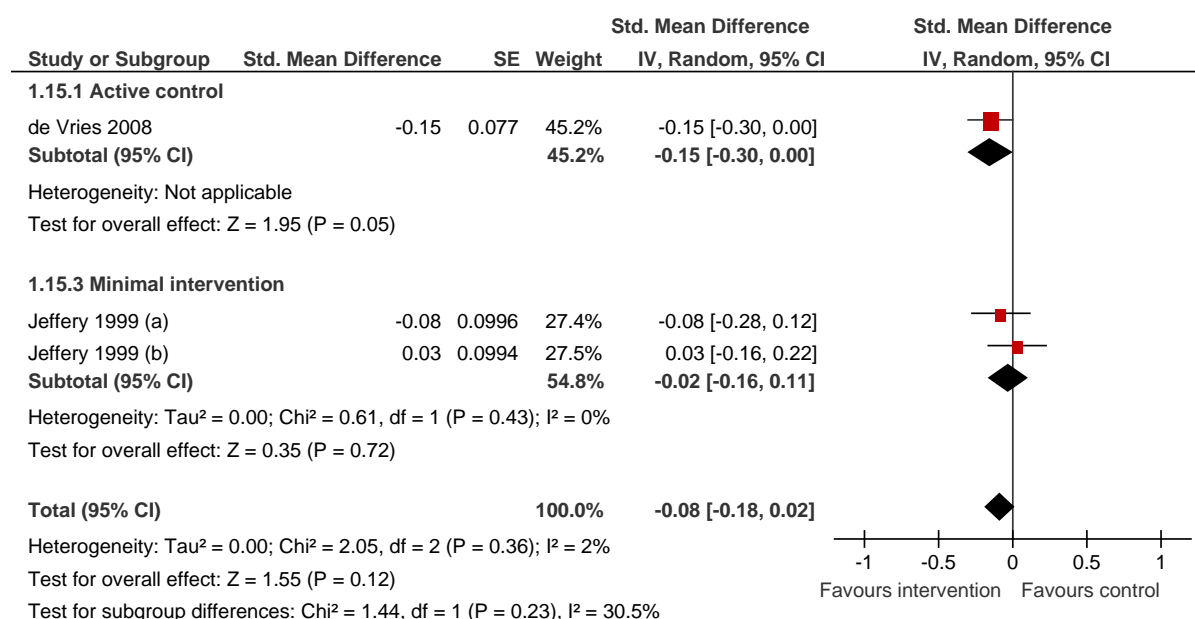


Figure 16.15. Differences between groups in mean changes from baseline in average physical activity levels.

Note: The two comparisons for Jeffery *et al.* involved the same control group but different intervention groups: (a) education intervention, (b) education and incentive intervention.

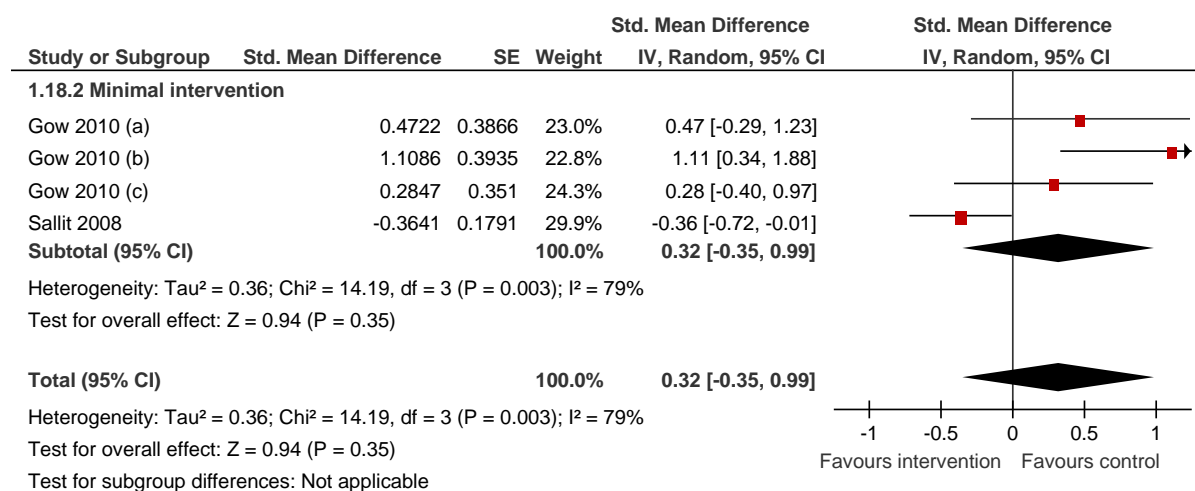


Figure 16.16. Differences between groups in smoking prevalence at final assessment times.

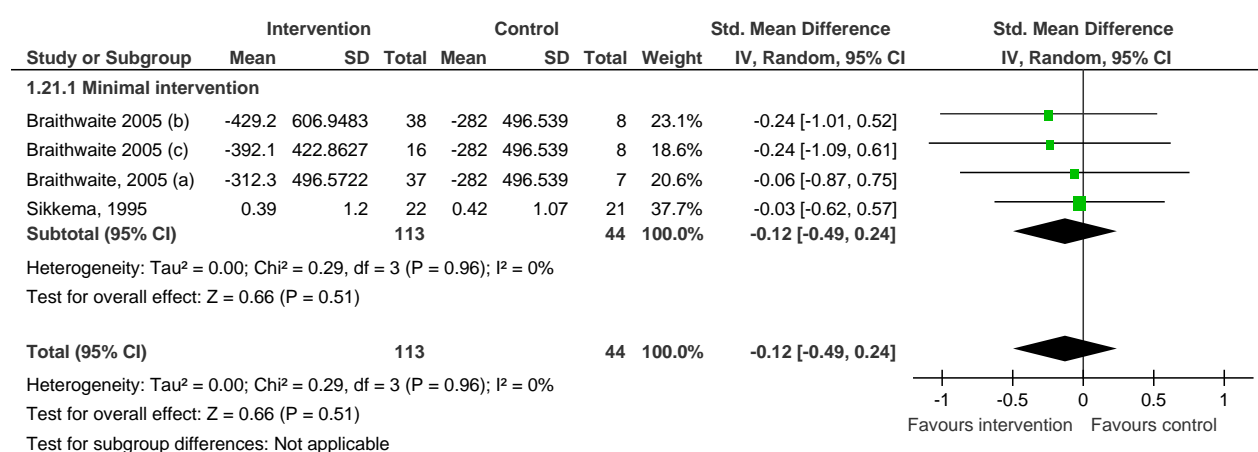


Figure 16.17. Differences between groups in prevalence of sexual risk behaviours at final assessment times.

Note: The three comparisons for Braithwaite *et al.* involved the same control group but different intervention groups: (a) didactic intervention, (b) peer negative intervention, (c) peer positive intervention.

Non-behavioural outcomes (continuous data)

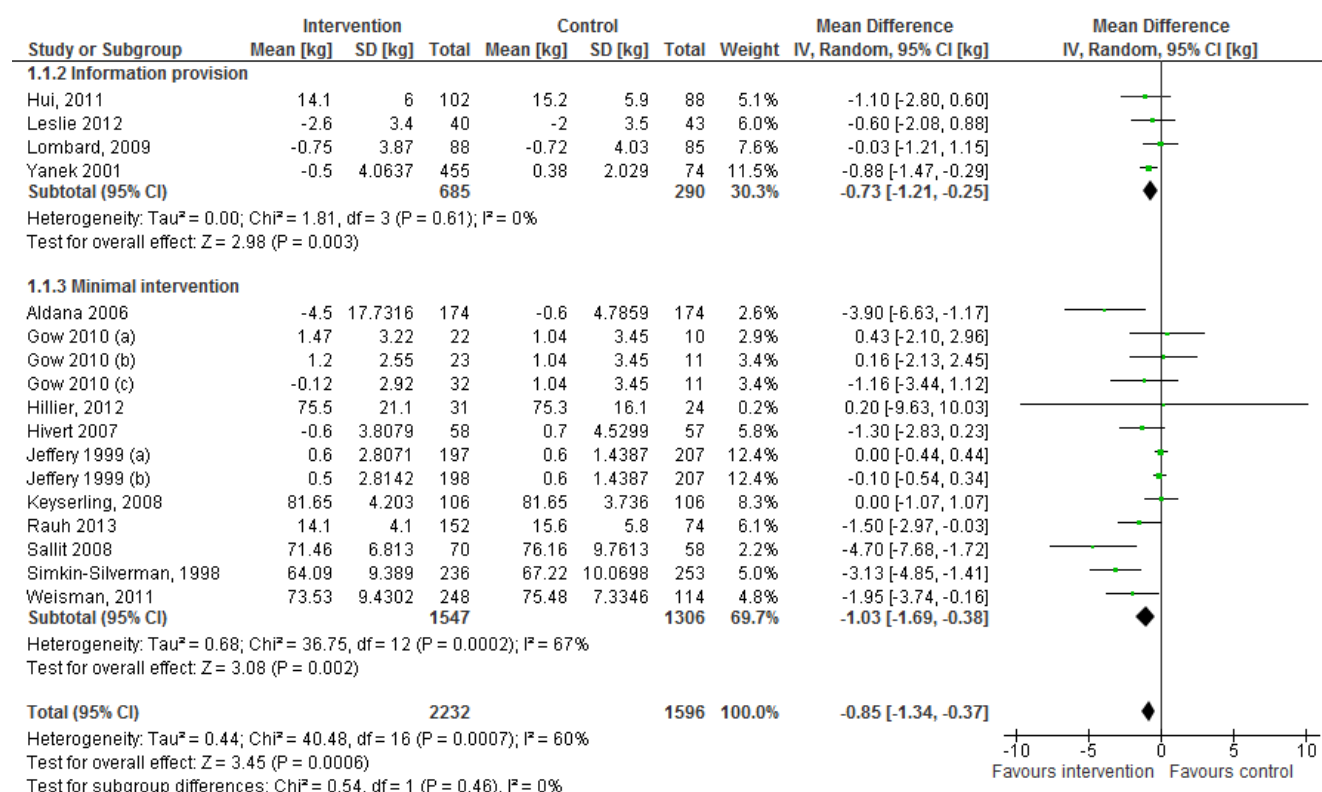


Figure 16.18. Differences between groups in body weight (kg) at final assessment times.

Note: Two studies in this meta-analysis each reported multiple comparisons involving one control group and a different intervention group each time. In Gow *et al.* the intervention groups were: (a) Internet intervention, (b) feedback intervention, (c) combined intervention. Intervention groups in Jeffery *et al.* were: (a) education intervention, (b) education and incentive intervention.

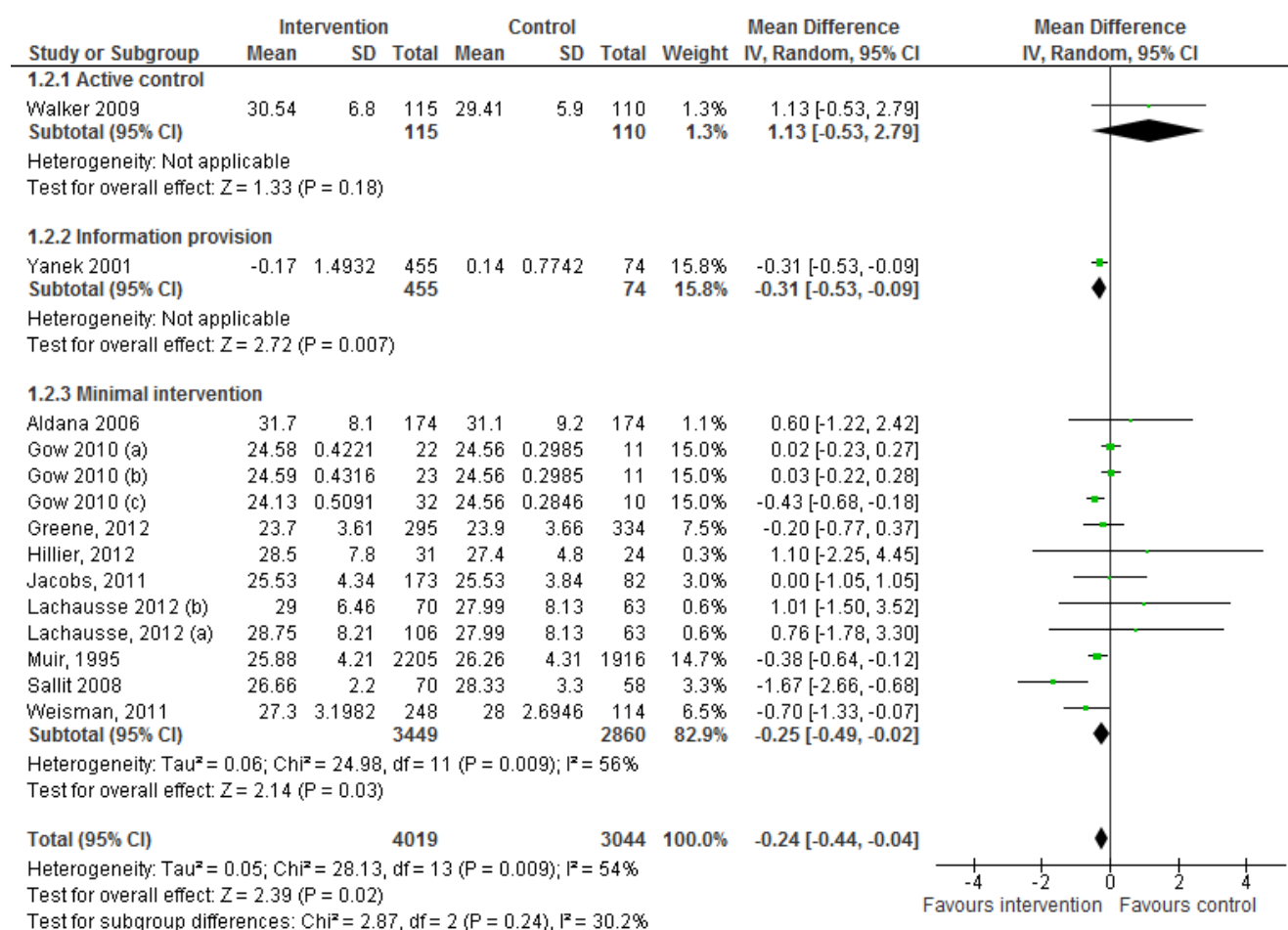


Figure 16.19. Differences between groups in body mass index (kg/m^2) at final assessment times.

Note: Two studies in this meta-analysis each reported multiple comparisons involving one control group and a different intervention group each time. In Gow *et al.* the intervention groups were: (a) Internet intervention, (b) feedback intervention, (c) combined intervention. Intervention groups in Lachausse *et al.* were: (a) Internet intervention, (b) on-campus intervention.

Appendix 17: Review 2 – Rationale for not including studies in the meta-analyses

Diet: Fruit and vegetable intake

Five studies reported additional data that could not be included in the meta-analyses (Franko *et al.*, 2008; Jacobs *et al.*, 2011; Leigh *et al.*, 1992; Leslie *et al.*, 2012; Wilkinson *et al.*, 2012; Zhou *et al.*, 2010). Franko *et al.* reported results (mean differences and standard error values) for two comparisons, comparing each intervention with the control group separately. We could not include these data in the relevant meta-analysis because it would have meant that the control group's data would have been used twice. The data from Jacobs *et al.*'s and Wilkinson *et al.*'s studies were reported as mean percentage changes, and it was not possible to convert these into a unit that could be meta-analysed. During data extraction, we spotted errors in the calculated data reported by Leigh *et al.* (1992) and decided that it was more appropriate to analyse their data narratively. Zhou *et al.* (2010) had performed an ordinal logistic regression analysis to give odds ratios demonstrating increase, no change, or decrease in health behaviours. These data were considered as giving slightly different meanings than other studies' data so it was considered more appropriate to report them narratively. We did not include Leslie *et al.*'s data in the meta-analyses, as the majority of participants received a pharmacological intervention (nicotine replacement therapy).

Diet: intake of fat, meat and dairy

Nine studies reported additional data that could not be included in the meta-analyses (OXCHECK study group, 1995; Jacobs *et al.*, 2011; Hui *et al.*, 2012; Leigh *et al.*, 1992; Leslie *et al.*, 2012; Lombard *et al.*, 2009; Parekh *et al.*, 2012; Simkin-Silverman *et al.*, 1998; van Assema *et al.*, 1994; Walker *et al.*, 2009). The OXCHECK study reported rates (%) of full cream milk and butter/hard margarine consumption, as this was the only study to report these outcomes their data were not considered suitable for meta-analysis. The data from Jacobs *et al.*'s study were reported as mean percentage changes, and it was not possible to convert these into a unit that could be meta-analysed. Hui *et al.* reported an extensive amount of data in relation to their participants' daily servings of foods and nutrients. Where data were deemed similar to most other studies' dietary outcomes, they were included in the relevant meta-analysis. The data that have been narratively reported below relate to all remaining dietary outcomes not included in meta-analyses. During data extraction, we spotted errors in the calculated data reported by Leigh *et al.* and decided that it was more appropriate to analyse their data narratively. Lombard *et al.* reported fat-related dietary behaviours (e.g., replace high fat foods, modify meat intake) which were very different to other studies' outcomes of fat intake. Thus, we decided not to include these data in the relevant meta-analysis but reported them narratively instead. Similarly, Parekh *et al.*'s data were reported narratively because they presented individual odds ratios and 95% confidence intervals for several fat-related dietary outcomes that most other studies had not measured (e.g., use of spread, milk intake). Some of Walker *et al.*'s data could be included in the meta-analysis of post-intervention values for fat intake. However, they also reported rates (%) for fat intake outcomes that no other studies had measured (see below), so these data were narratively reported. The fat intake data from Simkin-Silverman *et al.* could not be included in the meta-analysis because it was reported for a subgroup of White women, and was not representative of the total sample. We did not include Leslie *et al.*'s data in the meta-analyses, as the majority of participants received a pharmacological intervention (nicotine replacement therapy).

Physical activity

Six studies reported additional data that could not be included in the meta-analysis (Franko *et al.*, 2008; Leigh *et al.*, 1992; Lombard *et al.*, 2009; Ussher *et al.*, 2002; Vandelanotte *et al.*, 2005; Wilkinson *et al.*, 2012). Franko *et al.* reported results (mean differences and standard error values)

for two comparisons, comparing each intervention with the control group separately. We were unable to include these data in the relevant meta-analysis because to do so would have meant that the control group's data would have been double counted. During data extraction, we had spotted errors in the calculated data reported by Leigh *et al.* and decided that it was more appropriate to report their data narratively. Lombard *et al.* reported their data as MET-minutes for walking, and moderate and vigorous intensity physical activity. These outcomes were considered too different from other studies in the relevant meta-analysis, so their data were reported narratively (below). At the beginning of the synthesis process, we decided not to include Ussher *et al.*'s data in any of the meta-analyses because this was the only study whose intervention included a pharmacological element (nicotine replacement therapy). Due to a large imbalance in the total physical activity data reported for groups in the Vandelandotte *et al.* study, we considered it more appropriate to use the mean change from baseline results for each group in a meta-analysis. However, no estimation of standard errors, standard deviations, etc, were provided, and there were so few studies in the meta-analysis that we did not consider it appropriate to impute standard errors. Instead, we report the results narratively. The data from Wilkinson *et al.*'s study were reported as mean percentage changes, and it was not possible to convert these into a unit that could be meta-analysed.

Smoking

The data from five studies could not be included in the meta-analyses (de Vries *et al.*, 2008; McCambridge *et al.*, 2011; Leigh *et al.*, 1992; Leslie *et al.*, 2012; Ussher *et al.*, 2002; Zhou *et al.*, 2010). The continuous smoking outcome reported by de Vries *et al.* was considered to be too different from the other studies to be included in the relevant meta-analysis, so these data were synthesised narratively instead. Smoking prevalence data from the McCambridge *et al.* study were included in one of the meta-analyses, and additional data were available for the 30-day frequency of cigarettes smoked. However, these additional data were only reported for a subgroup of participants who reported being smokers at baseline, so they were not included in the relevant meta-analysis. During data extraction, we spotted errors in the calculated data reported by Leigh *et al.* and decided that it was more appropriate to report their data narratively. At the beginning of the synthesis process, we decided not to include Ussher *et al.*'s and Leslie *et al.*'s data in any of the meta-analyses because these studies included a pharmacological element (nicotine replacement therapy) for all or the majority of participants. Zhou *et al.* had performed an ordinal logistic regression analysis to give odds ratios demonstrating increase, no change, or decrease in health behaviours. These data were considered dissimilar to the data from other studies and the findings are reported narratively.

Alcohol misuse

The dichotomous data from two studies could not be meta-analysed (McCambridge *et al.*, 2011; Zhou *et al.*, 2010). McCambridge *et al.* had reported an outcome (prevalence of current alcohol use) which was considered too different from the other studies' outcomes to be included in the meta-analysis. Zhou *et al.* had performed an ordinal logistic regression analysis to give odds ratios demonstrating increase, no change, or decrease in health behaviours. These data were considered as giving slightly different meanings than other studies' data so it was considered more appropriate to report them narratively.

Five studies reported continuous data relating to alcohol intake, however the data were insufficient for meta-analysis (Leigh *et al.*, 1992; McCambridge *et al.*, 2011; Sikkema *et al.*, 1995; van Assema *et al.*, 1994; Werch *et al.*, 2010). As mentioned previously, we had decided to omit Leigh *et al.* from all relevant meta-analyses due to errors spotted in their data calculations. Of the four remaining studies, only two studies (McCambridge *et al.*, 2011; Werch *et al.*, 2010) were considered to have

outcomes which were comparable and suitable for meta-analysis. However the McCambridge *et al.* data came from a subgroup of participants who reported drinking alcohol at baseline, so a meta-analysis of these two studies was not considered appropriate.

Illicit drug use

Only one study reported use of a dichotomous outcome measure (McCambridge *et al.*, 2011); this measured the prevalence, cessation and initiation rates for cannabis use. Continuous outcome measures varied greatly and included average scores representing any drug use in the past two weeks (Sikkema *et al.*, 1995), average frequency of substance use (cannabis, alcohol and cocaine use) (Braithwaite *et al.*, 2005), average frequency of 'getting really high or stoned' with cannabis (Werch *et al.*, 2010), and average number of joints (in the past week), 30-day frequency or dependence score in relation to cannabis use (McCambridge *et al.*, 2011). None of the data relating to illicit drug use were amenable to meta-analysis, due to the variations in the drug use outcome measures.

Weight and BMI (secondary outcomes)

Three studies' weight-related data could not be included in these meta-analyses (Jacobs *et al.*, 2011; Parekh *et al.*, 2012; Ussher *et al.*, 2002). The data from Jacobs *et al.*'s study were reported as mean percentage changes, and it was not possible to convert these into a unit that could be meta-analysed. Parekh *et al.* was the only study that reported dichotomous data relating to weight change. As mentioned previously, the study by Ussher *et al.* was not included in any of the meta-analyses because it had a pharmacological component (nicotine replacement therapy), and was considered as being too different from the other study interventions to be compared statistically.

Appendix 18: Review 2 – Comparisons of main meta-analyses with analyses using robust variance estimation

Table 18.1. Effect estimates from main meta-analyses and meta-analyses using robust variance estimation

Outcome	Main analyses	Analyses using robust variance estimation
Fruit and vegetable intake (dichotomous)	OR 0.59 (95% CI 0.49 to 0.72)	OR 0.59 (95% CI 0.46 to 0.74)
Fruit and vegetable intake (continuous – post intervention)	SMD -0.19 (95% CI -0.25 to -0.14)	SMD -0.23 (95% CI -0.33 to -0.14)
Fat intake (continuous – post intervention)	SMD -0.21 (95% CI -0.31 to -0.11)	SMD -0.20 (95% CI -0.34 to -0.05)
Physical activity (dichotomous)	OR 0.82 (95% CI 0.73 to 0.92)	OR 0.82 (95% CI 0.72 to 0.94)
Physical activity (continuous – post intervention)	SMD -0.16 (95% CI -0.24 to -0.09)	SMD -0.22 (95% CI -0.34 to -0.10)
Weight loss in kg (continuous)	MD -0.85 (95% CI -1.34 to -0.37)	MD -1.08 (95% CI -1.78 to -0.40)
BMI (continuous)	MD -0.24 (95% CI -0.44 to -0.04)	MD -0.24 (95% CI -0.56 to 0.07)
Smoking (dichotomous)	OR 0.95 (95% CI 0.88 to 1.03)	OR 0.96 (95% CI 0.91 to 1.01)

Appendix 19: Review 2 – Comparisons of univariate and multivariate meta-analyses

Table 19.1. Effect estimates from univariate and multivariate meta-analyses

Outcomes	Univariate analysis: Effect estimates	Multivariate analysis: Effect estimates	Multivariate analysis: Estimated correlation between behaviours
Not meeting recommendations for sufficient physical activity and fruit and vegetable intake	Fruit and vegetable intake: OR 0.59 (95% CI 0.49 to 0.72) Physical activity: OR 0.82 (95% CI 0.73 to 0.92)	Fruit and vegetable intake: OR 0.63 (95% CI 0.51 to 0.79) Physical activity: OR 0.83 (95% CI 0.74 to 0.93)	r=0.524
Time engaging in physical activity and fruit and vegetable intake	Fruit and vegetable intake: SMD -0.19 (95% CI -0.25 to -0.14) Physical activity: SMD -0.16 (95% CI -0.24 to -0.09)	Fruit and vegetable intake: SMD -0.21 (95% CI -0.27 to -0.14) Physical activity: SMD -0.17 (95% CI -0.27 to -0.08)	r=0.394
Time engaging in physical activity, fruit and vegetable intake and weight loss (Kg and BMI)	Fruit and vegetable intake: SMD -0.19 (95% CI -0.25 to -0.14) Physical activity: SMD -0.16 (95% CI -0.24 to -0.09) Weight loss MD -0.85 (95% CI -1.34 to -0.37) BMI MD -0.24 (95% CI -0.44 to -0.04)	<i>Model with Weight loss (Kg)</i> Fruit and vegetable intake: SMD -0.21 (95% CI -0.27 to -0.15) Physical activity: SMD -0.17 (95% CI -0.27 to -0.08) Weight loss MD -0.67 (95% CI -1.06 to -0.28) <i>Model with Weight loss (BMI)</i> Fruit and vegetable intake: SMD -0.20 (95% CI -0.27 to -0.14) Physical activity: SMD -0.18 (95% CI -0.29 to -0.07) Weight loss MD -0.26 (95% CI -0.45 to -0.06)	Fruit and veg and Physical activity: r=0.407 Fruit and veg and weight loss: r=0.912 Physical activity and weight loss: r=0.544 Fruit and veg and Physical activity: r=0.381 Fruit and veg and BMI: r=0.176 Physical activity and BMI: r=0.124
Weight loss (Kg) and Calorie intake (Kcal)	Weight loss: MD -0.85 (95% CI -1.34 to -0.37) Calorie intake: MD -114.93 (95% CI -186.38 to -43.48)	Weight loss: MD -0.86 (95% CI -1.41 to -0.30) Calorie intake: MD -98.47 (95% CI -159.86 to -37.08)	Weight loss and calorie intake: r=0.463

Smoking, not meeting recommendations for sufficient physical activity and fruit and vegetable intake	<p>Fruit and vegetable intake: OR 0.59 (95% CI 0.49 to 0.72)</p> <p>Physical activity: OR 0.82 (95% CI 0.73 to 0.92)</p> <p>Smoking: OR 0.95 (95% CI 0.88 to 1.03)</p>	<p>Fruit and vegetable intake: OR 0.62 (95% CI 0.50 to 0.77)</p> <p>Physical activity: OR 0.79 (95% CI 0.67 to 0.92)</p> <p>Smoking: OR 0.99 (95% CI 0.93 to 1.08)</p>	<p>Fruit and veg and physical activity: $r=0.62$</p> <p>Fruit and veg and smoking: $r=-0.88$</p> <p>Physical activity and smoking: $r=-0.66$</p>
Smoking and Alcohol misuse (both dichotomous)	<p>Smoking: OR=0.95 (95% CI 0.88 to 1.03)</p> <p>Alcohol misuse: OR=0.84 (95% CI 0.65 to 1.08)</p>	<p>Smoking: OR=0.96 (95% CI 0.87 to 1.06)</p> <p>Alcohol misuse: OR=0.89 (95% CI 0.72 to 1.09)</p>	Correlation could not be estimated

Appendix 20: Review 2 – Additional implementation data extracted

- Intervention characteristics

Method of delivery

Methods of delivering the interventions could be broken down into three main categories: 1) face-to-face; 2) educational materials provided by post; and 3) educational materials provided online. Most commonly interventions were delivered face-to-face (30 studies) or involved a combination of face-to-face content and provision of education materials (nine studies). Although a sizeable number (11 studies) involved limited or no face-to-face intervention with content delivered by post and more recently online.

Duration of intervention

Ten studies included a brief intervention (i.e., one or two sessions) with session times ranging from 10 to 100 minutes. For all other studies the median duration of intervention was 12 weeks (ranging from 1 week to 3 years).

Staff characteristics

The most common deliverers of interventions were students (usually studying a subject relevant to the topic, such as health promotion, public health, or physical education) (seven studies). It was also common for peers or members of the community to conduct the intervention (five studies).

Sometimes professionals delivered the interventions; these included researchers (six studies), dieticians (six studies), psychologists (five studies), physicians (three studies), fitness trainers (two studies), and nurses (two studies). In addition, three studies recruited health trainers from the particular ethnic group targeted for the intervention.

- Contextual factors

Participant characteristics

Thirteen studies targeted a general adult population. All other studies targeted subgroups of the general adult population, including: university students (11 studies), people from black and minority ethnic groups (five studies), older adults (four studies), people attending primary care services (four studies), pregnant women (three studies), women only (six studies), people from low socio-economic status groups (two studies), prison inmates (one study), and parents with children (one study).

Intervention setting, geographic location, publication period

Most interventions were conducted in the community (12 studies), universities or colleges (12 studies), in participants' homes (11 studies), or in healthcare settings (10 studies). Four studies were conducted in churches and one study in a prison.

The substantial majority of studies were conducted in the USA (28 studies); this was followed by Australia (five studies), the Netherlands (four studies) UK (four studies), Canada (two studies) and Belgium (two studies). There was also one study conducted in each of the following countries: Spain, Mexico, New Zealand, Germany, and China.

Most studies were published in the 2000s (23 had been published since 2010), and only seven studies were published in the 1990s. This suggests a fast growing literature which is likely to expand further in the future.

Significant external events occurring at the time of intervention

Almost all studies made no specific mention of any external events that may have impacted on the effectiveness of the intervention(s).

However, the OXCHECK study group (1995) reported that during the conduct of their study, offering health checks (the intervention they were investigating) became part of GPs' contractual obligation. However, before the results of the trial had been published this policy had been abandoned. This instability in the organizational and political context may have impacted on the effectiveness of the intervention.

Participant uptake and satisfaction with intervention

Eighteen studies reported some process evaluation data. This was mostly on participant uptake and satisfaction with the intervention.

Participant usage of materials

Burke *et al.* (2013) reported high usage by participants of a pedometer (91%) provided as part of the intervention. However, there was much less usage of resistance bands (63%). Usage of pedometers was much lower in another study (Van Keulen *et al.*, 2011). Of the 1,201 participants who filled out the first follow-up questionnaire (week 47), 514 (43%) indicated pedometer possession, of whom 322 (63%) stated that they had used it.

Three studies examining the impact of tailored newsletters provided data on participant uptake (DeVries *et al.*, 2008; Campbell *et al.*, 2004; Jeffery *et al.*, 1999). DeVries *et al.* found that tailored letters (mean=3.89, SD=0.93) were read a little more than untailored letters (mean=3.65, SD=1.02). In another study, approximately 75% read most or all of the tailored newsletters but only 30% watched most or all of the videos (Campbell *et al.*, 2004). Jeffery *et al.* (1999) reported a similar number (80%) as above; participants reported reading most or all of the tailored newsletters.

Regarding use of online educational materials, one study reported that 85% of participants who provided data visited the website. In total, 72% visited the saturated fat module and the physical activity module; 60% of smokers visited the smoking cessation module (Oenema *et al.*, 2008).

Engagement and memory of materials/intervention

A common way of assessing participants' understanding and engagement was to ask about their memory of the intervention. Campbell *et al.* (2004) found that 70% of participants recalled that colorectal cancer prevention was the main aim of the study and had received materials concerning this topic. Similarly, Kreuter *et al.* (1996) reported that 74.5% of the enhanced health risk appraisal group and 70.6% for the typical health risk appraisal group remembered receiving health information.

Jeffery *et al.*'s (1999) recognition test suggested that their intervention was effective in transmitting desired information to study participants. Across the three years of the study, participants in the two education groups consistently identified 75% of the targeted treatment messages as being among the five best ways to prevent weight gain, as compared with 66% of those in the control group. Within the education groups, message recognition was also positively related to newsletter readership in follow-up years 2 and 3.

Van Assema *et al.* (1994) conducted a community-based intervention and sought to examine knowledge of their intervention in the community. Directly after the implementation period 82.4% of the 665 respondents who completed the first post-test of the effect evaluation were familiar with the project: 42.4% could mention the name of the project and 40% could not mention the name, but recognized the name after the interviewer mentioned it. Of all respondents 80.3% had read something about the project in newspapers. The information centre was familiar to 42% of all respondents. Almost 37% of all respondents said they had discussed the project with someone else.

Van Keulen *et al.* (2011) found that participants who received telephone-delivered motivational interviewing appeared to remember the content of the intervention better than participants who received tailored print materials. Within the combined group who received both, the content of the interviews were perceived as more interesting than the content of the letters. More participants discussed the interviews with others than allowed others to read the letters.

Participant engagement and influence on outcome

There was some evidence that participant engagement (e.g. use of materials, session attendance) influenced the effectiveness of interventions. Campbell *et al.* (2004) found that those who had read the tailored newsletters ate more fruits and vegetables at follow-up, although this was not the case for all outcomes.

There were similar findings in a study that provided a range of materials to aid behaviour change (Resnicow *et al.*, 2005). Individuals who reported using the cookbook and watching most or all of the educational video on fruit and vegetables showed a significantly greater increase in fruit and vegetable intake than did those not using these materials. Likewise, individuals who reported using the activity guide showed a significantly greater increase in physical activity than those not using the guide. Although differences between these two groups in physical activity levels were not statistically significant. Regular use of the pedometer was associated with a greater increase in activity, and this difference was statistically significant for moderate/vigorous activities and the index of exercise items.

Yanek *et al.* (2001) examined the impact of session attendance. Attendance ranged from 65% at the first session to 26.1% at the last session across all churches, and on any given session attendance was one-third to one-half of overall participants. This varied slightly by church, but not by spiritual vs. standard intervention. Number of sessions attended was a predictor of being in the top decile for weight loss.

Participant satisfaction with intervention and materials

Most studies that requested participant feedback showed a high level of satisfaction both with the materials provided (e.g. pedometers, exercise calendars, educational materials) and the content of the intervention (Burke *et al.*, 2013; DeVries *et al.*, 2008; Lee *et al.*, 2011; van Assema *et al.*, 1994; van Keulen *et al.*, 2011; Werch *et al.*, 2010; Wilcox *et al.*, 2013). While some studies did not find differences in satisfaction between participants in the intervention group compared with controls (Sikkema *et al.*, 1995; Ussher *et al.*, 2003; Werch *et al.*, 2007) these interventions were compared with relatively active control groups.

Perceived effectiveness and engagement in behaviour change by participants was less positive. Only 55% of participants in Burke *et al.*'s (2013) study felt the intervention improved their diet. Similarly, Lee *et al.* (2011) found less than 50% considered the intervention effective in improving their diet and physical activity, with only 25% engaging in new activities related to the intervention. Although

Van Keulen *et al.*'s (2011) participants were satisfied with how their motivational interviewing session was conducted, most provided neutral responses concerning perceived relevance for aiding their behaviour change.

Fidelity and challenges to implementation

Only two studies investigated intervention fidelity. The OXCHECK study group (1995) analysed 100 audiotapes of the health check conducted by nurses and found a high degree of fidelity in providing the intervention. This involved identification and modification of risk factors, responding to patients' concerns about their health, negotiating change according to patients' priorities and reinforcing change through supportive follow up. They found that the checks provided by nurses met required standards.

McCambridge *et al.* (2011) intended to audio-record a random sample of a quarter of motivational interviewing sessions for fidelity monitoring. However, it was only possible to obtain audio-recording of 31 sessions out of a total of 159. A number of college practitioners were uncomfortable about having their session recorded and also had difficulty asking consent from participants for this. In addition, there were four instances where there were problems with equipment or their use. Due to these difficulties no analysis of this fidelity data was undertaken or reported.

Three studies reported challenges in implementation; all concerned the use of lay leaders from the community contributing to the intervention. Yanek *et al.* (2011) found much lower weekly attendance for sessions when a transition was made from professional health educators leading weekly sessions to trained lay leaders in their church-based intervention. Post-study focus groups and in-depth interviews suggested this was due to a lack of confidence in the capabilities of peers who did not have the same level of professional expertise. A similar lack of uptake concerning input from lay leaders was found in another church-based intervention. Only 10% of participants reported talking with a lay health advisor, although 30% attended church activities organised by these lay church members (Campbell *et al.*, 2004).

Hillier *et al.* (2012) sought to recruit lifestyle helpers from the local community as 'community champions.' However, uptake of training was much lower than expected and none who received training successfully recruited participants to the trial and therefore dropped out of the intervention. These were replaced by students from Teesside University who successfully recruited participants and delivered the intervention.

Appendix 21: Review 2 – Definitions of covariates in meta-regression analyses

Mixed-effects meta-regression analyses were performed in order to explore substantial statistical heterogeneity shown in meta-analyses containing 10 or more studies. The covariates entered into the meta-regression analyses related to intervention characteristics or contextual factors.

Covariates related to intervention characteristics included combinations of intervention functions (classified using the Behaviour Change Wheel by Michie *et al.*, 2011), methods of delivery, intervention duration, and staff characteristics. Covariates related to contextual factors included participant (population) characteristics, the study setting, follow-up duration, and the publication period of the study (1990s versus 2000s).

The tables below present categories defined for each covariate, along with the code values assigned to each category in the meta-regression analyses.

- *Intervention characteristics*

Intervention functions

a) Number of intervention functions:

Table 21.1

Category	Code value assigned in the analysis
1 function	0
2 functions	1
3 functions	2
4 functions	3
5 functions	4

b) Specific intervention functions

For each outcome we assessed the impact of specific intervention functions used in three or more studies (the impact of education alone was not assessed as almost all studies included this as a component of their intervention):

Weight

Table 21.2

Category	Code value assigned in the analysis
Other	0
Enablement	1

Table 21.3

Category	Code value assigned in the analysis
Other	0
Modelling	1

Table 21.4

Category	Code value assigned in the analysis
Other	0
Persuasion	1
Category	Code value assigned in the analysis
Other	0
Education and enablement	1

Table 21.5

Category	Code value assigned in the analysis
Other	0
Education and training	1

Table 21.6

Category	Code value assigned in the analysis
Other	0
Education, training and enablement	1

Table 21.7

Category	Code value assigned in the analysis
Other	0
Education, training and modelling	1

Table 21.8

Category	Code value assigned in the analysis
Other	0
Education, training and persuasion	1

*BMI***Table 21.9**

Category	Code value assigned in the analysis
Other	0
Persuasion	1

Table 21.10

Category	Code value assigned in the analysis
Other	0
Education and training	1

Table 21.11

Category	Code value assigned in the analysis
Other	0
Education, training and persuasion	1

*Fat intake***Table 21.12**

Category	Code value assigned in the analysis
Other	0
Enablement	1

Table 21.13

Category	Code value assigned in the analysis
Other	0
Modelling	1

Table 21.14

Category	Code value assigned in the analysis
Other	0
Persuasion	1

Table 21.15

Category	Code value assigned in the analysis
Other	0
Environmental restructuring	1

Table 21.16

Category	Code value assigned in the analysis
Other	0
Education and training	1

Table 21.17

Category	Code value assigned in the analysis
Other	0
Education and enablement	1

Table 21.18

Category	Code value assigned in the analysis
Other	0
Education, training, and modelling	1

Table 21.19

Category	Code value assigned in the analysis
Other	0
Education, training, and persuasion	1

*Fruit and vegetable intake***Table 21.20**

Category	Code value assigned in the analysis
Other	0
Enablement	1

Table 21.21

Category	Code value assigned in the analysis
Other	0
Persuasion	1

Table 21.22

Category	Code value assigned in the analysis
Other	0
Education and training	1

Table 21.23

Category	Code value assigned in the analysis
Other	0
Education and enablement	1

*Physical activity (dichotomous outcome)***Table 21.24**

Category	Code value assigned in the analysis
Other	0
Persuasion	1

Table 21.25

Category	Code value assigned in the analysis
Other	0
Enablement	1

Table 21.26

Category	Code value assigned in the analysis
Other	0
Modelling	1

Table 21.27

Category	Code value assigned in the analysis
Other	0
Education and training	1

Table 21.28

Category	Code value assigned in the analysis
Other	0
Education and enablement	1

Table 21.29

Category	Code value assigned in the analysis
Other	0
Education, training, and persuasion	1

Table 21.30

Category	Code value assigned in the analysis
Other	0
Education, training, and modelling	1

*Physical activity (continuous outcome)***Table 21.31**

Category	Code value assigned in the analysis
Other	0
Enablement	1

Table 21.32

Category	Code value assigned in the analysis
Other	0
Modelling	1

Table 21.33

Category	Code value assigned in the analysis
Other	0
Persuasion	1

Table 21.34

Category	Code value assigned in the analysis
Other	0
Environmental restructuring	1

Table 21.35

Category	Code value assigned in the analysis
Other	0
Education and training	1

Table 21.36

Category	Code value assigned in the analysis
Other	0
Education, training, and modelling	1

Table 21.37

Category	Code value assigned in the analysis
Other	0
Education, training, and persuasion	1

Table 21.38

Category	Code value assigned in the analysis
Other	0
Education, training and enablement	1

Method of delivery**Table 21.39**

Category	Code value assigned in the analysis
Written	0
Telephone	1
Face to face	2
Other	3

Duration of intervention sessions**Table 21.40**

Category	Code value assigned in the analysis
Single session	0
< 6 months	1
6-12 months	2
≥ 12 months	3

Staff characteristics**Table 21.41**

Category	Code value assigned in the analysis
Health professional	0
Other (including students, lay people)	1

- Contextual factors***Participant characteristics*****Table 21.42**

Category	Code value assigned in the analysis
General adult population	0
Pregnant women	1
Black and minority ethnic groups	2
People with low-socioeconomic status	3
Older adults	4
Students	5

Intervention setting**Table 21.43**

Category	Code value assigned in the analysis
Community	0
Healthcare setting	1
Learning environment	2
Home	3

Publication period

Table 21.44

Category	Code value assigned in the analysis
1990s	0
2000s	1

Duration of follow-up

Table 21.45

Category	Code value assigned in the analysis
Endpoint	0
< 6 months	1
6-12 months	2
≥ 12 months	3

**Multiple risk behaviours and interventions to reduce
multiple risk behaviours**

1. General background

Scientific Literature

Modifiable health risk behaviours (e.g., physical inactivity, smoking, low fruit and vegetable intake) contribute significantly to the global burden of disease (1). The co-occurrence of these behaviours are common, for example 55.1% of adults in the Netherlands (2), 52% in the USA (3), 59.4% in Brazil (4), and 68% in England (5) reportedly engage in two or more risk behaviours. Moreover, all-cause mortality risk has been shown to be four times higher among individuals with multiple risk behaviours, both in the USA (6) and the UK (7).

Interventions to change behaviour have huge potential to alter current patterns of disease (8). Recently, interest has grown in the role of multiple risk behaviour interventions, because they may be an efficient way of improving people's lifestyles (9) and have potential for greater health benefits and reduction of health care costs (10). Targeting of multiple risk behaviours is currently incorporated within government public health strategies worldwide, including those of the US (11), the Netherlands (12), Australia (13), Sweden (14), and the United Kingdom (UK) (15).

Risk behaviours also need to be viewed in the context of social, physical and economic environments (16, 17). For example, previous findings have demonstrated that living in a neighbourhood perceived to be unsafe is a barrier to regular physical activity (18), thereby limiting the likely effectiveness of intervention strategies to promote regular exercise. However, contextual data are not frequently reported in systematic reviews evaluating the effects of interventions and there is growing recognition of their importance (19, 20). Systematic reviews of qualitative evidence can help to fill this gap by gathering information from qualitative studies linked to quantitative evaluations, or more generally from studies exploring wider contexts, such as experiences of making lifestyle changes and perceived barriers to change.

Policy Relevance

The Government is planning to re-balance allocation of public health funds so that more is spent on treating the causes of diseases, rather than the diseases themselves (21). Thus, collation and evaluation of relevant evidence is vital for increasing understanding of health inequalities, risk behaviour clusters and factors that influence these clusters. This would also aid policy decision-making for financial expenditure and the appropriateness of interventions for particular communities, families and individuals and financial expenditure. In turn, this would increase the effectiveness of service delivery and achieve overarching goals of health protection and resilience (22).

This project aims to support public health policies to improve national health and well-being by investigating multiple risk behaviours (risk clusters), predictors of risk clusters (review 1), interventions and intervention context for reducing risk behaviours (review 2), and people's experiences of making lifestyle changes (review 3). The project will use systematic review methods to identify, appraise and synthesise existing research evidence. The findings from the individual

systematic reviews will be brought together in an overall comparative synthesis, allowing key policy questions to be answered.

2. Methods

This systematic review will be conducted and reported with reference to guidance published by the Centre for Reviews and Dissemination (23), and the Preferred Reporting Items for Systematic Reviews and Meta-analyses (PRISMA) 2009 checklist (24). A framework for reporting of synthesis of qualitative health research will also be utilised (25). As the proposed methods for each of the systematic reviews in this project are quite different, separate protocols have been produced for each review. The information below refers to review 3.

2.1. Qualitative systematic review exploring people's experiences or perceptions of multiple risk behaviour change, and the contexts in which these changes occur (review 3).

2.1.1. Research aims

- i) To examine people's reported experiences and perceptions of multiple risk behaviour change, including barriers and facilitators.
- ii) To investigate the contexts in which changes in multiple risk behaviours are made.

The review will focus on qualitative studies linked to quantitative evaluations of multiple risk behaviour interventions, and to qualitative studies investigating multiple behaviour change in other contexts (i.e., not linked to an intervention).

2.1.2. Search strategy

The search has been pre-planned (i.e., comprehensive search strategies have been developed to identify all available evidence). The following databases will be searched from 1990 to November, 2013:

- CINAHL
- Embase
- MEDLINE
- PsycINFO
- Science Citation Index

Searches will be restricted to articles published in English from 1990 onwards. The cut-off date of 1990 is being used because preliminary searches have shown that most of the multiple risk behaviour literature is both time- and context-dependent. The literature searches for this review were developed using MEDLINE via OVIDSP and subsequently adapted for use with the other databases. One section of the search strategy uses synonyms and variants of "multiple risk behaviours" and "lifestyle modifications" to identify relevant studies while another section includes search terms for specific named behaviours such as alcohol misuse, physical inactivity, unhealthy diet and so on. To retrieve studies that refer to two or more of these risk behaviours the search terms will be initially combined using the Boolean AND operator (smoking AND physical activity; smoking AND unhealthy diet; smoking AND illegal drug use etc) with the resulting search sets then being combined using the Boolean OR.

The search strategy also includes filters to restrict the results to various study designs e.g. trials, evaluation studies, before and after studies and interrupted time series and also to various types of setting e.g., workplaces, communities. This approach will be replicated for the search strategies

used in the Embase and PsycINFO databases. For CINAHL, CENTRAL and Science Citation Index, however, it has been difficult to construct comparable search strategies because of differences in the database search interfaces. Consequently, for these three databases, the search strategy consists solely of search terms for “multiple risk behaviours” and “interventions, programmes” and “change.”

Electronic searches will be supplemented by examination of the bibliographies of included studies. This manual search will be conducted by one reviewer; their decisions will be checked by a second reviewer.

2.1.3. Inclusion/exclusion criteria

Titles/abstracts of records identified by the electronic searches will be downloaded into Endnote and assessed for inclusion by one reviewer. Full texts will be ordered and assessed for inclusion independently by two reviewers. Discrepancies will be resolved by discussion and involvement of a third reviewer where necessary.

Eligible studies will be primary studies, reporting the use of qualitative data collection and analysis methods to investigate people’s reported perceptions or experiences of multiple risk behaviour change. These may include perceptions of what the behaviour change process might be like, or actual experiences during previous attempts to change multiple risk behaviours. Eligible outcomes will include any factors perceived as influencing the multiple risk behaviour change process (including facilitators and/or barriers). The contexts in which any multiple risk behaviour changes have been successfully made are also of interest.

Inclusion will be restricted to studies of non-clinical adult populations (aged 16 years and over). We will not be including populations considered to be at risk for disease (e.g., diabetes, cardiovascular disease) because we do not want to duplicate a recent systematic review of qualitative studies on this type of population (26). No restrictions will be made on study country, length of follow-up, or study design.

Studies focusing on children and young people (up to the age of 15) will be excluded, so as to avoid duplication with work being led by Rona Campbell, University of Bristol (27).

2.1.4. Data extraction

The extracted data will consist of study characteristics, ‘raw’ data (i.e., direct quotes) from participants, and interpretative/descriptive statements made by study authors about the participant data. The participant data and authors’ interpretations/descriptions will be extracted from results and discussion/conclusion sections of study papers. Where the classification between these two types of data cannot be made, this will be noted. The classification and inclusion of these two data types is recommended in qualitative systematic reviews of health research (25).

Efforts will also be made to record the contextual reason/s for which the risk behaviours have been investigated. If time constraints allow, attempts will be made to contact authors for any missing data. Data from multiple publications of the same study (or dataset) will be extracted and reported as a single study.

Data extraction will be piloted on a selection of studies to ensure consistency, and all data will be extracted within Eppi Reviewer (version 4). The data representing participant data and authors’ interpretations/descriptions will be recorded using an inductive, line-by-line coding technique, whereby reviewers highlight the relevant text within the PDF/plain text of the study article and

assign it to an initial code. These initial codes will be created by reviewers as they read through the texts of the articles. Following the coding of the first study, subsequent studies will be coded into pre-existing initial codes or new initial codes will be created where necessary. A full description of the process has been published by Thomas & Harden (28).

Data will be extracted by one reviewer using a standard data extraction form, which will then be checked by a second reviewer. Discrepancies will be resolved by discussion, with involvement of a third reviewer where necessary.

2.1.5. Quality assessment

The quality of the individual studies will be assessed using a critical appraisal tool developed by Hawker *et al.* (29). This framework is being used because it allows assessment of both the quality of reporting and appropriateness of methods used, in relation to nine domains. These domains include abstract and title, introduction and aims, method and data, sampling, data analysis, ethics and bias, results, transferability/generalisability, implications, and usefulness. Each domain is scored from 1 (very poor) to 4 (good), so that total scores range between 9 and 36. Total quality scores for each study will be used to classify them as being of high quality (total score range: 30-36), medium quality (total score range: 24-29), or low quality (total score range: 9-23).

Two reviewers will independently assess the quality of the studies, with a pilot exercise conducted beforehand to ensure consistency across reviewers. Disagreements will be resolved by discussion and if necessary a third reviewer will be consulted. The quality assessment results will be recorded using Eppi-Reviewer 4.

2.1.6. Methods of analysis and synthesis

A thematic synthesis of participant data and interpretations/descriptions made by authors about these data will be performed in Eppi-Reviewer 4, using methods described by Thomas & Harden (28). Following the construction of initial codes, the codes will be examined and where there is any overlap, they will be combined into overarching codes. The overarching codes will then be placed into a table and the data (i.e., participant quotes and authors' interpretations/descriptions) will be entered under the overarching code to which they relate to. During the construction of this table, data will be checked for relevance to the overarching code and these overarching codes will be amended where required to fit with the data. The overarching codes will then be examined and where there is any overlap they will be grouped into analytical themes. The analytical themes will also be examined and amended where required to fit the overarching codes and data.

In order to ensure that these analytical themes are theoretically grounded and reflect the multidimensional nature of the social and environmental contexts, we will categorise them using the Bioecological Model of Human Development (30). This model takes into account individual level differences alongside contextual factors, and is useful for demonstrating where interventions may or may not work for particular populations (17).

One reviewer will identify the overarching codes and analytical themes, and categorise the analytical themes. The data, codes, and themes will be checked by multiple reviewers. The analytical themes will be the themes used to answer the research questions of the review; the overarching codes will be presented as the subthemes of the analytical themes.

This thematic synthesis approach has been selected because it is a tried and tested method, which synthesises the results of primary studies in a transparent way and enables explicit construction of

new concepts and hypotheses (28). It is also relatively quick to perform and can be conducted by reviewers with little experience of qualitative evidence synthesis.

The results from the synthesis will be presented in narrative form, and will take into account the contexts in which multiple risk behaviour changes have been discussed, attempted or made. The final quality ratings will not influence a study's inclusion in the review, or its weighting in the synthesis.

3. Advisory group

Professor Rona Campbell, University of Bristol, has acted as an advisor to the project.

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Appendix 23: Review 3 – Search strategy

The literature searches for this review were developed using MEDLINE via OVIDSP and subsequently adapted for use with the other databases. One section of the search strategy used synonyms and variants of “multiple risk behaviours” and “lifestyle modifications” to identify relevant studies while another section included search terms for specific named behaviours such as alcohol misuse, physical inactivity, unhealthy diet, etc. To retrieve studies that referred to two or more of these risk behaviours the search terms were initially combined using the Boolean AND operator (smoking AND physical activity; smoking AND unhealthy diet, etc) with the resulting search sets being then combined using the Boolean OR. The search strategy also included filters to restrict the results to various study designs e.g. trials, evaluation studies, before and after studies and interrupted time series and also to various types of setting, e.g., workplaces, communities. This approach was replicated for the search strategies used in the Embase and PsycINFO databases. For CINAHL, CENTRAL and Science Citation Index, however, it was difficult to construct comparable search strategies because of differences in the database search interfaces. Consequently, for these three databases, the search strategy consisted solely of search terms for “multiple risk behaviours” and “interventions, programmes” and “change.”

Multiple Risk Behaviours 3 Literature searching
27,920 records before deduplication
21,311 records after deduplication

Databases searched and records retrieved
CINAHL=13,209
Embase=5494
MEDLINE=3888
PsycINFO=2331
Science Citation Index=3557

CINAHL
Via EBSCO, search date 8th to 12th November 2013

S27	S24 OR S25 Limiters - Published Date: 19900101-; English Language; Age Groups: Adolescent: 13-18 years, Adult: 19-44 years, Middle Aged: 45-64 years, Aged: 65+ years, Aged, 80 and over Search modes - Boolean/Phrase
S26	S24 OR S25
S25	S14 AND S23
S24	S14 AND S22
S23	TI barrier* or facilitat* or hinder* or hindrance or impede* or attitude* or view* or experienc* or belief* or believ* or perception* or perceiv* or expectat* or understand* or understood
S22	S15 OR S16 OR S17 OR S18 OR S19 OR S20 OR S21
S21	(MH "Focus Groups")
S20	"focus group*"

S19	AB interview* N2 (indepth or in-depth or structured or semi-structured or unstructured)
S18	AB qualitative* N2 (literature or review* or synthesis)
S17	AB qualitative* N2 (research* or study or studies or sub-study or approach* or technique* or method* or analysis or analyses or interview*)
S16	(MH "Qualitative Studies")
S15	TI qualitative
S14	S1 OR S2 OR S3 OR S4 OR S5 OR S6 OR S7 OR S8 OR S9 OR S10 OR S11 OR S12 OR S13
S13	(new behaviors) N2 (adopt* or encourag* or take up or uptake* or took up or implement* or maintain* or sustain* or initiat*or promot*)
S12	(new behaviours) N2 (adopt* or encourag* or take up or uptake* or took up or implement* or maintain* or sustain* or initiat*or promot*)
S11	"disease management behavio*"
S10	(unhealthy behaviors) N2 (chang* or modif* or adopt* or "take up" or uptake* or "took up" or implement* or maintain* or sustain* or complet*or continu*or initiat*or reduc*or adjust*)
S9	(unhealthy behaviours) N2 (chang* or modif* or adopt* or "take up" or uptake* or "took up" or implement* or maintain* or sustain* or complet*or continu*or initiat*or reduc*or adjust*)
S8	(risk* behaviors) N2 (chang* or modif* or adopt* or "take up" or uptake* or "took up" or implement* or maintain* or sustain* or complet*or continu*or initiat*or reduc*or adjust*)
S7	(risk* behaviours) N2 (chang* or modif* or adopt* or "take up" or uptake* or "took up" or implement* or maintain* or sustain* or complet*or continu*or initiat*or reduc*or adjust*)
S6	(multiple behavior*) N2 (chang* or modif* or adopt* or "take up" or uptake* or "took up" or implement* or maintain* or sustain* or complet*or continu*or initiat*or reduc*or adjust*)
S5	(multiple behaviour*) N2 (chang* or modif* or adopt* or "take up" or uptake* or "took up" or implement* or maintain* or sustain* or complet*or continu*or initiat*or reduc*or adjust*)
S4	lifestyle N2 (chang* or modif* or adopt* or "take up" or uptake* or "took up" or implement* or maintain* or sustain* or complet*or continu*or initiat*or reduc*or adjust*)
S3	(MH "Life Style+")
S2	(MH "Risk Taking Behavior+")
S1	TI lifestyle* or "health* behaviour*" or "health* behavior*" or "multiple risk behaviour*" or "multiple risk behavior*"

EMBASE

- 1 (lifestyle\$ or health\$ behaviour\$ or health\$ behavior\$ or multiple risk behaviour\$ or multiple risk behavior\$).ti. (13240)
- 2 *Risk reduction/ (2787)
- 3 Lifestyle/ (69904)
- 4 Lifestyle modification/ (16825)
- 5 (lifestyle adj2 (chang\$ or modif\$ or adopt\$ or take up or uptake\$ or took up or implement\$ or maintain\$ or sustain\$ or complet\$ or continu\$ or initiat\$ or reduc\$ or adjust\$)).ti,ab. (14266)
- 6 (multiple behaviour\$ adj2 (chang\$ or modif\$ or adopt\$ or take up or uptake\$ or took up or implement\$ or maintain\$ or sustain\$ or complet\$ or continu\$ or initiat\$ or reduc\$ or adjust\$)).ti,ab. (11)
- 7 (multiple behavior\$ adj2 (chang\$ or modif\$ or adopt\$ or take up or uptake\$ or took up or implement\$ or maintain\$ or sustain\$ or complet\$ or continu\$ or initiat\$ or reduc\$ or adjust\$)).ti,ab. (65)
- 8 (risk\$ behaviours adj2 (chang\$ or modif\$ or adopt\$ or take up or uptake\$ or took up or implement\$ or maintain\$ or sustain\$ or complet\$ or continu\$ or initiat\$ or reduc\$ or adjust\$)).ti,ab. (182)
- 9 (risk\$ behaviors adj2 (chang\$ or modif\$ or adopt\$ or take up or uptake\$ or took up or implement\$ or maintain\$ or sustain\$ or complet\$ or continu\$ or initiat\$ or reduc\$ or adjust\$)).ti,ab. (688)
- 10 (unhealthy behaviours adj2 (chang\$ or modif\$ or adopt\$ or take up or uptake\$ or took up or implement\$ or maintain\$ or sustain\$ or complet\$ or continu\$ or initiat\$ or reduc\$ or adjust\$)).ti,ab. (19)
- 11 (unhealthy behaviors adj2 (chang\$ or modif\$ or adopt\$ or take up or uptake\$ or took up or implement\$ or maintain\$ or sustain\$ or complet\$ or continu\$ or initiat\$ or reduc\$ or adjust\$)).ti,ab. (54)
- 12 disease management behavio\$.ti,ab. (14)
- 13 (new behaviours adj2 (adopt\$ or encourag\$ or take up or uptake\$ or took up or implement\$ or maintain\$ or sustain\$ or initiat\$ or promot\$)).ti,ab. (12)
- 14 (new behaviors adj2 (adopt\$ or encourag\$ or take up or uptake\$ or took up or implement\$ or maintain\$ or sustain\$ or initiat\$ or promot\$)).ti,ab. (26)
- 15 1 or 2 or 3 or 4 or 5 or 6 or 7 or 8 or 9 or 10 or 11 or 12 or 13 or 14 (96611)
- 16 qualitative\$.ti. (22832)
- 17 qualitative research/ (22758)
- 18 qualitative analysis/ (31599)
- 19 (qualitative\$ adj2 (research\$ or study or studies or sub-study or approach\$ or technique\$ or method\$ or analysis or analyses or interview\$)).ab. (50605)
- 20 (qualitative\$ adj2 (literature or review\$ or synthesis\$)).ab. (1927)
- 21 ((indepth or in-depth or structured or semi-structured or unstructured) adj interview\$).ab. (34584)
- 22 structured interview/ (6359)
- 23 focus group\$.ti,ab. (24771)
- 24 16 or 17 or 18 or 19 or 20 or 21 or 22 or 23 (135275)
- 25 (barrier\$ or facilitat\$ or hinder\$ or hindrance or imped\$ or attitude\$ or view\$ or experienc\$ or belief\$ or believ\$ or perception\$ or perceiv\$ or expect\$ or understand\$ or understood).ti. (526563)
- 26 15 and 24 (2740)
- 27 15 and 25 (4203)
- 28 26 or 27 (6151)
- 29 limit 28 to english language (5724)
- 30 limit 29 to yr="1990 -Current" (5511)

- 31 exp animal/ not human/ (4094945)
- 32 30 not 31 (5494)

MEDLINE

Via OVIDSP, search date 8th November 2013

-
- 1 (lifestyle\$ or health\$ behaviour\$ or health\$ behavior\$ or multiple risk behaviour\$ or multiple risk behavior\$).ti. (11387)
 - 2 Risk reduction behavior/ (7563)
 - 3 Lifestyle/ (43518)
 - 4 (lifestyle adj2 (chang\$ or modif\$ or adopt\$ or take up or uptake\$ or took up or implement\$ or maintain\$ or sustain\$ or complet\$ or continu\$ or initiat\$ or reduc\$ or adjust\$)).ti,ab. (10908)
 - 5 (multiple behaviour\$ adj2 (chang\$ or modif\$ or adopt\$ or take up or uptake\$ or took up or implement\$ or maintain\$ or sustain\$ or complet\$ or continu\$ or initiat\$ or reduc\$ or adjust\$)).ti,ab. (14)
 - 6 (multiple behavior\$ adj2 (chang\$ or modif\$ or adopt\$ or take up or uptake\$ or took up or implement\$ or maintain\$ or sustain\$ or complet\$ or continu\$ or initiat\$ or reduc\$ or adjust\$)).ti,ab. (70)
 - 7 (risk\$ behaviours adj2 (chang\$ or modif\$ or adopt\$ or take up or uptake\$ or took up or implement\$ or maintain\$ or sustain\$ or complet\$ or continu\$ or initiat\$ or reduc\$ or adjust\$)).ti,ab. (159)
 - 8 (risk\$ behaviors adj2 (chang\$ or modif\$ or adopt\$ or take up or uptake\$ or took up or implement\$ or maintain\$ or sustain\$ or complet\$ or continu\$ or initiat\$ or reduc\$ or adjust\$)).ti,ab. (718)
 - 9 (unhealthy behaviours adj2 (chang\$ or modif\$ or adopt\$ or take up or uptake\$ or took up or implement\$ or maintain\$ or sustain\$ or complet\$ or continu\$ or initiat\$ or reduc\$ or adjust\$)).ti,ab. (20)
 - 10 (unhealthy behaviors adj2 (chang\$ or modif\$ or adopt\$ or take up or uptake\$ or took up or implement\$ or maintain\$ or sustain\$ or complet\$ or continu\$ or initiat\$ or reduc\$ or adjust\$)).ti,ab. (52)
 - 11 disease management behavior\$.ti,ab. (9)
 - 12 (new behaviours adj2 (adopt\$ or encourag\$ or take up or uptake\$ or took up or implement\$ or maintain\$ or sustain\$ or initiat\$ or promot\$)).ti,ab. (11)
 - 13 (new behaviors adj2 (adopt\$ or encourag\$ or take up or uptake\$ or took up or implement\$ or maintain\$ or sustain\$ or initiat\$ or promot\$)).ti,ab. (28)
 - 14 1 or 2 or 3 or 4 or 5 or 6 or 7 or 8 or 9 or 10 or 11 or 12 or 13 (61487)
 - 15 qualitative\$.ti. (21166)
 - 16 qualitative research/ (19672)
 - 17 (qualitative\$ adj2 (research\$ or study or studies or sub-study or approach\$ or technique\$ or method\$ or analysis or analyses or interview\$)).ab. (44846)
 - 18 (qualitative\$ adj2 (literature or review\$ or synthesis)).ab. (1760)
 - 19 ((indepth or in-depth or structured or semi-structured or unstructured) adj interview\$).ab. (29933)
 - 20 focus group\$.ti,ab. (22464)
 - 21 focus group/ (17220)
 - 22 15 or 16 or 17 or 18 or 19 or 20 or 21 (103658)
 - 23 (barrier\$ or facilitat\$ or hinder\$ or hindrance or impede\$ or attitude\$ or view\$ or experienc\$ or belief\$ or believ\$ or perception\$ or perceiv\$ or expectat\$ or understand\$ or understood).ti. (439208)
 - 24 14 and 22 (2103)
 - 25 14 and 23 (3020)

- 26 24 or 25 (4496)
- 27 limit 26 to (english language and yr="1990 -Current") (3892)
- 28 exp animals/ not humans.sh. (4058483)
- 29 27 not 28 (3888)

PsycINFO

Via OVIDSP, search date 8th November 2013

-
- 1 (lifestyle\$ or health\$ behaviour\$ or health\$ behavior\$ or multiple risk behaviour\$ or multiple risk behavior\$).ti. (4782)
 - 2 Lifestyle/ (5973)
 - 3 lifestyle changes/ (834)
 - 4 (lifestyle adj2 (chang\$ or modif\$ or adopt\$ or take up or uptake\$ or took up or implement\$ or maintain\$ or sustain\$ or complet\$ or continu\$ or initiat\$ or reduc\$ or adjust\$)).ti,ab. (2232)
 - 5 (multiple behaviour\$ adj2 (chang\$ or modif\$ or adopt\$ or take up or uptake\$ or took up or implement\$ or maintain\$ or sustain\$ or complet\$ or continu\$ or initiat\$ or reduc\$ or adjust\$)).ti,ab. (6)
 - 6 (multiple behavior\$ adj2 (chang\$ or modif\$ or adopt\$ or take up or uptake\$ or took up or implement\$ or maintain\$ or sustain\$ or complet\$ or continu\$ or initiat\$ or reduc\$ or adjust\$)).ti,ab. (46)
 - 7 (risk\$ behaviours adj2 (chang\$ or modif\$ or adopt\$ or take up or uptake\$ or took up or implement\$ or maintain\$ or sustain\$ or complet\$ or continu\$ or initiat\$ or reduc\$ or adjust\$)).ti,ab. (53)
 - 8 (risk\$ behaviors adj2 (chang\$ or modif\$ or adopt\$ or take up or uptake\$ or took up or implement\$ or maintain\$ or sustain\$ or complet\$ or continu\$ or initiat\$ or reduc\$ or adjust\$)).ti,ab. (528)
 - 9 (unhealthy behaviours adj2 (chang\$ or modif\$ or adopt\$ or take up or uptake\$ or took up or implement\$ or maintain\$ or sustain\$ or complet\$ or continu\$ or initiat\$ or reduc\$ or adjust\$)).ti,ab. (7)
 - 10 (unhealthy behaviors adj2 (chang\$ or modif\$ or adopt\$ or take up or uptake\$ or took up or implement\$ or maintain\$ or sustain\$ or complet\$ or continu\$ or initiat\$ or reduc\$ or adjust\$)).ti,ab. (32)
 - 11 disease management behavio\$.ti,ab. (13)
 - 12 (new behaviours adj2 (adopt\$ or encourag\$ or take up or uptake\$ or took up or implement\$ or maintain\$ or sustain\$ or initiat\$ or promot\$)).ti,ab. (4)
 - 13 (new behaviors adj2 (adopt\$ or encourag\$ or take up or uptake\$ or took up or implement\$ or maintain\$ or sustain\$ or initiat\$ or promot\$)).ti,ab. (32)
 - 14 1 or 2 or 3 or 4 or 5 or 6 or 7 or 8 or 9 or 10 or 11 or 12 or 13 (11072)
 - 15 qualitative\$.ti. (12161)
 - 16 qualitative study.md. (113831)
 - 17 (qualitative\$ adj2 (research\$ or study or studies or sub-study or approach\$ or technique\$ or method\$ or analysis or analyses or interview\$)).ab. (49850)
 - 18 (qualitative\$ adj2 (literature or review\$ or synthesis)).ab. (940)
 - 19 ((indepth or in-depth or structured or semi-structured or unstructured) adj interview\$).ab. (30865)
 - 20 interview.md. (100206)
 - 21 focus group\$.ti,ab. (18154)
 - 22 focus group.md. (10216)
 - 23 15 or 16 or 17 or 18 or 19 or 20 or 21 or 22 (212891)

- 24 (barrier\$ or facilitat\$ or hinder\$ or hindrance or impede\$ or attitude\$ or view\$ or experienc\$ or belief\$ or believ\$ or perception\$ or perceiv\$ or expectation\$ or understand\$ or understood).ti.
(204932)
- 25 14 and 23 (1694)
- 26 14 and 24 (1048)
- 27 25 or 26 (2447)
- 28 limit 27 to (english language and yr="1990 -Current") (2331)

Science Citation Index

Via Web of Science, search date 8th November 2013

# 22	3,557	(#21) AND Language=(English) <i>Databases=SCI-EXPANDED Timespan=1990-2013</i>
# 21	3,651	#20 OR #19 <i>Databases=SCI-EXPANDED Timespan=1990-2013</i>
# 20	2,448	#18 AND #11 <i>Databases=SCI-EXPANDED Timespan=1990-2013</i>
# 19	1,690	#17 AND #11 <i>Databases=SCI-EXPANDED Timespan=1990-2013</i>
# 18	374,153	TI=(barrier* or facilitat* or hinder* or hindrance or impede* or attitude* or view* or experience* or belief* or believ* or perception* or perceiv* or expect* or understand* or understood) <i>Databases=SCI-EXPANDED Timespan=1990-2013</i>
# 17	96,837	#16 OR #15 OR #14 OR #13 OR #12 <i>Databases=SCI-EXPANDED Timespan=1990-2013</i>
# 16	12,840	TS="focus group*" <i>Databases=SCI-EXPANDED Timespan=1990-2013</i>
# 15	21,185	TS=(interview* NEAR/2 (indepth or structured or semi-structures or unstructured)) <i>Databases=SCI-EXPANDED Timespan=1990-2013</i>
# 14	52,559	TS=(qualitative* NEAR/2 (research* OR study or studies or sub-study or approach* or technique* or method* or analysis or analyses or interview*)) <i>Databases=SCI-EXPANDED Timespan=1990-2013</i>
# 13	21,282	TS=(qualitative* and (review* or literature or synthesis)) <i>Databases=SCI-EXPANDED Timespan=1990-2013</i>

# 12	18,350	TI= qualitative* <i>Databases=SCI-EXPANDED Timespan=1990-2013</i>
# 11	48,532	#10 OR #9 OR #8 OR #7 OR #6 OR #5 OR #4 OR #3 OR #2 OR #1 <i>Databases=SCI-EXPANDED Timespan=1990-2013</i>
# 10	14	TS=("new behaviour*" NEAR/2 (change* or adopt* or "take up" or uptake or "took up" or implement* or maintain* or sustain* or complet* or continu* or initiat* or reduction* or reduce* or adjust* or adjustment*)) <i>Databases=SCI-EXPANDED Timespan=1990-2013</i>
# 9	31	TS=("new behavior*" NEAR/2 (change* or adopt* or "take up" or uptake or "took up" or implement* or maintain* or sustain* or complet* or continu* or initiat* or reduction* or reduce* or adjust* or adjustment*)) <i>Databases=SCI-EXPANDED Timespan=1990-2013</i>
# 8	3	TS=("disease management behavio*") <i>Databases=SCI-EXPANDED Timespan=1990-2013</i>
# 7	30	TS=("unhealthy behaviors" NEAR/2 (change* or modif* or adopt* or "take up" or uptake or "took up" or implement* or maintain* or sustain* or complet* or continu* or initiat* or reduc* or adjust*)) <i>Databases=SCI-EXPANDED Timespan=1990-2013</i>
# 6	10	TS=("unhealthy behaviours" NEAR/2 (change* or modif* or adopt* or "take up" or uptake or "took up" or implement* or maintain* or sustain* or complet* or continu* or initiat* or reduc* or adjust*)) <i>Databases=SCI-EXPANDED Timespan=1990-2013</i>
# 5	403	TS=("risk behaviors" NEAR/2 (change* or modif* or adopt* or "take up" or uptake or "took up" or implement* or maintain* or sustain* or complet* or continu* or initiat* or reduc* or adjust*)) <i>Databases=SCI-EXPANDED Timespan=1990-2013</i>
# 4	97	TS=("risk behaviours" NEAR/2 (change* or modif* or adopt* or "take up" or uptake or "took up" or implement* or maintain* or sustain* or complet* or continu* or initiat* or reduc* or adjust*)) <i>Databases=SCI-EXPANDED Timespan=1990-2013</i>
# 3	57	TS=("multiple behavio*" NEAR/2 (change* or modif* or adopt* or "take up" or uptake or "took up" or implement* or maintain* or sustain* or complet* or continu* or initiat* or reduc* or adjust*)) <i>Databases=SCI-EXPANDED Timespan=1990-2013</i>

# 2	9,198	TS=(lifestyle NEAR/2 (change* or modif* or adopt* or "take up" or uptake or "took up" or implement* or maintain* or sustain* or complet* or continu* or initiat* or reduc* or adjust*)) <i>Databases=SCI-EXPANDED Timespan=1990-2013</i>
# 1	48,008	TS=(lifestyle* or "health* behaviour*" or "health* behavior*" or "multiple risk behaviour*" or "multiple risk behavior*") <i>Databases=SCI-EXPANDED Timespan=1990-2013</i>

Appendix 24: Review 3 – Data extraction template

Item	Response format
Study characteristics	
Study aim	<input type="checkbox"/> Please specify <input type="checkbox"/> Not reported
Country	<input type="checkbox"/> Please specify <input type="checkbox"/> Not reported
Sample size	<input type="checkbox"/> Please specify <input type="checkbox"/> Not reported
Study setting	<input type="checkbox"/> Please specify <input type="checkbox"/> Not reported
Population type	<input type="checkbox"/> General population <input type="checkbox"/> Non-targeted subgroup of general population (provide further details)
Population age	<input type="checkbox"/> Mean/range/median <input type="checkbox"/> Not reported
Population gender/s	<input type="checkbox"/> Male (% or total) <input type="checkbox"/> Female (% or total) <input type="checkbox"/> Not reported
Risk behaviours discussed.	<input type="checkbox"/> Diet (specify type of dietary behaviour) <input type="checkbox"/> Physical activity <input type="checkbox"/> Other (please specify) <input type="checkbox"/> Not reported
Contextual reasons for multiple behaviour change (e.g., to reduce risk factors for coronary heart disease)	<input type="checkbox"/> Please specify <input type="checkbox"/> Not reported
Intervention details: content, duration, delivery mode, deliverer (where applicable)	<input type="checkbox"/> Please specify <input type="checkbox"/> Not reported
Data collection method (tick all that apply)	<input type="checkbox"/> Interview <ul style="list-style-type: none"> <input type="checkbox"/> Semi-structured <input type="checkbox"/> In-depth <input type="checkbox"/> Interview type not reported <input type="checkbox"/> Focus groups <input type="checkbox"/> Observations <input type="checkbox"/> Document analysis <input type="checkbox"/> Other (please specify)
Data analysis methods used (tick all that apply)	<input type="checkbox"/> Discourse analysis <input type="checkbox"/> Content analysis <input type="checkbox"/> Thematic analysis <input type="checkbox"/> Document analysis <input type="checkbox"/> Framework analysis <input type="checkbox"/> Grounded theory analysis <input type="checkbox"/> Constant comparison <input type="checkbox"/> Other (please specify)
Theoretical model used to interpret/contextualise findings	<input type="checkbox"/> Please specify <input type="checkbox"/> Not reported
Inductive coding	
Stage 1: Initial codes - each reviewer highlights and assigns text to relevant child codes (as line-by-line coding is performed).	Add new child codes into Eppi-reviewer when necessary.

<p>These should be placed within one of three adult codes:</p> <ol style="list-style-type: none"> 1. Raw data 2. Authors' interpretations of the data 3. Unclear 	
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Appendix 25: Review 3 – Characteristics of the included studies

Table 24.1. Characteristics of the included studies (14 in total)

Study author/s, (year of publication) and country	Study aim	Participant characteristics	Sample size, setting	Risk behaviours discussed and details of previous multiple behaviour change interventions received by participants (where applicable)	Contextual reason/s for discussing multiple risk behaviours	Methods for data collection and analysis
Bove & Olson, (2008) USA	To understand overweight and obesity in low-income mothers living in rural poverty, with a particular focus on the factors (unique to rural poverty) that make maintenance of a healthy weight challenging.	Mothers (aged 18 years or older) with children aged 12 years or younger, with an annual income less than 200% of the federal poverty line. Age range: 19-48 years.	N=28 Participants' homes, relatives' homes, or private rooms at participants' workplaces, or sites of programs already serving low-income families in the areas. The two sites were rural areas in New York State.	Diet, physical activity The participants had not previously received a multiple behaviour change intervention.	To understand factors contributing to obesity/overweight prevalence in rural, economically disadvantaged women.	Data collection method: Interview Data analysis methods/: Grounded theory analysis Theoretical model/s used to interpret/contextualise findings: None reported.
Condon <i>et al.</i> , (2008) UK (England)	To explore the views of prisoners on making healthy choices in prison.	Prisoners. Most were male (91%); a small proportion were female (9%). Five per cent were aged over 60 years and 18% were aged 16-20 years (no further details for age reported).	N=111 Twelve prisons (including men's prisons, young offenders' institutions and a women's prison).	Diet, physical activity, smoking, alcohol use The participants had not previously received a multiple behaviour change intervention.	To explore opportunities prisoners have and use for healthy choices in areas identified in the 2004 white paper, entitled 'Choosing Health.'	Data collection method : Interview Data analysis methods: Thematic analysis Theoretical model/s used to interpret/contextualise findings: None reported.
Doldren & Webb, (2013) USA	To explore the views of working age Black women to identify whether knowledge or attitudes to healthy food and physical activity were related to their motivations for	Black women of working age (aged 18-45 years).	N=40 No details of the study setting were reported.	Diet, physical activity The participants had not previously received a multiple behaviour change intervention.	To increase understanding for the reasons that the USA's obesity rates are higher among Black than White women.	Data collection method: Focus groups Data analysis methods: Thematic analysis Theoretical model/s used to interpret/contextualise findings: None reported.

	healthy behaviour.					
Farooqi <i>et al.</i> , (2000) UK (England)	To identify the key issues relating to knowledge and attitudes to lifestyle risk factors for coronary heart disease amongst South Asians aged over 40 years in Leicester.	South Asians aged over 40 years. Age range: 40-70 years. Fifty-five per cent were male and 45% were female. Fifty per cent were Sikh, 25% were Hindu and 25% were Muslim.	N=44 GP practices and community centres (including one Sikh community centre) in Leicester, England.	Diet, physical activity, smoking, alcohol use. The participants had not previously received a multiple behaviour change intervention.	South Asians have a higher risk of coronary heart disease in the UK than the general population.	Data collection method: Focus groups Data analysis methods: Content analysis, thematic analysis Theoretical model/s used to interpret/contextualise findings: None reported.
Folta <i>et al.</i> , (2008) USA	To determine knowledge and awareness of cardiovascular disease risks in midlife and older women, to identify barriers to heart-healthy eating and physical activity, and to develop intervention strategies likely to be both feasible and effective.	Sedentary women aged 40 and older. Age range: reported as early 40s to late 80s.	N=38 In addition, 25 agents for the Cooperative State Research, Education and Extension Service (CSREES) were asked for views on nutrition, physical activity, and heart health, and for opinions on interventions to address these issues in sedentary women aged 40 years or over. Community setting. Rural communities and small cities in Kansas and Arkansas.	Diet, physical activity The participants had not previously received a multiple behaviour change intervention.	Cardiovascular disease is the leading cause of death in women in the USA.	Data collection method: Interview, focus groups Only the sedentary women participated in the focus groups; CSREES agents were interviewed. Data analysis methods: Framework analysis (the framework was based on questions used in focus group; additional themes emerging from the data were then added to the framework, and data was then recoded). Theoretical model/s used to interpret/contextualise findings: None reported.
Gettleman & Winkleby (2000) USA	To use focus group feedback to generate ideas for the structure and implementation of	Low-income women of African-American (35%), Hispanic (35%), or White (29%) ethnicity.	N=51 Various community-based sites, in both rural and urban	Diet, physical activity, smoking The participants had not previously received a multiple behaviour change intervention.	Low-income women of African-American, Hispanic or White ethnicity are one of the largest groups at risk for	Data collection method: Focus groups Data analysis methods: Thematic analysis

	future cardiovascular disease interventions (tailored to low-income populations).	Mean age was 41 years (range: 19-59). Most were mothers (94%). Prevalence of disease risk factors (smoking, physical inactivity, high dietary fat, etc) were similar to low-income women in national samples.	locations.		cardiovascular disease. Few heart disease programs have effectively been implemented.	Theoretical model/s used to interpret/contextualise findings: Social learning Theory and Empowerment Theory.
Greaney <i>et al.</i> , (2004) USA	To explore the motivations of older adults for eating five or more servings of fruits and vegetables and/or exercise, and the strategies used to adopt or maintain these behaviours.	Adults aged 60 years and over. Mean age was 77 years (SD=4.8). Seventy-two per cent were female, 28% were male. Most were White (93%) and nearly half were widowed (48.3%). The mean number of years for education attainment was 13 (SD=2.4).	N=29 Community. The sample had been participants in a community-based health promotion trial for the Study of Exercise and Nutrition in Older Rhode Islanders (the SENIOR project). They had agreed to be contacted for additional studies.	Diet, physical activity Details of previous behaviour change intervention: targeted fruit and vegetable consumption and physical activity; based on the Transtheoretical Model. Included behaviour-based manuals and newsletters, tailored reports and counsellor phone calls. The intervention duration was twelve months; a 12-month follow-up was performed.	To better understand processes of change in older adults so that future behaviour change interventions might be more effective.	Data collection method: Focus groups Data analysis methods: Thematic analysis Theoretical model/s used to interpret/contextualise findings: The Transtheoretical Model.
Greaney <i>et al.</i> , (2009) USA	To identify barriers and enablers for healthy weight management in college students.	University students aged 18-24 years, who were not majoring in nutrition or exercise science. Mean age was 20 years (SD= 1.6). Forty-five per cent were male and 55% were female. Most were White (83%) and had a normal body mass index (72%); 25% had	N=115 Online - focus groups were accessible through WebCT (a computer conferencing program).	Diet, physical activity, alcohol use The participants had not previously received a multiple behaviour change intervention.	Weight management, i.e., prevention of rapid weight gain that commonly occurs in adults during their twenties.	Data collection method: Focus groups Data analysis methods: Framework analysis Theoretical model/s used to interpret/contextualise findings: Keller's ARCS model (attention, relevance, confidence, satisfaction) was used to guide focus group questions. Framework analysis was conducted

		an overweight/obese body mass index.				using the Social Ecological Model.
Higgins <i>et al.</i> , (2006) USA and Canada	To identify the social and economic contexts that shape behaviours related to heart health among low income lone mothers.	Low income, lone mothers living on social assistance. Age range: 17-53 years. Participants came from White, aboriginal, and immigrant populations in Pacific Northern areas of Canada and USA (no further details reported).	N=38 No details of the study setting were reported.	Diet, physical activity, smoking The participants had not previously received a multiple behaviour change intervention.	To understand behaviours related to CVD risk in low income lone mothers (because low income, poor education, etc, predispose women to heart disease).	Data collection method: Interview (two participants only), focus groups (all other participants). Data analysis methods: Framework analysis Theoretical model/s used to interpret/contextualise findings: McKinlay and Marceau's upstream-midstream-downstream framework was used for the framework analysis.
Kegler <i>et al.</i> , (2008) USA	To gain an in-depth understanding of the ways in which home and neighbourhood environments may affect healthy eating and physical activity in rural communities.	Adults aged 50 years or over. Eligible participants were African American or White, lived with at least one other person, and resided in one of the specified rural counties for at least 10 years. Mean age was 63 years (range=51-84). Fifty-two per cent were male and 48% were female.	N=60 Participants' homes, situated in two rural counties in Southwest Georgia.	Diet, physical activity The participants had not previously received a multiple behaviour change intervention.	Wanted to examine how home and neighbourhood environments may facilitate or act as a barrier to healthy eating and physical activity (i.e., obesity prevention) in rural communities.	Data collection method: Interview Data analysis methods: Content analysis, thematic analysis Theoretical model/s used to interpret/contextualise findings: None reported.
Koshy <i>et al.</i> , (2012) (Leslie <i>et al.</i> , 2012 was the	To explore whether participants taking part in a multiple behaviour change intervention study	People participating in smoking cessation classes, from deprived areas of Glasgow (no further details	N=30 Venues of smoking cessation classes in deprived areas of	Diet, smoking, physical activity Details of previous behaviour change intervention: received standard smoking cessation	The authors were trying to understand patients' perspectives regarding processes of change for both smoking cessation	Data collection method: Interview Data analysis methods: Thematic analysis

secondary paper for this) UK (Scotland)	perceived behavioural changes as being linked or discrete processes.	reported). Age range: 30 to more than 70 years. Thirty-five per cent were male and 65% were female.	Glasgow, Scotland (no further details reported).	classes and a weight management intervention, based on the Transtheoretical Model. Included a 5-week programme of nutritional advice, followed by five sessions for review, reinforcement of advice, and self-monitoring.	and dietary outcomes. This was all carried out within the context of a health improvement intervention.	Theoretical model/s used to interpret/contextualise findings: None reported.
Peterson <i>et al.</i> , (2013) USA	To describe the perceptions of Midwestern rural women in relation to healthy eating, physical activity and weight management.	Women residing in Midwestern rural areas - they could be any weight, body type, and have any level of involvement with physical activity. Mean age = 45 years (SD=9.3, range=20-65). Most were White (Caucasian) (94%); others were Hispanic (5%) or biracial (n=2%). Visual assessment showed that participants ranged from normal to obese.	N=65 Sites located in a rural Midwestern community.	Diet, physical activity The participants had not previously received a multiple behaviour change intervention.	To improve the design and implementation of physical activity and weight management interventions for Midwestern rural women, using a framework based on the Theory of Planned Behaviour.	Data collection method: Focus groups Data analysis methods: Framework analysis Theoretical model/s used to interpret/contextualise findings: Theory of planned behaviour.
Russell <i>et al.</i> , (2013) USA	To identify facilitators and barriers to behavioural change in past participants of a healthy lifestyle intervention, carried out in an urban underserved health centre. 'Underserved' populations included those with inadequate access to	Patients from an underserved, urban, community health centre. Most patients were referred to the centre because of obesity or obesity-related medical conditions. Age range: 25-70 years. Nine per cent were male and 91% were	N=23 Community health centre	Diet, physical activity, smoking Details of previous behaviour change intervention: The Healthy Living Program included group support, health education, and organised group exercise. Participants were encouraged to set goals (e.g., improved diet, increased physical activity). Intervention consisted of 24 biweekly sessions, including 60 minutes of group exercise and a 30-	To understand barriers and facilitators to behavioural change that this population experienced during the Healthy Living Program.	Data collection method: Focus groups Data analysis methods: Framework analysis Theoretical model/s used to interpret/contextualise findings: The Socio-Ecological Model.

	healthcare (e.g., the poor, uninsured, underinsured, or people in areas with insufficient access to healthcare).	female. Most were Black/African American (83%).		minute discussion on a health promotion/behaviour change topic (e.g., nutrition, stress reduction).		
Thornton <i>et al.</i> , (2006) USA	To investigate the influence of social support on weight, diet, and physical activity-related beliefs and behaviours among pregnant and postpartum Latino women.	Spanish-speaking Latino pregnant and post partum women (living in the community), aged at least 18 years. Their husbands and female relatives were also involved in the study. Mean age=27 years (range=21-36). All participants were Mexican immigrants. The women were all married housewives; the male dyad partners were construction workers, painters, or handymen.	N=10 dyads (consisting of 8 husband-wife pairs, one mother-daughter pair, and one pair involving a sister-in-law). Interviews were all conducted in places where confidentiality could be ensured. In Latino women these were places where they felt most comfortable; interviews with dyad partners were conducted in public places.	Diet, physical activity The participants had not previously received a multiple behaviour change intervention.	Results from this study were going to be used to help plan interventions to reduce risks of obesity and type 2 diabetes in this population.	Data collection method: Interview Data analysis methods: Thematic analysis Theoretical model/s used to interpret/contextualise findings: None reported.

Appendix 26: Review 3 – Quality assessment results

Table 25.1. Quality assessment results for the included studies (14 in total)

Study author/s (year of publication)	Abstract and title	Introduction and aims	Method and data	Sampling	Data analysis	Ethics and bias	Results: is there a clear statement of findings?	Transferability or generalizability	Implications and usefulness	Total quality score
Bove & Olson (2006)	Fair	Good	Good	Fair	Good	Good	Fair	Good	Good	33
Condon <i>et al.</i> (2008)	Fair	Fair	Fair	Good	Fair	Poor	Fair	Good	Good	29
Doldren & Webb (2013)	Fair	Fair	Fair	Fair	Fair	Fair	Good	Fair	Fair	28
Farooqi <i>et al.</i> (2000)	Good	Good	Good	Good	Good	Fair	Good	Good	Good	35
Folta <i>et al.</i> (2008)	Good	Good	Good	Fair	Fair	Fair	Good	Fair	Fair	31
Gettleman & Winkleby (2000)	Good	Good	Fair	Good	Good	Fair	Good	Good	Good	34
Greaney <i>et al.</i> (2008)	Good	Good	Good	Fair	Good	Fair	Fair	Fair	Fair	31
Greaney <i>et al.</i> (2009)	Good	Good	Good	Good	Good	Fair	Fair	Good	Good	34
Higgins <i>et al.</i> (2006)	Fair	Good	Good	Fair	Good	Fair	Fair	Fair	Good	31
Kegler <i>et al.</i> (2008)	Good	Good	Good	Good	Good	Fair	Good	Good	Good	35
Koshy <i>et al.</i> and Leslie <i>et al</i> (2012)	Good	Good	Fair	Good	Good	Fair	Good	Fair	Fair	32
Peterson <i>et al.</i> (2013)	Fair	Fair	Good	Fair	Good	Good	Fair	Fair	Fair	30
Russell <i>et al.</i> (2013)	Good	Good	Fair	Good	Fair	Fair	Good	Good	Fair	32
Thornton <i>et al.</i> (2006)	Good	Good	Fair	Fair	Good	Fair	Good	Good	Fair	32

Note: Total scores were categorised as follow: High quality (range: 30-36); medium quality (range: 24-29); and low quality (9-23). Shaded areas represent the studies rated as high quality.

Appendix 27: Review 3 – Thematic matrix showing all extracted qualitative data

Table 26.1. Thematic matrix showing all extracted participant quotes and authors' descriptions/interpretations

INTRAPERSONAL AND INTERPERSONAL (MICROSYSTEM) LEVELS:		
Theme	Subtheme	Supporting evidence (marked as raw data or author's own interpretation of raw data)
Psychological/physical factors (15 papers reporting on 14 studies)	Perceived risk of future events (e.g., disease, death)	<p>-Doldren & Webb, 2013 (raw data, p.34): "I see in myself the healthier options that I choose. So that's why I'm so passionate about not eating certain things. And maybe I will reward myself every now and then. But I am very conscious just because I have lost close people to me because of [such] disease [es] from eating."</p> <p>-Doldren & Webb, 2013 (raw data, p.35): ""I guess we've seen relatives and friends suffer through bad eating; that triggers within us ' so maybe I'll do things a little bit differently ' ."</p> <p>- Folta et al., 2008 (raw data, p.4): "I think it would be horrible to be incapacitated where you couldn't do for yourself . . . you couldn't drive, you couldn't walk to the mailbox, or whatever, you had to depend on someone else to do it for you. (larger community, Arkansas)"</p> <p>- Folta et al., 2008 (raw data, p.4): "We have a lot of heart history in our family, too, but they've survived it. And they've had stents and bypasses and all of this, but they've survived it and are doing very well — cancer just seems to be one of those things that you can't get stopped . . ." (larger community, Kansas)"</p> <p>- Folta et al., 2008 (raw data, p.4): "I've been there, and done that, been through two major heart surgeries, and I'm invincible. (larger community, Arkansas)"</p> <p>- Folta et al., 2008 (authors' interpretation, p.4): "CSREES agents confirmed that heart disease was not perceived as a major threat to women, despite their high levels of awareness. Agents added that some women are more concerned about breast cancer and that other women believe that heart disease will not happen to them."</p> <p>- Folta et al., 2008 (authors' interpretation, p.4): "Some focus group participants expressed a certain amount of fatalism regarding their risk, because of strong family history."</p> <p>- Greaney et al., 2004 (raw data, p. 29): "watching relatives or friends die at a young age"</p> <p>- Russell et al., 2013 (raw data, p.455): "My mother passed away when she was 49 from a massive heart attack and a lot of the things that a lot of us go through now is what contributed to heart attack, being overweight, not eating healthy. I have a daughter and I don't want to die before time."</p> <p>- Russell et al., 2013 (raw data, p.454): "It's a mind thing - setting my mind to do it. My mother passed at 49 from a heart attack. I have a daughter and don't want to die before my time."</p>
	Perceived outcomes of healthy lifestyle behaviours	<p>-Doldren & Webb, 2013 (raw data, p.35): "I'm starting, slowly to gradually eat healthier. I got to a point, I'm going to be 30 in a year, and I was just like, eventually, I'm going to have kids. Eventually, I want to do certain things. And I started thinking about my body – not just for me, but for the future."</p> <p>-Doldren & Webb, 2013 (raw data, p.35): "I find more African American people want to exercise, go to the gym. You see it everywhere. To me, I think, African Americans are trying maybe not to lose it but to stay in shape, just for their health. I personally engage in fitness activities and eating healthy. I'm trying not to gain the weight; I'm trying to take control of my weight. I'm trying to stay healthy."</p> <p>- Farooqi et al., 2000 (raw data, p.295): "We are too old, what good (is change) going to do us"?</p> <p>- Farooqi et al., 2000 (raw data, p.296): "I can't do vigorous exercise, my muscles and joints hurt."</p> <p>- Folta et al., 2008 (raw data, p.4): "My goal for myself is just to make changes that are healthy and become so much a part of my life that I'm not focused on that. (Several agree). I'd rather be focused on a lot of other things. (smaller</p>

		<p>community, Kansas)"</p> <ul style="list-style-type: none"> - Folta et al., 2008 (authors' interpretation, p.4): "The women talked about several types of physical activity that would be good for their hearts, including walking, running, or things that "get your heart rate up." CSREES agents confirmed that for the most part, women in the target population have a moderately high level of understanding about the role of physical activity in reducing risk and the types of activity that are most beneficial" - Folta et al., 2008 (authors' interpretation, p.4): "In each group, at least one woman talked about how diet and physical activity had not made an impact on her cholesterol levels." - Greaney et al., 2004 (raw data, p.28): "My cholesterol and triglycerides were high. I can control them without medication by eating healthy. I started when I found I had a high cholesterol problem. I started because I was overweight. I couldn't walk without huffing and puffing. I couldn't bend down to tie my shoes. I started when the doctor sent me to physical therapy." - Greaney et al., 2004 (raw data, p.28): "I've had a good life and want to keep going. I have always been active. The Grim Reaper is after me and it is harder to hit a moving target." - Greaney et al., 2004 (raw data, p.30): "When people move, they have adjustment problems. Moving to a new house can cause adjustment problems. Exercise can help you though the adjustment." - Greaney et al., 2004 (authors' interpretation, p.28): ""Participants also spoke of adopting these behaviors to improve appearance, specifically to lose weight and/or remained toned." - Koshy et al., 2012 (raw data, p.6): "If you're eating the right stuff and you see yourself not putting on weight and feel fitter it gives you that extra gee to get up in the morning, your chest's clear, you've not got a smoker's cough, overall you feel better." - Koshy et al., 2012 (raw data, p.6): "You know hard physical exercise makes you feel good and . . . healthy eating makes you feel good . . . and the smoking got to be a no no." - Koshy et al., 2012 (raw data, p.6): "I feel more refreshed and raring to go and I look forward to the day." - Peterson et al., 2013 (raw data, p.77): "My clothes fit better and I can buy nicer clothes." - Peterson et al., 2013 (raw data, p.77): "I have learned that when I do exercise, I feel better and actually have more energy." - Peterson et al., 2013 (raw data, p.77): "What's in it for me?" - Peterson et al., 2013 (authors' interpretation, p.77): "A defeatist attitude was present among many of these participants. This attitude was the results of the lack of immediate gratification associated with lifestyle changes." - Peterson et al., 2013 (authors' interpretation, p.77): "Other facilitators were the outcome(s) from healthy lifestyle choices. These included clothes that fit better, having more energy, and an improved self-esteem." - Russell et al., 2013 (raw data, p.455): "I know for me, knowing that I was exercising, knowing that I was changing my eating habits, it made me feel more . . . it made me feel good about myself." - Russell et al., 2013 (raw data, p.453): "...knowing that I need this at this time in my life. That it's going to help me be a better person mentally, physically and emotionally, okay. It's going to allow me probably to stay on this Earth a little bit longer to enjoy my family and stuff." - Thornton et al., 2006 (raw data, p.101): "I don't say this to offend you, but exercise so you can feel good."
	Motivation for healthy lifestyle behaviours	<ul style="list-style-type: none"> - Bove & Olson, 2008 (author's interpretation, p.74): "Findings from our study may elucidate this contradictory position held by overweight low-income women, that is, they would like to weigh less but seem uninterested in enacting weight-loss behaviors." - Doldren & Webb, 2013 (raw data, p.36): "Laziness. Sometimes you just don't feel like going. You know that it will

		<p>help you. Of course you know that it will benefit you, but sometimes you just don't feel motivated to go. Oh, I got to do that. Assert yourself. You've worked all week and you're just tired sometimes. [Participant from Focus Group 1] I think it has to do with motivation. Every morning, my mind tells me I'm going to get up and work out. But it never happens. I have the desire but, by nightfall, I'm like, I didn't do it today. I'll do it tomorrow. Tomorrow comes and it never happens. So I have the desire, but the motivation is not there. [Participant from Focus Group 4]"</p> <p>-Doldren & Webb, 2013 (raw data, p.37): "You have to want to do it. That's the first thing. You have to want to do it and then you have to say, I'm not going to make excuses for not being able to do it. I'm not going to do anything of that nature. Even though I would love to sleep in – goodness knows I would love to sleep in, I have to make sure I get up. [Participant from Focus Group 2]"</p> <p>- Folta et al., 2008 (raw data, p.5): "[A]nd then I changed jobs, and it took so long to get down to the Y to work out . . . I just stopped doing it, and then gradually I just started eating bad again and whatnot . . . I don't really have an excuse now. I have lots of time, I could do it, I just got out of the habit. (larger community, Arkansas)"</p> <p>- Folta et al., 2008 (authors' interpretation, p.5): "Retired women said that they were tired of cooking after doing it for so many years and did not want to spend the time."</p> <p>- Folta et al., 2008 (authors' interpretation, p.5-6): "A few women said that physical activity could be boring, but they would be willing to do it if it could be made fun."</p> <p>- Folta et al., 2008 (authors' interpretation, p.6): "Only a couple of women said that they do not exercise because they are lazy or dislike it."</p> <p>- Gettleman & Winkleby, 2000 (authors' interpretation, p. 446): "Many participants agreed that women might feel more motivated to change if encouraged to "keep in shape for yourself, rather than keep in shape for your children," as they are the people directly affected by their unhealthy lifestyles."</p> <p>- Gettleman & Winkleby, 2000 (authors' interpretation, p. 447): "Nothing makes me want to sneak around and smoke a cigarette more than some- one trying to take my smoking away."</p> <p>- Greaney et al., 2004 (raw data, p.29): "Fear: It is a great motivator. I am afraid of illness and incapacity."</p> <p>- Greaney et al., 2004 (raw data, p.30): "I was sick and had to make up my mind to get out"</p> <p>- Greaney et al., 2004 (raw data, p.30): "If I haven't felt well, have to make myself [exercise]."</p> <p>- Kegler et al., 2008 (raw data, p.7): "[tending to a vegetable garden]...Shoot man that's too much work, I can buy it cheaper than I can raise it. (African-American Male)"</p> <p>- Kegler et al., 2008 (raw data, p.6): "We've talked about it, and we know that we need to, but we just hadn't gotten, I guess you can say we're procrastinating. (White Female)"</p> <p>- Koshy et al., 2012 (raw data, p.6): "It [smoking cessation] is making me want to go to the gym and get my fitness back – if you're feeling fit and you've got it in your mind that you've given up the smoking and you're putting all the good nutrients into your body, well, aye, that would drive me on."</p> <p>- Koshy et al., 2012 (authors' interpretation, p.6): "A similar proportion identified improvements to their diet, physical activity and smoking as motivating them to maintain or make more positive changes. These participants felt that the psychological benefits they perceived while making one behavioural change encouraged them to make other healthy changes...These processes centred on improved confidence and increased self-efficacy induced by positive changes."</p> <p>- Leslie et al., 2012 (raw data, p.8): "I think I took my mind off the goal which was to stop smoking and have a healthier lifestyle.... I can't seem to get myself again focussed enough to get back on track, to think, 'No, this is not where I want to be at this time'."</p> <p>- Peterson et al., 2013 (raw data, p.77): "I have so far to go that one meal, or two pounds, is not going to make that</p>
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		<p>much difference."</p> <p>- Russell et al., 2013 (raw data, p.455): "My motivation is to live for my daughter and be healthier and not be on a diet like they say, but learn how to eat healthy."</p> <p>- Russell et al., 2013 (raw data, p.454): "I am persistent, if there is something I want to do, I target it and go for the jugular."</p> <p>- Russell et al., 2013 (raw data, p.453): "definitely being open minded . . . to learn something different and something new. Something that really never entered my mind."</p> <p>- Russell et al., 2013 (authors' interpretation, p.454): "Many of the participants who considered themselves successful at reaching their goals related a sense of internal motivation and perseverance."</p> <p>- Russell et al., 2013 (authors' interpretation, p.454): "Many participants noted the start of a new medication or a new diagnosis (e.g. diabetes or hyperlipidaemia) as the catalyst for their behavioural change."</p> <p>- Russell et al., 2013 (authors' interpretation, p.455): "The idea of 'role modelling' as both motivation and a goal was described by many participants and serves as another example of the interconnectedness of individual- and interpersonal-level facilitators."</p> <p>- Russell et al., 2013 (authors' interpretation, p.456): "The credibility of the group leaders and the personal connection was a motivator both to come to class and to continue working towards healthy lifestyle goals."</p> <p>- Thornton et al., 2006 (raw data, p.101): "What is my motivation? . . . feeling good . . . feeling healthy. It's my first motivation. And my second motivation . . . is my husband . . . because he likes athletics so much."</p>
	Caring about what other people and society think	<p>- Folta et al., 2008 (authors' interpretation, p.5): "feeling self-conscious at the gym was also a barrier."- Peterson et al., 2013 (raw data, p.77): "I try to eat the right foods and move, rather than sit, as a role model for my children. It is hard and I often wonder why I bother. People on TV are fat, and they are still loveable. In fact, size is only mentioned on programs that are focused on really obese people—and we are not there. Society has allowed fat."</p> <p>- Peterson et al., 2013 (raw data, p.77): "We have allowed being fat to be okay."</p> <p>- Peterson et al., 2013 (raw data, p.77): "I am no different than any other woman in the area. . . . I may be overweight, but I am not self-conscious about it in town. I am normal."</p> <p>- Peterson et al., 2013 (raw data, p.77): "We live in a rural area to be away from people. There are probably pluses and minuses to the isolation of rural living, but I like the pluses. So—if no one sees me, what difference does it [being overweight] make?"</p> <p>- Peterson et al., 2013 (raw data, p.78): "I think that even if there was a fitness center nearby, I would not go. I do not like to exercise in front of other people. We live in a rural area to NOT be around people."</p> <p>- Thornton et al., 2006 (raw data, p.100): "Yes, he likes it if I eat more healthy . . . it makes me feel good that he's happy."</p> <p>- Thornton et al., 2006 (raw data, p.99): "Sometimes it's only to please people . . . I do eat it to satisfy others"</p>
	Will power and discipline	<p>-Doldren & Webb, 2013 (raw data, p.37): "...you have to say, I'm not going to make excuses for not being able to do it. I'm not going to do anything of that nature. Even though I would love to sleep in – goodness knows I would love to sleep in, I have to make sure I get up. [Participant from Focus Group 2]"</p> <p>- Folta et al., 2008 (raw data, p.5): "And the healthy foods are always there. You know, you can lead a horse to water but can't make him drink. I try to cook healthy and try to have healthy things . . . but I like fried foods too, so it's hard. (larger community, Kansas)"</p> <p>- Folta et al., 2008 (authors' interpretation, p.5): "Many women reported that avoiding high-calorie snacks was especially difficult. They saw snacking as their main downfall. Even when they were able to eat more healthfully at</p>

		<p>meals, they reported having difficulty choosing healthy snacks."</p> <p>- Gettleman & Winkleby, 2000 (raw data, p.444): "I made a promise to my husband that I wasn't going to smoke after I got home from the hospital with my little girl. But I did. I started smoking a month after her birth. Soon I was smoking in the same room."</p> <p>- Greaney et al., 2004 (authors' interpretation, p.30): "Participants also spoke of the importance of willpower as being instrumental both to continuing to eat healthy and to exercising as well as returning to these behaviors after a setback."</p> <p>- Greaney et al., 2009 (authors' interpretation, p.283): "temptation and lack of discipline"</p> <p>- Kegler et al., 2008 (raw data, p.6): "If you want to get it, because you don't pay no more or less to go down there and buy cabbage, rutabaga, squash, than you buy this other stuff. No, it's not hard, it's just a matter of wanting to do that. It's a choice, it's my choice. (African- American Female)"</p> <p>- Russell et al., 2013 (raw data, p.456): "I went food shopping and grandma's always putting candy and bubble gum and everything in my cart for the kids. I say it's for the kids, okay. But I know when the kids ain't around I'm sneaking one of their bubble gums or I'm sneaking one of their Kit Kats."</p> <p>- Russell et al., 2013 (authors' interpretation, p.454): A 'lack of willpower' was described as the primary individual-level barrier to healthy change, especially involving exposure to something that they considered a weakness. This was noted by many of the same participants who reported high degrees of internal motivation and this seemed to be more of a temporary barrier, existing in response to certain stimuli."</p>
	Stress, emotions and mental states	<p>- Bove & Olson, 2008 (raw data and author's interpretation, p.68): "Emeline ate "everything that I can, that's not good for me" "because I get so nervous"; Eliza "overindulges" "if I'm hurt or offended"; Aggie "munch[es] constantly" when feeling stressed; and Kylie "snack[s] more" on "anything that's bad for me." Foods commonly consumed at these times were "chips and dips," "junk food," soda, ice cream, and chocolate desserts."</p> <p>- Bove & Olson, 2008 (raw data and author's interpretation, p.69): " Emeline, food insecure at her first and second interviews but food secure at the third, noted that her bingeing at the time of the third interview occurred not only because she felt "nervous"— which, she said, "overwhelms me to the point where I start feeling really hungry"—but also because her anxiety was occurring within the context of "knowing that I have the stuff [food] that I need and that I can afford.""</p> <p>- Bove & Olson, 2008 (raw data and author's interpretation, p.68): "bingeing"" "felt out of control," were "obsessing" about food, and/or had "that guilty feeling" after eating."</p> <p>- Bove & Olson, 2008 (author's interpretation, p.71): "the emotional eating that was common among these women went largely unnoticed."</p> <p>- Condon et al., 2008 (raw data, p.162): "I really don't want to go into a hostel because you don't want to sit in a place like that all day. So you look for somewhere to go and make friends, and you end up in the pub all day. I don't want to end up in the same habit again and straight back to square one. I want to get out of that. They say to me, 'Are you looking forward to getting out?', but I'm not ... because I don't know what I'm being let out to yet. (IP6, aged 31 years, category B prison)"</p> <p>- Condon et al., 2008 (raw data, p.159): "When he was outside he never used to smoke but now he's started smoking and you can tell from his lips they've gone really black from where he's just been sitting and smoking. I've noticed how serious smoking is, how bad it is for your health people who can't really survive, they get really frustrated when they can't have tobacco. (GP5, aged 21 years, category A prison)"</p> <p>- Condon et al., 2008 (authors' interpretation, p.161): "Many prisoners regarded using the gym as a coping strategy,</p>

		<p>with some describing it as a lifeline in that it provided a distraction and also an opportunity to make social bonds with other prisoners."</p> <p>- Condon et al., 2008 (authors' interpretation, p.161): "In two prisons, older prisoners complained that they were prevented from using the gym because they were not considered adequately fit. These prisoners felt that this caution stemmed from a fear of litigation which unfairly excluded them from a healthy activity."</p> <p>- Greaney et al., 2004 (authors' interpretation, p.29): "Participants also made some use of experiential processes. For example, self re-evaluation emerged when participants stated "feeling guilty" when they did not exercise or eat healthy."</p> <p>- Greaney et al., 2004 (raw data, p.30): "I lost my husband a few months ago and that has made it hard [to eat healthy]."</p> <p>- Greaney et al., 2004 (raw data, p.30: "Transitions may make you stop. Life transitions such as death, disappointment. But if you can work through it . . ."</p> <p>- Greaney et al., 2004 (raw data, p.30: "Poor emotional health. If chronically depressed, will just sit around."</p> <p>- Greaney et al., 2009 (authors' interpretation, p.283): "being bored."</p> <p>- Greaney et al., 2009 (authors' interpretation, p.284): "...whereas stress contributing to overeating was identified only in focus groups with females."</p> <p>- Higgins et al., 2006 (raw data, p.224): "I think when you feel really good about yourself [and your life], it is a lot easier to leave bad things behind."</p> <p>- Higgins et al., 2006 (raw data, p.224-225): "Depression over living such a difficult lifestyle in poverty, alone, and demeaned."</p> <p>- Higgins et al., 2006 (raw data, p.225): "The emotions that affect my health are sadness, fear, and overwhelmness (if this is an emotion). As I go through them, I know they are only temporary, how - ever they created an unhealthy lifestyle, such as eating poorly, not exercising, and making little effort to do feel good stuff. (research participant)."</p> <p>- Higgins et al., 2006 (raw data, p.226): "I really want somebody to respect me, respect me as I would respect them. I think it [should be] more of an equal thing . . . but [right now] it's hierarchical."</p> <p>- Higgins et al., 2006 (raw data, p.226): "It's like going in front of a bunch of people and just stripping butt naked. That's how I feel every time I go into the [public assistance] office. You have to just strip yourself clean. They want to know everything, even if they doubt you, you know, they question everything you say."</p> <p>- Higgins et al., 2006 (raw data, p.226): "I feel like they run my life."</p> <p>- Higgins et al., 2006 (raw data, p.229): Well, it would help if the welfare workers were nicer. The verification office that I was dealing with, she talked to me like I was stupid. And, I mean, I've been through school, I've worked, everything else. I mean, I'm not ignorant. If they would just treat you with some compassion."</p> <p>- Higgins et al., 2006 (raw data, p.229): "It's interesting to see how some workers treat you . . . A lot of it is discrimination."</p> <p>- Higgins et al., 2006 (raw data, p.229): "Looking down on people on welfare. Of their being disgraced—embarrassed by their life situation that's what [contributes to patterns of risky behavior]."</p> <p>- Higgins et al., 2006 (raw data, p.229): We're all persons. We all should be treated with respect. I don't think they're [case work- ers] doing a good enough job when it comes to respect."</p> <p>- Higgins et al., 2006 (raw data, p.229): "I think once they find out that you're a single mom or you're a younger mother but you are getting some sort of benefit, be it EI [employment insurance] or welfare or disability, they automatically look down at you. You are put into a different class in their eyes. I feel that if you had a little more</p>
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		<p>prestige in the community or something or you had more money you wouldn't be dealt with in that way."</p> <p>- Higgins et al., 2006 (raw data, p.229): "I'll tell you one thing, welfare [recipients] get treated a lot poorer than wealthy people do. Because we're the low-class citizens—it's not just the low class, it's the way they see that word welfare and immediately the little arrow comes up in their head and oh well, she's not worth the time. I still think that we should be treated as an equal regard- less of our income [because] we're all taxed. One way or another, we are all taxed, we [should] all get the same treatment that we're supposed to, but we don't and that's stress."</p> <p>- Higgins et al., 2006 (raw data, p.229): "I think they [social services] think we want to sit around . . . I just find it's very stressful going in there and having to ask for help. We feel powerless, and that's probably where a lot of the anger comes from."</p> <p>- Higgins et al., 2006 (authors' interpretation, p.224): "Confounding the situation, participants found that cigarettes or junk food helped them to cope with stress and the mental anxiety that permeated their lives."</p> <p>- Higgins et al., 2006 (authors' interpretation, p.224): "institutionalized social practices, consequent low income levels, low social status, and the disrespectful relational practices of others created stress and social exclusion and concomitant depression that impaired the women from engaging in a heart healthy life (upstream)"</p> <p>- Higgins et al., 2006 (authors' interpretation, p.224): "Participants acknowledged that their negative emotions or mental states often fueled health-compromising habits:"</p> <p>- Higgins et al., 2006 (authors' interpretation, p.225): "Although social services and the food bank were institutions that made life on a shoe string possible, the management systems and the attitudes of some workers made the participants feel like second-class citizens."</p> <p>- Peterson et al., 2013 (raw data, p.78): "I believe being depressed resulted in being unmotivated to exercise, or do much besides eat and watch TV. I thought if I fixed the inside of me, I might fix the outside of me. But neither is working."</p> <p>- Peterson et al., 2013 (raw data, p.78): "I have been overweight since I can remember. Now I have arthritis, which makes it impossible to exercise. That resulted in becoming depressed . . . which added to the weight and inability to exercise."</p> <p>- Russell et al., 2013 (raw data, p.456): "It's expensive to go to the Y, for me it is . . . I applied for the scholarship. And I thought everything was okay because I brought my income paper. And at the last minute she wanted me to go get a record to prove that I have food stamps. And I got mad 'cause I said I hate going to the welfare centre because you go get something simple like that and they make you stay all day."</p> <p>- Russell et al., 2013 (raw data, p.456): "If things are not going well on your job. If you become frustrated or if you lose your job . . . or if there is a downsize or your hours are cut, that affects you. Because now you have responsibilities that you need to keep up with, okay. And if you no longer have the means to do that, that's extremely stressful. So now you're at, damn, now okay, what am I gonna do. And it sure in hell ain't exercising."</p> <p>- Russell et al., 2013 (authors' interpretation, p.454): "They also commented on the role of stress and negative emotions as a barrier to healthy choices."</p>
	Impact of health status and physiological factors	<p>- Folta et al., 2008 (authors' interpretation, p.5): "hunger when they try to cut down on portion sizes"</p> <p>- Folta et al., 2008 (authors' interpretation, p.5): "not liking fruits and vegetables"</p> <p>- Koshy et al., 2012 (raw data, p.6): "Now you can taste what it's supposed to taste like."</p> <p>- Koshy et al., 2012 (authors' interpretation, p.6): "...10 interviewees discussed physiological mechanisms emanating from smoking cessation such as: improved breathing which encouraged them to be more active; and, better taste perception which helped them appreciate subtler tastes such as those of vegetables and fruit. Thus, of the 10</p>

		<p>interviewed participants who identified physiological mechanisms as aiding behaviour changes, 7 quit smoking and 3 were successful at both changes."</p> <p>- Koshy et al., 2012 (raw data, p.6): "My exercises – I can do a lot more because I'm not breathless, I can go up and down the stairs no bother. I just feel a lot healthier, a lot fitter and healthier."</p> <p>- Koshy et al., 2012 (raw data, p.6): "Fantastic. I just like the taste . . . when I was smoking and you were eating a piece of fruit it just tasted the same kind of bland . . . this time it's really lovely . . . your carrot and your broccoli and all the different things that I'm eating . . . it's just a lovely taste."</p> <p>- Leslie et al., 2012 (raw data, p.8): "When I first stopped the smoking I couldn't stop eating sweet things, it was dreadful."</p> <p>- Peterson et al., 2013 (authors' interpretation, p.78): "Other barriers included physical limitations, such as arthritis, and comorbid health conditions, such as depression."</p> <p>- Peterson et al., 2013 (authors' interpretation, p.78): "Physical limitations mentioned included acute and chronic health conditions."</p>
Knowledge/awareness (13 papers reporting on 12 studies)	Knowledge/awareness about risk behaviours and disease	<p>- Bove & Olson, 2008 (raw data and author's interpretation, p.71): "'lives on coffee" and "can go weeks without eating." Her husband too could not fathom her weight given that she so often went without meals so that her children could eat: "I don't know why she has weight problems 'cause she starves herself half the time." Theda, another informant who was obese, marveled that she had gained weight even as she had "completely cut down eating" to "help make food go [last] longer" when her household's food supply had shrunk following her recent job loss."</p> <p>- Bove & Olson, 2008 (author's interpretation, p.73): "Our findings suggest that food insecurity, with its uneven food intake, dietary coping strategies, and perceived psychological and socio - cultural components, might have obscured women's knowledge of overall dietary intake."</p> <p>- Farooqi et al., 2000 (raw data, p.295): "I think the elderly will not change their habit, they don't know how."</p> <p>- Farooqi et al., 2000 (raw data, p.296): "Do you feel alcohol and smoking is doing harm to the heart at all?"</p> <p>- Farooqi et al., 2000 (raw data, p.296): "Is alcohol bad for the health?"</p> <p>- Folta et al., 2008 (authors' interpretation, p.3): "Most women in the focus groups were aware that the leading cause of death for women in the United States is heart disease, although several believed that it was breast cancer."</p> <p>- Folta et al., 2008 (authors' interpretation, p.3): "They were generally aware that heart attack symptoms for a woman are often more subtle than those for men. One group talked about women having smaller veins."</p> <p>- Folta et al., 2008 (authors' interpretation, p.4): "CSREES agents reported that the women were more likely to have misconceptions about diet than about physical activity."</p> <p>- Folta et al., 2008 (authors' interpretation, p.4): "Participants did have some food-related misconceptions, though. Cheese, garlic, and spices were incorrectly named as foods that would promote heart health. Coffee and caffeine were incorrectly named as things that should be avoided."</p> <p>- Folta et al., 2008 (authors' interpretation, p.4): "but they have difficulty in putting their knowledge into practice."</p> <p>- Folta et al., 2008 (authors' interpretation, p.5): "confusion over what they perceive as conflicting health messages"</p> <p>- Folta et al., 2008 (authors' interpretation, p.5): "lack of menu planning that leads to eating out"</p> <p>- Gettleman & Winkleby, 2000 (authors' interpretation, p.451): "Our findings demonstrate that low SES women are concerned about heart disease, interested in changing health behaviors, and aware of broader societal influences on health behaviors."</p> <p>- Gettleman & Winkleby, 2000 (raw data, p.446): "I am completely dunced as to what should be included in my diet."</p>

		<p>Half the time I am just eating. There is no time to think about what I am taking in."</p> <p>- Gettleman & Winkleby, 2000 (authors' interpretation, p.451): "the new generation of low SES women may be more empowered and have an increased interest and knowledge about cardio-vascular health than their predecessors."</p> <p>- Greaney et al., 2009 (authors' interpretation, p.283): "... limited knowledge to shop and/or prepare healthful food."</p> <p>- Higgins et al., 2006 (authors' interpretation, p. 224): "... participants were knowledgeable about heart health, its risks, and its significance to their health"</p> <p>- Higgins et al., 2006 (authors' interpretation, p. 224): "Overall, participants' general knowledge of health and heart health reflected a holistic understanding, recognizing the genetic aspect of heart disease and the effect of preventive behaviors—such as exercising, eating well, being smoke free, and managing stress—as important to heart health."</p> <p>- Thornton et al., 2006 (raw data, p.99): "For example, here [U.S.] . . . not knowing how to prepare them . . . how to mix in a fruit or a vegetable that you don't like too much. Also not knowing to use ingredients that are good for you."</p> <p>- Thornton et al., 2006 (authors' interpretation, p.102): "Some participants reported that low interaction with experienced women limited their knowledge of ways to cook and eat healthy, and increased feelings of isolation."</p>
	Perceived importance of healthy lifestyle behaviours	<p>- Greaney et al., 2009 (raw data and authors' interpretation, p.283): "Overall, participants said it was important to be "aware of what to eat and what not to eat."</p> <p>- Koshy et al., 2012 (raw data, p.5): "It's one thing cutting out the cigarettes to cut out heart disease, but you're just going to kill yourself anyway if you're eating all these fatty foods."</p> <p>- Koshy et al., 2012 (raw data, p.5): "There's no point in improving one side of your health to let the other side deteriorate."</p> <p>- Koshy et al., 2012 (raw data, p.5): "I don't want to [think] I've done one healthy thing and then all of a sudden I'm obese."</p> <p>- Koshy et al., 2012 (raw data, p.5): "I'm willing to do anything to better my life from stopping smoking and eating healthily . . . and getting some form of exercise – Now, the three of them go hand in hand, don't they."</p> <p>- Koshy et al., 2012 (raw data, p.5): "Everything works in as one thing, you know, your not smoking, your eating healthy food, your on a control diet or whatever it is and your exercising – it 's not just four different things."</p> <p>- Russell et al., 2013 (raw data, p.455): "It's kind of interesting because, you know, like I'll buy the scratch offs from time to time. And it's like I don't think anything of just buying a \$5 scratch off but I'll be like \$5 for grapes?! It's about having . . . I: Priorities. R2: Self-worth. R1: Well, that's it. R2: And knowing that \$5 worth of grapes, I'm worth it!"</p>
	Communication with health professionals/instructors and welfare staff	<p>- Higgins et al., 2006 (authors' interpretation, p.225): "...workers offered conflicting information about the women's right to access those services..."</p> <p>- Leslie et al., 2012 (raw data, p.8): "...still smoking and you're a failure...there's not that negativity at all, whereas it's always, 'Yea, you are but you can still do this.' Everything's dealt with in a very, very positive manner..... it makes me quite happy to be open and honest about I've not been too good here."</p> <p>- Peterson et al. 2013 (authors' interpretation and raw data, p.76): "When explaining their knowledge deficit, one participant stated, "My doctor never mentions weight as a health issue, or the health consequences of an inactive life." Another agreed with this perspective, stating "they are too chicken."</p> <p>- Peterson et al., 2013 (authors' interpretation, p.79): "Women in this study indicated that physicians and other healthcare providers do not directly address their overweight or obesity during health visits, but rather avoided the topic."</p> <p>- Russell et al., 2013 (raw data, p.454): "The support more than the exercise is important to me. I like listening to people to get information for living."</p>

		<p>- Russell et al., 2013 (raw data, p.455): I was an avid fast food person and I didn't realize how poisonous that stuff was, I really, really didn't. And she brought in a carb sheet from all of them. And I realized I was killing myself. So now I don't do it anymore. I don't mess with it all.'</p> <p>- Russell et al., 2013 (raw data, p.455): "I also liked the fact that [the instructor] was very open and honest. She told us about herself, the things that she did, her eating habits, how she's lost weight and how she loves to eat . . . she knows if she goes to have that cheeseburger, she's going to have to do a little extra work- out."</p> <p>- Russell et al., 2013 authors' interpretation, p.456): "Additional programmatic-level facilitators were the skill of the instructor and the personal care and attention provided by the programme coordinator. Participants felt that the instructor and the coordinator truly cared about them and believed in their ability to be successful."</p> <p>- Thornton et al., 2006 (raw data, p.101): "The doctor told her . . . look Isabel, if you get pregnant again, please walk. Otherwise, you are going to struggle again."</p> <p>- Thornton et al., 2006 (authors' interpretation, p.100): "Medical advice to walk during pregnancy also influenced participants' beliefs about the types of physical activity that foster a healthy pregnancy and delivery."</p>
	Strategies used to maintain healthy lifestyle behaviours	<p>-Doldren & Webb, 2013 (raw data, p.36): "On Sunday, I make all my meals for the week. That's my lunch and my dinner, and I just pack it in a Tupperware bowl, put it in the refrigerator, and just take that to work. [Participant from Focus Group 3] The way that I know is the best way to beat down some of these barriers is preplanning. And it is my Crock-Pot ™. I cook. I know somebody says they cook on Sunday for the whole week. What I do is I make one big something, say the meat – I make a chicken. If I make a chicken, I'm going to cook three chickens on Sunday instead of just one. Preplan. When I leave in the morning, I have my breakfast, my lunch, and my snack. I know I like this. I know I like that. I have it ready for me so I don't have to stop or pick up anything. It takes time. I have to get up a little bit earlier to pack my lunch but it's for me. When I think about it, it's for me. It's going to keep me where I want to be as far as my weight goes. [Participant from Focus Group 3]"</p> <p>- Farooqi et al., 2000 (raw data, p.295): "Have recently changed our ways of cooking." [A.2.15] "Teenage children won't let you cook in too much ghee or oil." [E.7.15] "We now grill our food rather than fry." [B.7.11]</p> <p>- Folta et al., 2008 (authors' interpretation, p.6): "A few women did not want yet another commitment, and they mentioned strategies for incorporating physical activity into their regular schedule, such as parking further away from the store or taking the stairs rather than the elevator."</p> <p>- Greaney et al., 2004 (raw data, p.29): "I don't buy things like ice cream. If it's not there, I don't have it."</p> <p>- Greaney et al., 2004 (raw data, p.29): "I try to find healthy substitutions. I'll have broccoli instead of potatoes."</p> <p>- Greaney et al., 2004 (raw data, p.29): "You have to make the time, commitment [to exercise]."</p> <p>- Greaney et al., 2009 (raw data, p.283): "eating in moderation," "watching portion size," "daily calorie limit."</p> <p>- Greaney et al., 2009 (authors' interpretation, p.283): "These participants said it was important to drink water and eat healthful food; eat around the same time daily; limit snacks; and eat only when hungry."</p> <p>- Greaney et al., 2009 (authors' interpretation, p.283): "Almost all participants had goals related to getting more exercise and/or improving their diet. Exercise goals included going to the gym more often and exercising regularly; dietary goals included eating better, increasing consumption of fruits and vegetables, and reducing intake of unhealthful food. Male participants were more likely to want to "bulk up," whereas the females wanted to become "toned." Weight- related goals included wanting to lose, gain, or maintain current weight. Although several females stated that their goal was to maintain their current weight, females were more likely than males to mention losing weight, typically 5 to 20 pounds, as a goal. Losing weight was mentioned as a goal in less than one-third of the male focus groups, and they were more likely than females to be specific about wanting to lose fat but gain muscle mass."</p>

	Impact of culture and religion on knowledge/awareness, beliefs and lifestyle behaviours	<p>-Doldren & Webb, 2013 (raw data, p.35): "We don't culturally know what [how] to eat properly. And then we don't know what's considered to be eating properly or healthy. There's so much more to making conscientious choices about what you should consume and what you shouldn't consume. [Participant from Focus Group 4]"</p> <p>- Farooqi et al., 2000 (raw data, p.295): "I cannot blame food, our forefathers have been eating this food, the only thing that has changed is the environment and atmosphere."</p> <p>- Farooqi et al., 2000 (raw data, p.295): "We should eat less fried food and cut down ghee in our cooking." [A.5.11]</p> <p>- Farooqi et al., 2000 (raw data, p.295): "The diets we have now are the same as what we had when in India, why is diet a problem?"</p> <p>- Farooqi et al., 2000 (raw data, p.295): "I feel personally that foods cooked in ghee and sugary foods which are heavy are the cause of it all."</p> <p>- Farooqi et al., 2000 (raw data, p.295): "We eat a lot of ghee (clarified butter) and oil. This will not do us any good. In India it was all right but not here."</p> <p>- Farooqi et al., 2000 (raw data, p.295): "Our diet is in fact better than some, it is the worries in a foreign country that is the main reason for ill health."</p> <p>- Farooqi et al., 2000 (raw data, p.296): "The western community centres where they have a gym and swimming, but we don't feel comfortable when it is mixed. It would be more beneficial if we had separate facilities."</p> <p>- Farooqi et al., 2000 (raw data, p.296): "I would like to swim, but as yet have not found a place where I will be allowed to swim with my karpaan" (religious dagger).</p> <p>- Farooqi et al., 2000 (raw data, p.296): "It is our religion, somebody will see me and spread gossip about me, if I go to swimming or aerobics."</p> <p>- Farooqi et al., 2000 (raw data, p.296): "We Indians don't do that" (in response to going to formal exercise sessions).</p> <p>- Farooqi et al., 2000 (raw data, p.296): "I don't think we (the Asian community) have a drinking problem."</p> <p>- Farooqi et al., 2000 (raw data, p.296): "Some Asians have lots of tobacco in their paan— but I have not read that it could be the cause of heart attacks."</p> <p>- Russell et al., 2013 (authors' interpretation, p.454): "Several participants mentioned faith or spirituality as an individual-level facilitator for behavioural change."</p> <p>- Russell et al., 2013 (raw data, p.456): "That was a great change for us. Especially for us African Americans, we had to fight back all that bad foods. It was bacon for breakfast, so you know we were raised that way. Fried everything . . . it was fried three course meals every day."</p> <p>- Russell et al., 2013 (authors' interpretation, p.457): "Others described food-related cultural traditions that made behavioural changes difficult."</p> <p>- Russell et al., 2013 (authors' interpretation, p.457): "Finally, many cultural barriers were described. Some participants mentioned a cultural hesitancy to talk about problems, which prevented them from enjoying the relief and validation that others found in sharing their struggles with the group."</p> <p>- Thornton et al., 2006 (raw data, p.99): "They say when one eats watermelon, jicama, beans, it's real bad after the pregnancy, the birth . . . the womb gets cold . . . they tell me that you shouldn't even eat avocado. . . it's very bad because it's too cold."</p> <p>- Thornton et al., 2006 (raw data, p.99-100): "...if she doesn't eat what she craves, that might harm the baby."</p> <p>- Thornton et al., 2006 (authors' interpretation, p.99): "Secondary sources of informational support that influenced women's eating patterns included their husbands' preferences and traditional cultural beliefs. These very old traditions such as avoidance of foods defined as 'cold' and indulgence of cravings were transmitted by both male and</p>
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		<p>female family members."</p> <p>- Thornton et al., 2006 (authors' interpretation, p.98): "Both eating and physical activity patterns were influenced by cultural beliefs and family rituals concerning safe and appropriate foods and physical activities during and after pregnancy."</p> <p>- Thornton et al., 2006 (authors' interpretation, p.100): "Since active lifestyles in Mexico involving sports and daily walks were valued by women and their families, engaging in such activities after pregnancy was perceived as a natural and desirable"</p> <p>- Thornton et al., 2006 (authors' interpretation, p.100): "Adhering to cultural norms regarding a new mother's need to rest for at least 1-month post-delivery was also expected by most participants and influential persons. However, instruction about this norm was translated to participants by older female relatives, such as mothers-in-law, and not by husbands or others."</p>
Interventions (8 papers reporting on 7 studies)	Perceptions and ideas relating to lifestyle interventions	<p>- Farooqi et al., 2000 (raw data, p.295): "Lots have no idea (on how to cook differently). We should have classes on healthy cooking."</p> <p>- Folta et al., 2008 (authors' interpretation, p.6): "Overall, the women thought that they already knew a fair amount about what they need to do to reduce their risk of CVD in terms of diet and physical activity but that they just need help putting that knowledge into practice."</p> <p>- Folta et al., 2008 (authors' interpretation, p.6): "They said that to motivate them to keep coming, an intervention program should be hands-on. CSREES agents confirmed that programs with a hands-on component are most popular with their constituency. Hands-on nutrition intervention programs that had worked best for them in the past had included tastings and cooking exercises."</p> <p>- Folta et al., 2008 (authors' interpretation, p.6): "Focus group participants also wanted a program to include goal-setting where they set reasonable, realistic goals so that they could see results, even small ones. They wanted to receive recognition that they had met those goals. CSREES agents felt comfortable in helping women set goals and in giving them recognition for meeting goals."</p> <p>- Gettleman & Winkleby, 2000 (raw data, pp.444 and 446): "You need to show what is going on with cigarettes inside the body and what the cigarettes are doing."</p> <p>- Gettleman & Winkleby, 2000 (raw data, p.447): "You don't want to see a soap-opera type person, because they have the money to do it. You just want to see basic people who have to struggle."</p> <p>- Gettleman & Winkleby, 2000 (raw data and authors' interpretation, p.446): "One woman mentioned that if an exercise program provided her with individual attention, she would feel "They're specializing on me and they are trying to make me perfect like a movie star with all of those personal trainers." "</p> <p>- Gettleman & Winkleby, 2000 (raw data, p.447): "The key word is class. You need to change that word into something else. Some people, even though they have not been to high school or college, they don't want to go to a class to learn. They need to have a different type of environment. A class—it's always a lecture."</p> <p>- Gettleman & Winkleby, 2000 (raw data and authors' interpretation, p.447): "One woman suggested that she would like to see a heart disease prevention program that would show "a big heavy woman who used to have high cholesterol, who cut out fatty foods and then looked nice." "</p> <p>- Gettleman & Winkleby, 2000 (authors' interpretation, p.447): "Women felt that videos would be most effective if watched and discussed in groups rather than individually. Since many of the participants described their home lives as frequently "chaotic," they preferred attending programs outside of their homes where they would have less distraction."</p>

		<p>- Gettleman & Winkleby, 2000 (authors' interpretation, p.444): "Focus group participants wanted to know how smoking, lack of exercise, and a high fat diet cause coronary artery disease, and how they could lower these risk factors within the financial and time constraints of their lives. Some of the women explained that knowing the science behind heart disease would motivate them to change their high risk behaviors. Others expressed that such knowledge would help them develop skills necessary to separate health "myths" from health "facts.""</p> <p>- Gettleman & Winkleby, 2000 (authors' interpretation, p.446): "The participants who smoked wanted to know how to stop smoking if they lacked the money or the health insurance to obtain nicotine patches. In regard to diet, many of the women expressed interest in seeing how high fat foods could harm their health and how they could prepare healthier foods within a limited budget."</p> <p>- Gettleman & Winkleby, 2000 (authors' interpretation, p.446): "participants valued the idea of having a CVD intervention that focused entirely upon the needs of low SES women and made them feel special."</p> <p>- Gettleman & Winkleby, 2000 (authors' interpretation, p.446): "Many women also expressed that they felt special when members of the medical community, and especially their children's doctors, expressed interest in their health as well as their children's. Many agreed that a doctor's interest in their health would motivate them to participate in a heart disease prevention program."</p> <p>- Gettleman & Winkleby, 2000 (authors' interpretation, p.446): "Women also felt special when they were asked to make behavior changes for their own personal benefit, instead of making changes for the sake of their children. The idea of doing something for oneself and not for the family was an appealing luxury, as few of these women had time to focus on themselves."</p> <p>- Gettleman & Winkleby, 2000 (authors' interpretation, p.451): "Past interventions tailored to low SES groups have tended to focus on women's families and children now low SES women may prefer that their own health needs are emphasized."</p> <p>- Gettleman & Winkleby, 2000 (authors' interpretation, p.446-447): "Most of the women agreed that they would be more likely to participate in a CVD prevention program if it were presented as a choice, as they were tired of being told what to do."</p> <p>- Gettleman & Winkleby, 2000 (authors' interpretation, p.447): "Most of the participants stressed that they would feel more like they had a choice if health information was presented in a group or workshop format, in contrast to a lecture format or class. Participants indicated that the word "class" was associated with the education that many of them lacked."</p> <p>- Gettleman & Winkleby, 2000 (authors' interpretation, p.447): "Women recommended that interventions need to focus on visual rather than on written components and images. They felt that health videos were especially appealing because they allowed women to "see things that can happen to you and your health."</p> <p>- Gettleman & Winkleby, 2000 (authors' interpretation, p.447): "The focus group women wanted to see health information presented with testimonials from "normal women" who described how they changed their behavior, with factual commentaries by physicians."</p> <p>- Gettleman & Winkleby, 2000 (authors' interpretation, p.447): "The majority of participants wanted to see women like themselves serve as examples of how people can change."</p> <p>- Gettleman & Winkleby, 2000 (authors' interpretation, p.451): "Our findings also suggest that women are amenable to participating in CVD prevention programs that recognize their time, financial, and family constraints."</p> <p>- Gettleman & Winkleby, 2000 (authors' interpretation, p.448): "Women felt that the three primary individual barriers to participating in a CVD intervention program were lack of time, transportation, and child care. Most</p>
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		<p>women agreed that they could not participate in any CVD intervention program without free child care."</p> <p>- Gettleman & Winkleby, 2000 (authors' interpretation, p.448): "With regard to time constraints, women working outside the home suggested that intervention programs be held at job sites during lunch hours; mothers not employed outside the home suggested that programs be held at community sites during school hours. They noted that offering programs where women work or routinely go with their children, such as a public libraries or pediatric clinics, would ease the problem of transportation."</p> <p>- Gettleman & Winkleby, 2000 (authors' interpretation, p.448): "Women suggested that grocery stores, laundromats, libraries, health clinics, pediatricians' offices, children's play areas, and detention centers would be effective sites to advertise an intervention program for low SES women."</p> <p>- Gettleman & Winkleby, 2000 (authors' interpretation, p.448): "While the majority of the women agreed that motivation for participation must come from the woman herself, many also agreed that free meals and the camaraderie of an all women's group would encourage attendance. Other women suggested that financial incentives, such as cash or food vouchers, would be strong incentives for participation. The differing opinions about incentives may reflect different individual needs of women (e.g., need for financial assistance versus social support), but could be accommodated by providing various incentives as part of an intervention program."</p> <p>- Greaney et al., 2009 (authors' interpretation, p.284): "Participants stated that additional opportunities (eg, intramural sports and group events) and increased social support would help them become more physically active."</p> <p>- Greaney et al., 2009 (authors' interpretation, p.284): "They noted that getting into a routine might be beneficial."</p> <p>- Greaney et al., 2009 (authors' interpretation, p.284): "Some students said that their university needs better fitness facilities because of overcrowded and/or inadequate facilities. Participants also mentioned that additional resources such as having a personal trainer, free membership to a gym, or a fitness center in the residence hall would enable activity."</p> <p>- Greaney et al., 2009 (authors' interpretation, p.284): "Many females felt that they would be more physically active if they knew what classes (eg, Pilates) were available on campus and if they knew how to use the available equipment."</p> <p>- Higgins et al., 2006 (authors' interpretation, p.225): "One program that was described as helpful was the Good Food Box, a program that pools money to buy fresh produce from local farmers at sale prices. Similarly, programs such as Peas in the Pod for expectant women, Common Threads for women on income assistance, community kitchens for low-income families, teen centers, and housing programs for homeless families offered instrumental support, respectful and caring companionship and mentoring, a break from child care, and sometimes opportunities to increase life skills and health knowledge relevant to heart health."</p> <p>- Leslie et al., 2012 (raw data, p.8): "It's quite nice to see how many steps you've done each day and I think it's been a bit of challenge."</p> <p>- Leslie et al., 2012 (raw data, p.8): "It was a 12-mile walk.... I found it quite easy because I had been building maself up for it over a period of weeks. I do the gym three times a week. Ma sessions - I've upped them from half-an-hour to an hour."</p> <p>- Russell et al., 2013 (raw data, p.455): "I would say we had went over portions one time. I think it was like how our plates was to look like. But my doctor and the dietician used to go over that same old plate. I guess it was different because I had never been in a group setting, sharing things with other people. So I think that's what made me motivate myself more. But I took paper plates when I went home and I drew the diagram on the plate."</p> <p>- Russell et al., 2013 (raw data, p.454): "I learned to add spices and experiment with food I had not been introduced</p>
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		<p>to. I didn't even know butternut squash was a vegetable."</p> <p>- Russell et al., 2013 (raw data, p.455): "One thing that I do that I used to not do is read labels. Now I go in the store to grocery shop and I used to be 20 minutes to half an hour, now I am in there an hour. I have to stop and read everything."</p> <p>- Russell et al., 2013 (authors' interpretation, p.456): "Participants also noted that the nutritional and lifestyle manual provided to the group was too wordy for participants who do not read well."</p> <p>- Russell et al., 2013 (authors' interpretation, p.456): "Another programmatic-level facilitator was the specific nutrition information taught during the didactic parts of the sessions. Many participants mentioned reading nutrition labels as a skill that had helped them make the lifestyle changes. Adding high-fibre foods, decreasing sodium intake, eating breakfast, baking rather than frying, experimenting with new vegetables and spices, drinking more water and avoiding fast food restaurants were all mentioned as specific nutrition information that the participants had learned through the HLP."</p>
	The process of changing multiple risk behaviours	<p>- Koshy et al., 2012 (authors' interpretation, p.6): "viewed smoking, diet and physical activity patterns as inextricably linked."</p> <p>- Koshy et al., 2012 (authors' interpretation, p.6): "...expressed the view that a multiple behaviour change focus would be beneficial in diluting attention from each individual difficult shift. Thus, of seven participants who felt that attempting to improve their diet and physical activity could distract them from smoking and hence aid their quit attempt, 5 quit and all 3 intervention participants were also able to limit weight gain to $\leq 3\%$."</p> <p>- Koshy et al., 2012 (raw data, p.5): "My daughter says 'you don't think it's a bit much to focus on the two at the same time' but I find it's actually quite good because it takes my mind [off]. If I'm thinking about one, I'm not thinking about the other."</p> <p>- Koshy et al., 2012 (raw data, p.5): "I'm willing to do anything to better my life from stopping smoking and eating healthily...and getting some form of exercise – Now, the three of them go hand in hand, don't they."</p> <p>- Koshy et al., 2012 (raw data, p.5): "I think it would take your mind off thinking about cigarettes – you've got something else to think about and to focus on, so you're not going [to] be focusing on cigarettes all the time."</p> <p>- Koshy et al., 2012 (authors' interpretation, p.5-6): "First, a small number of participants in both intervention and control groups noted that they were particularly keen to avoid post-cessation weight gain because of concerns that this would undermine any potential health benefits of smoking cessation."</p> <p>- Koshy et al., 2012 (raw data, p.5): "I feel that if I really push myself . . . I'm frightened I might just resort to having a cigarette instead . . . I'd rather that [smoking cessation] is done and dusted."</p> <p>- Koshy et al., 2012 (raw data, p.5): "I don't see the point in doing all this exercise when I'm still smoking anyway, so I'd rather nip that [smoking cessation] in the bud."</p> <p>- Koshy et al., 2012 (raw data, p.5): "Smoking was the last thing to deal with, I've dealt with the drinking, dealt with the weight, dealt with the smoking."</p> <p>- Koshy et al., 2012 (raw data, p.6): "When I never had a cigarette I had this in my head . . . your lungs start clearing . . . inside me is getting cleared out so I'll watch what I'm putting in . . . I was drinking plenty of water, fruit, vegetables, exercise every day and when I went back on the cigarettes, to hang with it, I started eating, fruit and veg is out the window and I'm back to the old sort of style [and] I'm actually smoking more."</p> <p>- Koshy et al., 2012 (raw data, p.6): "I'm angry at myself [for over-eating] – I shouldn't be giving in to it – I'm actually worrying about it and, you know, it's making me want to smoke . . . it's a vicious circle really."</p> <p>- Koshy et al., 2012 (raw data, p.5): "It's your metabolism, so you are eating more, you are compensating for a</p>

		<p>cigarette and you're not compensating with an apple or a banana or an orange."</p> <p>- Koshy et al., 2012 (raw data, p.5): "Maybe you think 'I'll have a cup of tea and biscuit' but I don't want to do that so now it's back to a wee cup of tea and cigarette. I need to be doing something, one or other."</p> <p>- Koshy et al., 2012 (authors' interpretation, p.6): "On the other hand, six participants described 'virtuous' pathways whereby achievements in one behavioural sphere would trigger success in others and of these 4 quit smoking and 3 of them were also successful at weight management."</p> <p>- Koshy et al., 2012 (authors' interpretation, p.7): "Psychological mechanisms such as improved confidence and increased self-efficacy following one behaviour change and physiological mechanisms such as improved taste sensation, ease of breathing and feeling 'healthier' were described as motivating participants to make further changes."</p> <p>- Koshy et al., 2012 (authors' interpretation, p.5): "Across those who viewed optimal change as happening either sequentially or concurrently more than a third [8], 10C described their desire to 'treat' themselves to comfort food to compensate for 'depriving' themselves of cigarettes during their quit attempt."</p> <p>- Koshy et al., 2012 (authors' interpretation, p.6): "...three participants all of whom gained > 3% weight described how perceived failure in one behaviour change triggered failure in others."</p> <p>- Russell et al., 2013 (authors' interpretation, p.454): "They also described 'pride and self-esteem' from reaching their goals as leading to a sense of 'competence' that encouraged them to continue with healthy changes."</p>
Personal responsibilities (9 studies)	Being a role model and responsible for others	<p>-Doldren & Webb, 2013 (raw data, p.35): "I have small children; I'm not sure who else does that we use those words around our girls, our kids now. Mommy, did you exercise today, and she's age 3. [Participant from Focus Group 1]"</p> <p>-Doldren & Webb, 2013 (raw data, p.36): "Even with my kids, I just wash a tomato and say, 'Here.' You have to start them early. Because they do what they're accustomed to. [Participant from Focus Group 2] Because it's not just about me. My husband's 40. I have to show him. My kids see me prepare stuff. I don't fry anything. And I told them why and they see it. They're learning it. They're being raised that way. I'm happy about that. [Participant from Focus Group 3]"</p> <p>- Gettleman & Winkleby, 2000 (raw data, p.446): "I am already working hard for my children."</p> <p>- Greaney et al., 2004 (raw data, p.28): "You are conscious of what you give them [your children]."</p> <p>- Greaney et al., 2004 (authors' interpretation, p.28): "Some spoke of beginning to eat healthy after they had had children."</p> <p>- Peterson et al., 2013 (authors' interpretation, p.76): "The role of women as caretakers for their families placed unique demands on these participants. Healthy food choices, fruit versus potato chips, salads versus fried foods, were known, but difficult to put into practice."</p> <p>- Russell et al., 2013 (raw data, p.455): "For me, it was my mother, her blood pressure was high for 5 years and just the other day, her blood pressure was down and it made me feel good when she told the nurse that 'my daughter made me change my eating habits and made me get on that treadmill.' That helps me knowing that I am able to help my mother get her blood pressure down."</p> <p>- Russell et al., 2013 (raw data, p.455): "I am a strong woman and I am the glue that holds my family together. Since I am the glue, we need to get that glue sticky not let it dry out and get lazy."</p> <p>- Russell et al., 2013 (authors' interpretation, p.456): "Exemplifying the interaction between the individual and interpersonal levels, participants described their desire to be a 'role model' for family and friends who were struggling with similar conditions."</p>
	Competing time demands	- Farooqi et al., 2000 (raw data, p.296): "There is no time for exercise. Home life is too busy." [G.1.22]

		<p>- Foltz et al., 2008 (authors' interpretation, p.5): "Time emerged as a major barrier to healthy eating, for different reasons. Women with children still in the home said that they had very busy schedules and did not have time to cook."</p> <p>- Gettleman & Winkleby, 2000 (authors' interpretation, p.444): "Exercise and diet were seen as difficult to change because of lack of time and the need to be motivated."</p> <p>- Greaney et al., 2009 (authors' interpretation, p.283): "Students reported that time constraints associated with being a student, make it difficult to obtain or prepare healthful meals and to exercise."</p> <p>- Greaney et al., 2009 (authors' interpretation, p.283): "reliance on precooked meals and unhealthful food."</p> <p>- Kegler et al., 2008 (raw data, p.7): "No, too old for a garden. One time we had one, a long time ago. But that's long past. My husband had one but I don't have time for a vegetable garden. But my neighbor has one. (African-American Female)"</p> <p>- Kegler et al., 2008 (raw data, p.5): "Well one of the reasons, we don't have as much time to do it and we so tied up doing other things that we don't, we won't take the time to do it. I won't say we don't have it but we can't make the time for more. (African-American Male)"</p> <p>- Peterson et al., 2013 (raw data, p.80): "We say we are going to walk at six—but I cannot go, so we are going to do it at four. That does not work, and sooner or later we have talked ourselves out of it."</p> <p>- Russell et al., 2013 (raw data, p.454): "It's hard to say no. My plate is overflowing with other commitments."</p> <p>- Russell et al., 2013 (authors' interpretation, p.454): "Participants cited 'competing time demands' as a major barrier. They described the challenges of home- work assistance and maintaining a household, in addition to the lack of childcare options if they wanted go to the HLP or the gym. For others, competing time demands involved the exhaustion of a long workday and the difficulty in making time for exercising or for cooking nutritious meals."</p> <p>- Russell et al., 2013 (raw data, p.456): "For me, being a single parent, I am always on the go . . . It is hard for me to say I am going to the gym today because she may have something at the school and I have to go do that."</p> <p>- Russell et al., 2013 (authors' interpretation, p.456): "Access to the programme posed a challenge for some as it was held in the evenings and conflicted with family or work commitments."</p>
	Disruption to routine	<p>- Greaney et al., 2004 (raw data, p.29-30): "I live a rather structured life. I go to bed at the same time and get up at the same time. If I am in my structure and in my environment, I will be my active self. If I'm visiting someone, it will throw structure off. Also, I might eat more. Structure makes it easier to exercise."</p> <p>- Greaney et al., 2004 (authors' interpretation, p.29): "Positive reasons for not participating in these behaviors included babysitting, having company, and traveling."</p> <p>- Russell et al., 2013 (raw data, p.456): "I was going regularly [to the Healthy Living Program] with my daughter, making new friends, achieving goals, you know? And then I get this call from my work, are you interested [in taking on a new case as a home health aide]? Of course, I'm interested, okay . . . then for the family to just take him away, put him in a nursing home and then he passes away. In the meantime what did I accomplish? I didn't finish the Healthy Living Program. I don't have that case anymore. So, I was angry."</p>
Social network (13 studies)	Family habits during childhood and adolescence	<p>- Doldren & Webb, 2013 (raw data, p.35): "It's also the education that your family has about nutrition and what you see within your family. So I would have to say, my mom is a PE teacher so it's a little bit different. She's going to have an emphasis on nutrition and health, exercise, and things of that nature, and not living such a sedentary life. [Participant from Focus Group 4] One of the things my mother liked was that she incorporated into my eating habits is that even though you have this big plate, you don't need to fill your plate up with everything and try to get it on. And it's starting to really transfer to my entire life. [Participant from Focus Group 3]"</p>

		<p>- Farooqi et al., 2000 (raw data, p.295): "I can't leave our food, this is what I have been eating since I was born and is what I will eat until I die." [A.5.3]</p> <p>- Farooqi et al., 2000 (raw data, p.296): "My daughter-in-law goes with her children, she takes them swimming." [B.5.9]</p> <p>- Folta et al., 2008 (raw data, p.5): "And we're in a generation, our kids now are not that way, but we're in a generation that don't waste food. I mean, my kids were — when they went to the table and they ate what was on the table and they cleaned their plates out. But now, they're not that way. So I think that's an example, because we've been taught not to waste food and we eat instead of throwing it out. (larger community, Arkansas)"</p> <p>- Folta et al., 2008 (authors' interpretation, p.5): "difficulty in changing eating patterns they had developed in childhood."</p> <p>- Greaney et al., 2004 (authors' interpretation, p.27-8): "When asked about why they began to eat five or more servings of fruits and vegetables a day and/or exercise, numerous participants across all focus groups spoke of always consuming a diet high in fruits and vegetables as well as always being active. These participants mentioned of their parents serving as role models."</p> <p>- Russell et al., 2013 (raw data, p.455): 'We grew up eating a lot of vegetables, so that has a lot to do with it too. Whatever your family grows up eating . . .'</p> <p>- Russell et al., 2013 (raw data, p.456): "Coming from a family who doesn't take care of themselves . . . I quit smoking. I come from a family where we all smoke. You grew up smoking cigarettes even before you put one to your mouth because it was going on so heavily . . . I think a lot of us have backgrounds where what we eat is part of our culture and part of our way of life."</p> <p>- Russell et al., 2013 (authors' interpretation, p.454): "Family 'traditions surrounding food' can also act as a facilitator or barrier to healthy lifestyle changes."</p>
	Influence from family and/or friends in adulthood	<p>- Bove & Olson, 2008 (raw data, p.67): "We'd go to my dad's and have supper or something. We may've had to do like a bowl of cereal at midday and then go down to Grandpa's and have supper and we'd eat like hogs. . . . probably twice a week, and then we'd go over to Mom's. . . ."</p> <p>- Folta et al., 2008 (raw data, p.5): "I think I'm one of the oldest ones here, so I can say as a younger mother, I did that [cooked healthfully] for my family. Trying to have them have a healthy diet. But now, it's a lot harder. (larger community, Kansas)"</p> <p>- Folta et al., 2008 (raw data, p.5): "I think when you have kids, there's a snack problem. We still have a child at home, and he will eat salads and vegetables, but he really likes to have other things in the house, too. (smaller community, Kansas)"</p> <p>- Folta et al., 2008 (authors' interpretation, p.6): "CSREES agents confirmed that their most successful programs for midlife or older women include a social component, and that if participants have opportunities to build relationships, they will be highly motivated to keep coming back."</p> <p>- Greaney et al., 2004 (raw data, p.29): ""My husband and I always exercised."</p> <p>- Greaney et al., 2004 (raw data, p.29): ""My husband was a stickler. He'd keep me on the straight . . ."</p> <p>- Greaney et al., 2004 (authors' interpretation, p.28): "Several participants spoke of beginning to exercise for social reasons. The opportunity to socialize with others also was mentioned as being an important motivator to continue exercising."</p> <p>- Greaney et al., 2009 (authors' interpretation, p.284): "Social support was seen, also, as making it easier to be physically active. Both males and females mentioned that they were more likely to go to the gym if they went with a</p>

		<p>friend."</p> <ul style="list-style-type: none"> - Greaney et al., 2009 (authors' interpretation, p.284): "Females spoke of social support (i.e., friends) as being both an enabler and a barrier to eating healthfully and being physically active, whereas males spoke of friends in terms of providing support to be physically active." - Greaney et al., 2009 (authors' interpretation, p.284): "Females were more likely than males to state that their friends provided social support to eat healthfully." - Greaney et al., 2004 (raw data, p.29): "I have a wife who does the shopping and cooking. She is health conscious." - Higgins et al., 2006 (raw data, p.224): "A single parent has stress on top of stress on top of stress and when we finally do get a break, you don't even know what to do with it sometimes. You haven't got the network of friends to call up and say, "Let's go for coffee," or anything like that. (research participant)" - Higgins et al., 2006 (authors' interpretation, p.225): "Changing a risk behavior, managing stress in particular, was reported by participants to be much easier with the support of family or friends." - Higgins et al., 2006 (authors' interpretation, p.225): "Exercising alone (e.g., walking) was viewed as less expensive but also less motivating and lacking the social interaction and support often sought." - Higgins et al., 2006 (authors' interpretation, p.225): "Participants preferred to participate in classes with their children." - Kegler et al., 2008 (raw data, p.5): "...we don't 'cause everybody here and there so we don't 'cause my husband used to walk before he went to work and it be so early I still be you know and I walk after daylight, so it's a long [time] since we walked together. (African- American Female)" - Kegler et al., 2008 (raw data, p.6): "Uh huh. But he said he's not walking for nobody and he don't do Played a lot of ball, sports, and stuff, but he don't do any of that now. (African-American Female)" - Kegler et al., 2008 (authors' interpretation, p.5): "Additional reasons for families not engaging in physical activity together include: laziness, less motivation now that children are grown, differing exercise preferences including walking pace, spouses refusing even when asked, physical limitations and caretaking responsibilities." - Kegler et al., 2008 (authors' interpretation, p.6): "Among those who stated their family could do something to encourage them to be more physically active, participation in or invitations to engage in physical activities were viewed as helpful. Verbal support or encouragement would also help, as would taking the time or committing to be physically active together." - Kegler et al., 2008 (authors' interpretation, p.6): "Family efforts to encourage physical activity included: inviting a family member to take a walk, talking about physical activity, or in a few instances, purchasing equipment. In families where someone did encourage the family to be more physically active together, about half said such efforts were not terribly effective. Two common responses were outright refusals or procrastination. Others discussed schedule conflicts and shortness of breath due to smoking as making it difficult for family members to be physically active together." - Peterson et al., 2013 (raw data, p.78): "My husband says I look just fine. He does not think I should spend time away from the family to take a walk ...and he will not go with me." - Peterson et al., 2013 (raw data, p.77): "My friends oversee my activities...They keep me accountable." - Peterson et al., 2013 (authors' interpretation, p.77): "Participants identified people who supported healthy lifestyle decisions. These individuals encouraged the participant to make a healthy lifestyle choice, or to continue an activity which was positive." - Peterson et al., 2013 (authors' interpretation, p.77): "Family members and friends were identified as principal
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		<p>facilitators."</p> <p>- Peterson et al., 2013 (raw data, p.78): "I would not want to exercise with [name], because I could not keep up. THAT would make me stop exercising."</p> <p>- Peterson et al., 2013 (raw data, p.77): "If I commit, then I have to be there [to walk], for my friends are counting on me."</p> <p>- Peterson et al., 2013 (authors' interpretation, p.80): "Buddies, or individuals with similar body types and activity abilities, were perceived as being the most desired persons to help them adopt and maintain health behaviors."</p> <p>- Peterson et al., 2013 (authors' interpretation, p.80): "In addition, individuals that hold the participant accountable for performing the activity (dietary and / or exercise) and adhering to a set-schedule for exercise are critical in changing health behaviors."</p> <p>- Russell et al., 2013 (raw data, p.453): "Knowing that with the support that I could do it, that there were no barriers."</p> <p>- Russell et al., 2013 (raw data, p.455): "And when I first started, my sister came over and asked me if I wanted to go [to the HLP] and I said no. I said my legs ache a little bit. And she said well that's why you need to go. And they don't ache anymore."</p> <p>- Russell et al., 2013 (raw data, p.455): "When I came into the programme, it was stressful for me sometimes because I don't drive, I don't have a car. So, my son always takes me. I would ask him when the time is coming up, I'd say 'where are you? I need to get to that programme! But he's always there for me.'" [referring to healthy lifestyle programme]</p> <p>- Russell et al., 2013 (authors' interpretation, p.454): "family support' was noted to be a facilitator of healthy changes"</p> <p>- Russell et al., 2013 (authors' interpretation, p.454): "resistant family members acted as a barrier"</p> <p>- Russell et al., 2013 (authors' interpretation, p.454): "Similarly, having or losing a 'work-out buddy' was also noted as a factor that could promote or hinder successful changes."</p> <p>- Russell et al., 2013 (raw data, p.456): "Sometimes it's hard that there are other things in your house that you don't need to eat or whatever. Like I would say to my partner why don't you just hide that? . . . And she wouldn't do that. She'd go 'just eat it, take it."</p> <p>- Thornton et al., 2006 (raw data, p.99): "My wife drinks juice. I buy her a gallon of juice every week . . . so it can last . . ."</p> <p>- Thornton et al., 2006 (raw data, p.99): "I tell her, instead of eating other things, eat fruit. She eats a lot of fruit. Because my husband's mother is like that . . . for everything she combines fruit and vegetables and I learned from her."</p> <p>- Thornton et al., 2006 (raw data, p.99): "I usually tell her not to eat too much . . . eat more vegetables . . . I forbid her from eating cookies, cake, and other things that make people fat."</p> <p>- Thornton et al., 2006 (raw data, p.100): "From Monday through Friday we eat homemade food. On Saturday and Sunday we go out to eat hamburgers, hot dogs . . . We go to McDonalds, to Burger King, and to many other restaurants."</p> <p>- Thornton et al., 2006 (raw data, p.101): ". . . she tells me that it's very recommendable that you be a month without much activity . . . A month in which you have a little rest so you can recover."</p> <p>- Thornton et al., 2006 (raw data, p.101): "When I'm at home, I help her with the baby, and she sometimes goes out for a walk or she simply walks to the store."</p> <p>- Thornton et al., 2006 (authors' interpretation, p.101): "According to the participants, the informational support that</p>
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		<p>most influenced their diet and eating patterns came from their small network of female relatives and friends in the U.S. (Table II). This was important since several participants reported not knowing how to cook some foods when they moved away from biological families and their mothers' advice in Mexico to live with husbands in the U.S. These women provided advice that helped the women change unhealthy diets, particularly during pregnancy. Female in-laws suggested eating more fruit, beans, lentils, vegetables, and stew, and avoiding contaminants or too many ingredients."</p> <p>- Thornton et al., 2006 (authors' interpretation, p.98): "Informational and emotional support of husbands were the most important and consistent influence on participants' weight, eating, and physical activity practices."</p> <p>- Thornton et al., 2006 (authors' interpretation, p.98): "Geographic distance was the primary reason for Latinas being separated from close female-centered networks, which seemed to interrupt the transmission of health-related beliefs and behaviors."</p> <p>- Thornton et al., 2006 (authors' interpretation, p.100): "Overall, participants reported that their husbands provided the most important source of informational support for increasing physical activity...They consistently told their wives to exercise to lose pregnancy weight so they would not become fat or ill and this advice usually resulted in women engaging in more physical activity. The type of informational support that women received to exercise varied by their pregnancy status. During pregnancy, and immediately postpartum, they were advised and expected by both husbands and extended family to limit strenuous physical activity. Lifting heavy objects was strongly discouraged to protect the baby and mother's health. "</p> <p>- Thornton et al., 2006 (raw data, p.101): "If I had a companion, I'd go out to walk, right? But all by myself I don't really want to go out very much."</p> <p>- Thornton et al., 2006 (authors' interpretation, p.100): [about husbands] "They encouraged women to exercise and provided companionship to help them do so."</p> <p>- Thornton et al., 2006 (raw data, p.101): "Let's go walk, get some exercise . . . my husband is the one that motivates me the most." "My husband and I sometimes go to the park . . . I go play tennis with him."</p> <p>- Thornton et al., 2006 (raw data, p.99): "We eat when my husband gets home . . . We eat late. Not advice, but he does encourage me to do things. Sometimes I don't want anything and he makes it so we can eat together."</p> <p>- Thornton et al., 2006 (raw data, p.99): "I say, bring me some ice cream. And he brings me some ice cream."</p> <p>- Thornton et al., 2006 (raw data, p.100): "She worries a lot about me . . . if I don't eat before leaving the house, she will not eat either."</p> <p>- Thornton et al., 2006 (authors' interpretation, p.98): "Absence of mothers and female relatives to provide companionship and advice about food was evident."</p> <p>- Thornton et al., 2006 (authors' interpretation, p.100): "Most women said they looked forward to the companionship that came with eating meals with their husbands on a daily basis. Thus, mealtime patterns and food choices were highly influenced by the work schedules and preferences of husbands. Being alone, or worrying about husbands when they were away from home, led women to irregular eating patterns or a tendency to either under- or overeat. "</p> <p>- Thornton et al., 2006 (authors' interpretation, p.101): "For other women, social isolation or a lack of support from husbands or friends with whom to exercise were barriers to getting regular exercise."</p> <p>- Thornton et al., 2006 (authors' interpretation, p.101): "Husbands occasionally watched their children so their wives could exercise, but this occurrence appeared to be rare and restricted to evenings or weekends when husbands were home from work. "</p>
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	Support groups	<p>- Gettleman & Winkleby, 2000 (raw data, p.447): "I used to be 170 pounds before. But once I talked to a lady—we have a group, and she told me what is good to eat and what things are bad—too much fat, how many times you eat at MacDonalds a week. I remember her advice. Now I drink a lot of water so I fill up. And then I eat some salad and buy a little hamburger."</p> <p>- Leslie et al., 2012 (raw data, p.8): "Meeting other individuals I think has been a bit of a challenge as well you don't want to let the rest of the group down."</p> <p>- Leslie et al., 2012 (raw data, p.8): "If you're getting a craving for a cigarette you come to a group and the more people that's in a group the more opportunity you got for an answer. Person A might say, 'Oh I do this', Person B say, 'I'll do this', and then you've got a choice to try it."</p> <p>- Leslie et al., 2012 (raw data, p.8): "I mean the fact that you've got other people there who support you, willing to talk to you and wie the same sort of feelings as yourself. it makes you realise you know that well if someone else can get through it, so can you."</p> <p>- Russell et al., 2013 (raw data, p.455): "I liked coming here too because it is a support group and you need a support. When you don't have that, I think that chocolate looks real good."</p> <p>- Russell et al., 2013 (raw data, p.455): "It helped me a lot with just the routine of getting in here and talking to other people and sharing . . . you know, how they was doing. Because everybody, you know, we all messed up, so we try to pull each other together."</p> <p>- Russell et al., 2013 (raw data, p.455): "Yes, you hear it and you know it in your mind, you know that's what you need to do and you think, he [her primary care doctor] can sit there and talk all he wants, but you don't know how hard it is. But, then when you come here, everybody here is having issues. We all are having issues trying to do the right thing."</p> <p>- Russell et al., 2013 (authors' interpretation, p.456): "Some mentioned that the sense of 'accountability to the group' acted as a facilitator. For example, they would watch what they ate over the weekend because they knew Monday evening they would have to report back and they did not want to disappoint the group."</p> <p>- Russell et al., 2013 (authors' interpretation, p.455): "Participants cited the importance of HLP group members as key facilitators of success. Several described the group as a place to 'unload' and receive validation and encouragement for the stresses of daily life. Participants recognized this support as instrumental in countering stress and negative emotions. Others benefited from the knowledge and advice for healthy living and strategies to overcome common barriers received from other members of the group. This was described as being more effective than receiving similar advice from health care professionals because it was being given by people who had 'been there.'"</p> <p>- Russell et al., 2013 (authors' interpretation, p.456): "A few participants noted that they got support from groups at</p>

		churches they attend; one participant started her own support and exercise group at her church."
	Social occasions	<p>- Folta et al., 2008 (authors' interpretation, p.5): "pressured to eat at social events"</p> <p>- Gettleman & Winkleby, 2000 (raw data, p.444): "You don't just quit smoking, you also quit your whole social life. You miss a lot of things besides the smoke."</p> <p>- Greaney et al., 2009 (authors' interpretation, p.283): "Participants noted that the behavior of others often influences what and when they eat and that social situations, like going out to dinner, were associated with overeating and eating unhealthful food."</p> <p>- Greaney et al., 2009 (authors' interpretation, p.283): "Both males and females spoke about external social pressures to eat, but females were more likely than males to state that social situations made it difficult to maintain a healthful weight."</p> <p>- Greaney et al., 2009 (authors' interpretation, p.283): "Males and females spoke of calories in alcohol and in "drunk eating," a term used for eating fattening food in excess when intoxicated as contributing to weight gain."</p> <p>- Thornton et al., 2006 (raw data, p.100): "whenever someone offers us something to eat, to be polite, we don't refuse . . . we do that to be courteous or for the sake of our friendship."</p> <p>- Thornton et al., 2006 (authors' interpretation, p.100): "Both women and their husbands also described social influences to overeat at parties and celebrations hosted by family and friends, often related to pleasing others:"</p>
GEOGRAPHICAL (EXOSYSTEM) LEVEL:		
Theme	Subtheme	Supporting evidence (marked as raw data or author's own interpretation of raw data)
Geographical location and environment (10 studies)	Access to physical activity spaces and equipment	<p>- Bove & Olson, 2008 (author's interpretation, p.63): "Homes outside of population centers were located along highways with no sidewalks and few streetlights and along rural roads that were muddy in spring and snow- and ice-covered in winter. Walking was difficult in these settings, especially for informants with young children and strollers or for those with health problems inhibiting mobility."</p> <p>- Bove & Olson, 2008 (author's interpretation, p.65): Informants with transportation problems who resided in remote areas of the countryside typically were less active in their daily lives than were those who lived in (seven women at first interviews) or moved to (an additional five women by the study's end) the village centers where even those without a working vehicle were able to walk to run errands, reach places of employment, shop for groceries, and visit local parks, schools, and physicians' offices. Furthermore, regardless of whether personal transportation was problematic, the informants who mentioned walking for pleasure or recreation were those residing in, or with easy access to, the population centers of the two counties."</p> <p>- Condon et al., 2008 (authors' interpretation, p.161): "Access to both exercise and gym facilities could be constrained by the prison environment, particularly in high security prisons. Whereas in some prisons inmates had the opportunity to walk outside every day, in other prisons exercise was regularly cancelled. This lack of predictability in the regime was found to be very difficult by prisoners, who generally considered the opportunity to walk in the fresh air very important to their health." "Where 'remedial gym' was provided for prisoners with health problems, interviewees described wider participation in exercise among the elderly."</p> <p>- Condon et al., 2008 (authors' interpretation, p.161): "In many prisons excellent gym facilities were available; young offenders generally described a wide range of physical activities on offer."</p> <p>- Condon et al., 2008 (authors' interpretation, p.161): "Many prisoners, particularly young men, described themselves as taking more exercise in prison than outside prison, often because imprisonment was the only time they were not using drugs."</p> <p>- Condon et al., 2008 (authors' interpretation, p.161): "Access to both exercise and gym facilities could be constrained</p>

		<p>by the prison environment, particularly in high security prisons. Whereas in some prisons inmates had the opportunity to walk outside every day, in other prisons exercise was regularly cancelled." "This lack of predictability in the regime was found to be very difficult by prisoners, who generally considered the opportunity to walk in the fresh air very important to their health." "Procedures varied for getting access to the gym. Some prisoners described scrupulously fair procedures, whilst others, in all categories of prison, seemed to regard themselves the victim of an arbitrary system under which access to the gym was infrequent or non-existent."</p> <p>- Greaney et al., 2009 (authors' interpretation, p.284): "Additionally, participants felt that the university's environment supports physical activity by having access to gyms making it easier to maintain weight. Male students spoke of enjoying intramural sports and that their participation resulted in them being physically active. There were 4 participants who were members of their university's athletic teams who stated that this commitment resulted in them being physically active."</p> <p>- Greaney et al., 2009 (authors' interpretation, p.284): "In approximately half of the focus groups, participants said the geographic layout of their campus made it easy to maintain a healthful weight and that parking shortages forced them to walk/bike from their home/dorms to class."</p> <p>- Kegler et al., 2008 (raw data, p.5): "There are no walking trails or anything. There are side- walks [...]. There are no gyms, no, really, it's a small town. There's really nothing. [...] There's not a track or anything like that. So, you're basically walking on, I hesitate to use the word city with a small town, but you're walking in town, town streets, and crossing streets, and traffic and all. (White Female)."</p> <p>- Kegler et al., 2008 (raw data, p.5): "I live in the country, and I have all the room in the world to walk, get around. (White Female)"</p> <p>- Kegler et al., 2008 (raw data, p.5): "It's in a rural area, so we can get out and walk on the street and not be worried about vehicles because we don't have them, the traffic is very slow. (White Female)"</p> <p>- Kegler et al., 2008 (raw data, p.5): "We're a small town and everybody knows each other and it's safe to get out and walk and you have lots of friends that will walk with you. (White Male)"</p> <p>- Kegler et al., 2008 (authors' interpretation, p.5): "When asked specifically about lack of sidewalks and streetlights, quite a few reported not having sidewalks. Lack of streetlights appeared less common, but was mentioned by a few, primarily as a deterrent to exercising after dark. "</p> <p>- Peterson et al., 2013 (authors' interpretation, p.77): "Rural locations typically lack sidewalks; parks and school-based tracks are often unavailable. Thus, a safe and enjoyable walking area is hard to identify."</p> <p>- Russell et al., 2013 (authors' interpretation, p.456): "Other financial barriers included the cost of athletic footwear and the expense of gym membership."</p>
	Access to healthy foods	<p>- Bove & Olson, 2008 (author's interpretation, p.63): "Rising gasoline prices further forced families to drive less; [therefore] families made fewer trips to shop at discount grocery stores" [and had less chance to] "to walk and window-shop at malls."</p> <p>- Condon et al., 2008 (raw data, p.160): ""The kitchen man is an empire of his own. Nurse X and Mr Y, the kitchen man, came over to my wing we had to sit down to talk. All Mr Y said was, I'm not going to give anyone skimmed milk, because it is not part of my contract. One. Number Two, he said, it is a struggle for them to give me two [pieces of] brown bread. (AP3, aged 50 years, female prisoner)"</p> <p>- Condon et al., 2008 (raw data, p.160): "On the outside I'm never at home, you're always busy. But in here you've got three meals a day. It's like ... you're always there, aren't you, to have them. (HP5, aged 20 years, young offender)"</p>

		<p>- Condon et al., 2008 (raw data, p.160): "Prisoners who deliberately chose good food as part of their normal lifestyle found the adjustment to prison very difficult. A foreign national prisoner believed that the transition from a low-fat African diet to a British prison diet was the cause of her ill-health."</p> <p>- Folta et al., 2008 (authors' interpretation, p.4): "Only one community (in Kansas) had a health food store."</p> <p>- Folta et al., 2008 (authors' interpretation, p.4): "Stores in both states carried frozen fish, but breaded fish dominated the freezer section, and the selection of plain filets was extremely limited."</p> <p>- Folta et al., 2008 (authors' interpretation, p.5): "although a few women added that fresh produce is not as readily available in the winter months."</p> <p>- Folta et al., 2008 (authors' interpretation, p.6): "However, the results from the audit suggest that most heart-healthy foods are readily available in the communities and that access is not a major barrier. The major supermarkets had a good selection of whole grain products. They also had a good selection of fresh and frozen vegetables, fresh and frozen fruits, and dried and canned beans. Although the stores devoted more space to 2% and whole milk, all had an ample supply of 1% and non-fat milk. All stores had a good selection of canned fish. Fresh fish was readily available in Arkansas, but in Kansas, only the one large store in the larger city had fresh fish."</p> <p>- Greaney et al., 2009 (authors' interpretation, p.283): "Conversely, lack of access to healthful food, including a lack of grocery stores and transportation to get to them, served as barriers for weight management for some."</p> <p>- Greaney et al., 2009 (authors' interpretation, p.283): "Having a limited disposable income was seen as making it difficult to eat well as healthful food items were perceived as being more expensive than un-healthful food. More males than females mentioned the expense of eating healthfully and suggested that it is much cheaper and easier to eat unhealthful options."</p> <p>- Greaney et al., 2009 (authors' interpretation, p.283): "Additionally, ready access to unhealthful food, including fast-food restaurants was seen as making it difficult to maintain a healthful weight."</p> <p>- Greaney et al., 2009 (authors' interpretation, p.283): "Participants also felt that unhealthful food served at university cafeterias contributed to overeating and made it difficult to eat healthfully and maintain a healthful weight. More females than males stated that they had difficulty controlling intake of unhealthful food, especially if they were on a college meal plan that allowed unlimited access to food."</p> <p>- Greaney et al., 2009 (authors' interpretation, p.284): "...university dining services making it possible to eat healthfully emerged as supportive of healthful weight management."</p> <p>- Higgins et al., 2006 (raw data, p.225-226): "If you have ever checked out what the [food banks] give in their bags of groceries to the poor, you will find it is what all the good people don't want hanging around in their cupboards—high fat, highly processed, high in sugar and chemicals—high risk foods! And guess who has to supplement her family's food from time to time from food banks? The lone mother."</p> <p>- Kegler et al., 2008 (raw data, p.6): "It's easy, 'cause you can always go to the store and get yourself a veggie. (African-American Female)"</p> <p>- Kegler et al., 2008 (raw data, p.6): "I don't think it's hard to get healthy foods, especially in an area where, a rural area where a lot of farming go, it easy to get fresh vegetables. It's easy to get fruit or, you know, than less healthy foods. (African-American Male)"</p> <p>- Kegler et al., 2008 (authors' interpretation, p.6): "Among those who expressed difficulty in getting healthy foods for the family, the cost of healthy foods was cited as the main barrier."</p> <p>- Kegler et al., 2008 (authors' interpretation, p.6): "Other barriers included poor selection at local stores, limited time to shop and the price of gas."</p>
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	Influence of local environment on smoking and alcohol use	<p>- Condon et al., 2008 (authors' interpretation, p.159): "Many prisoners described imprisonment as an opportunity to access smoking cessation courses and nicotine patches."</p> <p>- Condon et al., 2008 (authors' interpretation, p.160): "Non-smoking prisoners commonly described passive smoking as a problem, especially when they were put in cells with smokers, despite having requested a non-smoking cell. Some non-smokers thought smoking should be banned in all parts of the prison because of its effect upon the health of both active and passive smokers. One Young Offenders' Institution had become a 'non-smoking prison', for both inmates and staff. Interviewees generally thought this a sensible measure and found that stopping smoking was easier than they thought, resulting in benefits such as improved fitness. However, some considered that stress levels increased as a result, and one described how tobacco had become contraband, to be smuggled into prison."</p> <p>- Condon et al., 2008 (authors' interpretation, p.160): "However, in several prisons, interviewees described long</p>

		<p>waiting lists to go on smoking cessation courses, and sometimes considerable persistence was required to get a place. One young offender was not able to access a course for five months because the staff member who ran the course was unavailable."</p> <p>- Condon et al., 2008 (raw data, p.161): "There's no help for people that's got a problem with drink detox pack and that's it. (IP8, aged 41 years, category B prison)"</p> <p>- Condon et al., 2008 (authors' interpretation, p.161): "Both drug and alcohol misusers described the difficulties of adapting to life outside prison when released. Lack of help for alcohol addiction in prison combined with the likelihood of hostel accommodation on release meant that some prisoners saw little hope of adjusting to life outside prison"</p> <p>- Gettleman & Winkleby, 2000 (authors' interpretation, p.444): "Smoking cessation was viewed as equally difficult to change because of the addictive nature of cigarettes, the loss of the social outlet that smoking provided, and the lack of programs and resources for smoking cessation."</p> <p>- Russell et al., (raw data, p.456): "...You grew up smoking cigarettes even before you put one to your mouth because it was going on so heavily..."</p>
	Personal safety	<p>- Higgins et al., 2006 (authors' interpretation, p.225): "The issue of neighborhood safety was also a barrier to walking as exercise."</p> <p>- Kegler et al., 2008 (raw data, p.5): "I have to wait 'til somebody come and walk with me 'cause I'm scared of them dogs. When they get at me and they run (laughing). (African-American Female)"</p> <p>- Kegler et al., 2008 (raw data, p.5): "I used to walk in the mornings, I did so for a good little while with no problem, and then in the path that I walked there was a person that all of a sudden showed up and was sitting in a certain area, and it was very uncomfortable, because it was not something that I had been seeing normally. So, that stopped me from walking by myself in that area. (White Female)"</p> <p>- Kegler et al., 2008 (raw data, p.5): "[heavy/speeding traffic]...they don't have no compassion for a person walking. They're concerned, you see me coming, you better get out of the road. (African-American Male)"</p> <p>- Kegler et al., 2008 (raw data, p.5): "It's in a rural area, so we can get out and walk on the street and not be worried about vehicles because we don't have them, the traffic is very slow. (White Female)"</p> <p>- Kegler et al., 2008 (raw data, p.5): "We're a small town and everybody knows each other and it's safe to get out and walk and you have lots of friends that will walk with you. (White Male)"</p> <p>- Peterson et al., 2013 (raw data, p.78): "in addition to there being no sidewalks, parks to walk in, I do not feel safe walking along the road. Traffic speeds, and if I lose my footing, I'll be in big trouble."</p>
	Weather	<p>- Foltz et al., 2008 (authors' interpretation, p.5): "Weather did arise as a barrier to physical activity in both the focus groups and the key informant interviews."</p> <p>- Peterson et al., 2013 (raw data, p.78): "No matter how much I try to stay active, you simply cannot walk outside during the winter. The roads are icy and the snow is seldom removed efficiently. SO—whatever I gain (activity level) in the summer and fall, I lose in the winter."</p> <p>- Peterson et al., 2013 (authors' interpretation, p.78): "Midwestern rural winters provide a unique barrier to outside exercise. Snow, ice, and temperatures that are routinely below freezing provide physical obstacles that prevent outdoor walking 5 months out of the year."</p> <p>- Russell et al., 2013 (raw data, p.454): "We had Rochester WalkFit, but that only lasted 3 weeks, we kept having to postpone because of bad weather."</p> <p>- Russell et al., 2013 (authors' interpretation, p.454): "Participants also cited inclement weather as a significant</p>

		barrier to outdoor activity or in getting to the Healthy Living Program location."
STRUCTURAL (MACROSYSTEM) LEVEL:		
Theme	Subtheme	Supporting evidence (marked as raw data or author's own interpretation of raw data)
Income status and availability of resources (4 studies)	Influence of a low or unstable income on lifestyle behaviours	<p>- Bove & Olson, 2008 (raw data, p.66): "It wasn't really we couldn't afford it. It was more or less, you know you're gonna start running out, the fact that you're lookin' at saving what you got left for your kids and not for you. Nothing was ever because you didn't have enough food stamps or cash. Just other things come up, like the electric or gas, or you've spent what you can."</p> <p>- Bove & Olson, 2008 (raw data, p.66): "I don't like to waste food, so sometimes I'll find myself eating what the kids left over on their plates . . . when things are low you don't think about sitting down and having that complete meal, you just want to make sure there's enough for the kids. And when you've got older kids, you gotta make sure there's enough if they want seconds."</p> <p>- Bove & Olson, 2008 (raw data, p.66): "I would make sure I fed my kids first, and then what was left I would eat" [Therica]"</p> <p>- Bove & Olson, 2008 (raw data, p.66): "It's easier as the adult to go without than to have them [the children] say they're hungry.""</p> <p>- Bove & Olson, 2008 (raw data, p.66): "If there wasn't enough I always made sure the boys ate. And I'd grab somethin' else. You know, like cereal or somethin'."</p> <p>- Bove & Olson, 2008 (raw data, p.66): ""I would, like, not have a bowl of cereal because the milk had to stretch for the kids" [Sue]"</p> <p>- Bove & Olson, 2008 (raw data, p.67): " "just liquid" [Lee] or "coffee and water" [Steph] on the days they did not eat." ""Well, during the day it's more coffee than it is soda 'cause I probably drink, maybe like one soda would last me a while 'cause I like sip it. But with coffee, forget it. I lost count. It's a lot!""</p> <p>- Bove & Olson, 2008 (raw data, p.67): "Therica: I go hungry for like two days and then I'll eat. . . . 'Cause I normally don't eat, I let the kids eat, and then I go for two days without eating and then when I do eat it's big meals that I eat. Interviewer: Okay so you're like making, feel like you're making up for lost meals. Therica: Yeah. 'Cause I do it a lot, so. . . . Like once a week maybe. So. Interviewer: So about every week you'll go a couple days without eating? Therica: Yup. Just so the kids, the food would stretch so the kids had somethin' to eat."</p> <p>- Bove & Olson, 2008 (raw data, p.68): "Well, like last night I was just walking around the kitchen like it was Christmastime because there was, we had cookies! And I took three cookies and finally had to put the bag away 'cause I think I could've eaten half a bag of cookies, because it had been so long."</p> <p>- Bove & Olson, 2008 (raw data and author's interpretation, p.68): ""She gets in those moods where she just wants to eat everything. . . . she seems like she's eating all day"— which was perceived by the wife to occur early in the month when their disability check and food stamps arrived."</p> <p>- Bove & Olson, 2008 (authors' interpretation, pp.68-69): " Bevin, for example, who was food insecure at all three interviews, said that a waning food supply meant she "can't justify "bingeing" both because it would deprive her family of food and because her favorite binge foods would not be available"</p> <p>- Bove & Olson, 2008 (raw data and author's interpretation, p.69): " Eliza, who also was food insecure throughout the study, noted that she binged on sweet foods when she had extra money available; her current "hang-up with ice cream" meant she might eat "a half of a half a gallon" at a time "a good once a month."</p> <p>- Bove & Olson, 2008 (raw data, p.69): "I might actually take the time to fix something, like make [a] cake or something. Something I wouldn't normally do being busy. So then you add in extra calories because you've got a cake</p>

		<p>or a pie sittin' there in front of your face."</p> <p>- Bove & Olson, 2008 (authors' interpretation, p.65): "In two-parent households both parents typically cut back their intake, although this was not the case for Steph's household in which Steph, at her insistence, cut back her intake during the winter to ensure food not only for her 11-year-old daughter and two grandchildren but also for her husband."</p> <p>- Bove & Olson, 2008 (author's interpretation, p.65): "Informants from food-insecure households spoke of ever-changing household food supplies, with fluctuations following monthly (for families receiving benefits from federal welfare programs) or paycheck cycles. Superimposed upon these cycles were fluctuations associated with seasonal changes in utility bills or employment status."</p> <p>- Bove & Olson, 2008 (author's interpretation, p.65): "For some food- insecure families, household food supplies rose quickly upon the receipt of food stamps and/or a paycheck but then dwindled until the next food stamps or paycheck arrived, unless supplemented by food from a food pantry, relative, or friend."</p> <p>- Bove & Olson, 2008 (author's interpretation, p.67): "Two food-insecure informants drank sugar-sweetened beverages as a means of coping with eating little solid food on some days. Lee and Steph insisted they went for days without eating without feeling hungry."</p> <p>- Bove & Olson, 2008 (author's interpretation, p.71): " the consumption of sugar-sweetened coffee and soft drinks (with their unseen calories) that were drunk as a means of coping with food restrictions"</p> <p>- Bove & Olson, 2008 (author's interpretation, p.71): "the consumption of non-traditional foods for meals—e.g., eating cereal for lunch or dinner to spare the customary foods for those meals for one's children—which meant that such meals were not perceived as meals."</p> <p>- Bove & Olson, 2008 (author's interpretation, p.71): "Thus the periodic overeating that sometimes accompanied the periodic influx of food into food-insecure homes"</p> <p>- Bove & Olson, 2008 (author's interpretation, pp.71-72): "Most apparent to these informants was the knowledge that periodically they went without meals to stretch the household food supply to ensure that others might eat."</p> <p>- Greaney et al., 2009 (authors' interpretation, p.283): "Having a limited disposable income was seen as making it difficult to eat well as healthful food items were perceived as being more expensive than un-healthful food. More males than females mentioned the expense of eating healthfully and suggested that it is much cheaper and easier to eat unhealthful options."</p> <p>- Greaney et al., 2009 (authors' interpretation, p.283): "Students also spoke of high monetary costs associated with healthful behaviors, specifically that a lack of money and limited budgets make it difficult to join an off-campus fitness center and/or pay the fees associated with on-campus facilities."</p> <p>- Higgins et al., 2006 (authors' interpretation and raw data, p.224): [A lack of money compromised their ability to buy nutritious food (fruits and vegetables) "which is a really sad statement for all society to be able to say that it costs more money to eat healthy" (research participant)."</p> <p>- Higgins et al., 2006 (raw data, p.225): "Many of us give our children healthier food than we give ourselves."</p> <p>- Higgins et al., 2006 (raw data, p.225): "We just feel a lot of stress trying to make the best lives possible for our children and ourselves."</p> <p>- Higgins et al., 2006 (raw data, p.225): "The costs of a regular exercise program and to pay for child minding while attending a program are prohibitive for us. It is hard to motivate ourselves to exercise regularly."</p> <p>- Higgins et al., 2006 (raw data, p.229): " "The welfare system barely provides enough to survive on" (research participant)."</p>
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		<p>- Higgins et al., 2006 (raw data, p.229): "Poverty, lack of meaningful work, lack of feeling of contributing, and not having access to safe, quality, affordable child care hinders [changing risky behaviors]."</p> <p>- Higgins et al., 2006 (authors' interpretation, p.225): "Finances presented a barrier to attending community recreation or exercise classes, particularly with the additional cost of finding child care."</p> <p>- Higgins et al., 2006 (authors' interpretation, p.224): "Participants reported regularly sacrificing fruits and vegetables for their children's consumption, echoing the literature where low-income mothers have reported deprivation from nutrient-rich foods"</p> <p>- Higgins et al., 2006 (authors' interpretation, p.225): "Some participants reported that policies related to these services often took the decision making out of their hands, and social assistance did not provide adequate funding for survival or nutritious food."</p> <p>- Thornton et al., 2006 (raw data, p.99): "When my husband hasn't worked for a prolonged number of days . . . we don't buy everything we should be buying . . . I would like to buy more things to eat so that our diet can be more balanced . . . Yes, I always wish I could buy more vegetables and more fruit."</p> <p>- Thornton et al., 2006 (raw data, p.99): "WIC gives help, but it's not enough..."</p> <p>- Thornton et al., 2006 (authors' interpretation, p.100): "Some participants reported eating or buying fewer healthy foods when they experienced financial constraints due to husbands' seasonal work schedules" "and living with extended family. During financial distress, fruits and vegetables were typically the first to be sacrificed from food purchases instead of beans, lentils, and, particularly meats, because of husbands' preferences."</p> <p>- Thornton et al., 2006 (authors' interpretation, p.102): "During times of financial shortages or husbands' unemployment, participants would often forego purchasing healthy foods, especially fresh fruits and vegetables, in favor of foods, such as meat, that husbands preferred."</p>
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Note: The qualitative data for one study was reported in two papers (Koshy et al., 2012 and Leslie et al., 2012).

Appendix 28: Review 3 – Summary of the themes and subthemes identified

Table 27.1. Summary of the themes and subthemes identified during the thematic synthesis

Theme (number of studies discussing theme)	Subtheme	Number of studies demonstrating subtheme	Study authors, year of publication
INTRAPERSONAL AND INTERPERSONAL (MICROSYSTEM) LEVELS:			
Psychological and physical factors (15 papers reporting on 14 studies)	Perceived risk of future events (e.g., disease, death)	4	Doldren & Webb, 2013 Folta et al., 2008 Greaney et al., 2004 Russell et al., 2013
	Perceived outcomes of healthy lifestyle behaviours	8	Doldren & Webb, 2013 Farooqi et al., 2000 Folta et al., 2008 Greaney et al., 2004 Koshy et al., 2012 Peterson et al., 2013 Russell et al., 2013 Thornton et al., 2006
	Motivation for healthy lifestyle behaviours	10	Bove & Olson, 2008 Doldren & Webb, 2013 Folta et al., 2008 Gettleman & Winkleby, 2000 Greaney et al., 2004 Kegler et al., 2008 Koshy et al., 2012 (and Leslie et al., 2012) Peterson et al., 2013 Russell et al., 2013 Thornton et al., 2006
	Caring about what other people and society think	3	Folta et al., 2008 Peterson et al., 2013 Thornton et al., 2006
	Will power and discipline	7	Doldren & Webb, 2013 Folta et al., 2008 Gettleman & Winkleby, 2000 Greaney et al., 2004 Greaney et al., 2009 Kegler et al., 2008 Russell et al., 2013
	Stress, emotions, and mental states	7	Bove & Olson, 2008

			Condon et al., 2008 Greaney et al., 2004 Greaney et al., 2009 Higgins et al., 2006 Peterson et al., 2013 Russell et al., 2013
	Impact of health status and physiological factors	3	Folta et al., 2008 Koshy et al., 2012 (and Leslie et al., 2012) Peterson et al., 2013
Knowledge/awareness (13 papers reporting on 12 studies)	Knowledge/awareness about risk behaviours and disease	7	Bove & Olson, 2008 Farooqi et al., 2000 Folta et al., 2008 Gettleman & Winkleby, 2000 Greaney et al., 2009 Higgins et al., 2006 Thornton et al., 2006
	Perceived importance of healthy lifestyle behaviours	3	Greaney et al., 2009 Koshy et al., 2012 Russell et al., 2013
	Communication with health professionals/instructors and welfare staff	5	Higgins et al., 2006 Leslie et al., 2012 Peterson et al. 2013 Russell et al., 2013 Thornton et al., 2006
	Strategies used to maintain healthy lifestyle behaviours	5	Doldren & Webb, 2013 Farooqi et al., 2000 Folta et al., 2008 Greaney et al., 2004 Greaney et al., 2009
	Impact of culture and religion on knowledge/awareness, beliefs and lifestyle behaviours	4	Doldren & Webb, 2013 Farooqi et al., 2000 Russell et al., 2013 Thornton et al., 2006
Interventions (8 papers reporting on 7 studies)	Perceptions and ideas relating to lifestyle interventions	7	Farooqi et al., 2000 Folta et al., 2008 Gettleman & Winkleby, 2000 Greaney et al., 2009 Higgins et al., 2006 Leslie et al., 2012

			Russell et al., 2013
	The process of changing <i>multiple</i> risk behaviours	2	Koshy et al., 2012 Russell et al., 2013
Personal responsibilities (9 studies)	Being a role model and responsible for others	5	Doldren & Webb, 2013 Gettleman & Winkleby, 2000 Greaney et al., 2004 Peterson et al., 2013 Russell et al., 2013
	Competing time demands	7	Farooqi et al., 2000 Folta et al., 2008 Gettleman & Winkleby, 2000 Greaney et al., 2009 Kegler et al., 2008 Peterson et al., 2013 Russell et al., 2013
	Disruption to routine	2	Greaney et al., 2004 Russell et al., 2013
Social network (13 studies)	Family habits during childhood and adolescence	5	Doldren & Webb, 2013 Farooqi et al., 2000 Folta et al., 2008 Greaney et al., 2004 Russell et al., 2013
	Influence from family and/or friends in adulthood	9	Bove & Olson, 2008 Folta et al., 2008 Greaney et al., 2004 Greaney et al., 2009 Higgins et al., 2006 Kegler et al., 2008 Peterson et al., 2013 Russell et al., 2013 Thornton et al., 2006
	Support groups	3	Gettleman & Winkleby, 2000 Leslie et al., 2012 Russell et al., 2013
	Social occasions	4	Folta et al., 2008 Gettleman & Winkleby, 2000 Greaney et al., 2009 Thornton et al., 2006
GEOGRAPHICAL (EXOSYSTEM) LEVEL:			
Geographical location and environment (10)	Access to physical activity spaces and equipment	6	Bove & Olson, 2008

studies)			Condon et al., 2008 Greaney et al., 2009 Kegler et al., 2008 Peterson et al., 2013 Russell et al., 2013
	Access to healthy foods	9	Bove & Olsen, 2008 Condon et al., 2008 Folta et al., 2008 Greaney et al., 2009 Higgins et al., 2006 Kegler et al., 2008 Peterson et al., 2013 Russell et al., 2013 Thornton et al., 2006
	Influence of local environment on smoking and alcohol use	3	Condon et al., 2008 Gettleman & Winkleby, 2000 Russell et al., 2013
	Personal safety	3	Higgins et al., 2006 Kegler et al., 2008 Peterson et al., 2013
	Weather	3	Folta et al., 2008 Peterson et al., 2013 Russell et al., 2013
STRUCTURAL (MACROSYSTEM) LEVEL:			
Income status and availability of resources (4 studies)	Influence of low or unstable income on lifestyle behaviours	4	Bove & Olson, 2008 Greaney et al., 2009 Higgins et al., 2006 Thornton et al., 2006

Note: The qualitative data for one study was reported in two papers (Koshy et al., 2012 and Leslie et al., 2012).

Appendix 29: Integration of review findings – Comparing data from intervention studies (Review 2) with themes identified in the qualitative synthesis (Review 3)

Table 28.1. Mapping data from intervention studies (Review 2) onto themes identified in the synthesis of qualitative studies (Review 3)

Theme identified in qualitative synthesis	Subtheme identified in qualitative synthesis:	Did Intervention Studies address this?	Which intervention studies addressed this subtheme and how?	Challenges to addressing this theme in interventions?	Suggestions for ways in which future interventions might address themes
Intrapersonal and interpersonal (micro-system)					
Psychological/ physical factors (15 papers reporting on 14 studies)	Perceived risk of future events (e.g., disease, death) Doldren & Webb 2013 (Diet and PA) Folta et al 2008 (Diet and PA) Greaney et al 2004 (Diet, PA, smoking) Russell et al 2013 (Diet, PA)	Yes (educational content related to the individual) No (persuasion, enablement, identification of barriers/ problem solving)	All studies addressed this in terms of education content (information provision) But qualitative studies tended to focus on how their experiences of death/illness in family impacted their current behaviour – this was not addressed in any intervention studies.	Not reported	Intervention content to address these issues suggested by qualitative studies may include: Persuasion (how might their experiences of health problems in friends and families encourage behaviour change) Enablement (how might those who are fatalistic about behaviour change be supported)
	Perceived outcomes of healthy lifestyle behaviours Doldren & Webb 2013 (Diet and PA) Farooqi et al 2000 (Diet, PA, smoking, alcohol misuse) Folta et al 2008 (Diet and PA) Greaney et al 2004 (Diet, PA, smoking) Koshy et al 2012 (Diet, smoking) Peterson et al 2013 (Diet, PA) Russell et al 2013 (Diet, PA)	Yes	Most studies provided information on the positive benefits of healthy behaviour beyond health (e.g. self-esteem, improved appearance)	Not reported	N/A
	Motivation for lifestyle behaviours Bove & Olson 2008 (Diet and PA) Doldren & Webb 2013 (Diet and PA) Folta et al 2008 (Diet and PA)	Yes	A number of studies sought to use motivational interviewing/persuasion techniques: DeVries et al 2008 (Diet, PA and smoking)	Not reported	Impact of motivational techniques were not strong – different approaches may need to be tried in future interventions

	<p>Gettleman & Winkleby, 2000 (Diet, PA, smoking)</p> <p>Greaney et al 2004 (Diet, PA, smoking)</p> <p>Kegler et al 2008 (Diet, PA)</p> <p>Koshy et al; Leslie et al 2012 (Diet, smoking)</p> <p>Peterson et al 2013 (Diet, PA)</p> <p>Russell et al 2013 (Diet, PA)</p> <p>Thornton et al 2006 (Diet, PA)</p>		<p>Emmons et al 2005 (Diet and PA)</p> <p>Gow et al 2010 (Diet, PA and smoking)</p> <p>Hillier et al 2012 (Diet and PA)</p> <p>Jackson et al 2011 (Diet and PA)</p> <p>Jacobs et al 2011 (Diet and PA)</p> <p>Keyserling et al 2008 (Diet and PA)</p> <p>Lee et al 2011 (Diet and PA)</p> <p>McCambridge et al 2011 (Smoking, alcohol misuse and illicit drug use)</p> <p>Oenema et al 2008 (Diet, PA and smoking)</p> <p>Resnicow et al 2005 (Diet and PA)</p> <p>Sallit 2008 (Diet and smoking)</p> <p>Simkin-Silverman et al 1998 (Diet and PA)</p> <p>Van Keulen et al 2011 (Diet and PA)</p> <p>Zhou et al 2010 (Diet, PA, smoking alcohol misuse)</p>		
	<p>Caring about what other people and society think</p> <p>Folta et al 2008 (Diet and PA)</p> <p>Peterson et al 2013 (Diet, PA)</p> <p>Thornton et al 2006 (Diet, PA)</p>	<p>No specific content of social approval but related content on modelling</p>	<p>A number of studies included modelling intervention content:</p> <p>Braithwaite et al 2005 (Sexual risk behaviour, illicit drug use, alcohol misuse, smoking)</p> <p>Hivert et al 2007 (Diet, PA)</p> <p>Yanek et al 2001 (Diet, PA)</p> <p>Hillier et al 2012 (Diet, PA)</p>	Not reported	<p>CALO-RE taxonomy: provide information about others approval</p> <p>Behaviour change wheel: Modelling (closest intervention function but does not completely encompass the theme)</p>

			<p>Campbell et al 2004 (Diet, PA) Resnicow et al 2005 (Diet, PA) Wilcox et al 2013 (Diet, PA) Sikkema et al 1995 (Alcohol misuse, illicit drug use, sexual risk behaviour) Simkin-Silverman et al 1998 (Diet, PA) Lesley et al 2012 (Diet, smoking)</p> <p>But other barriers not addressed: Self-conscious attending gym Societal acceptance of being overweight or obese</p>		
	<p>Will power/discipline Doldren & Webb, 2013 (Diet, PA) Folta et al 2008 (Diet and PA) Gettleman & Winkleby, 2000 (Diet, PA, smoking) Greaney et al 2004 (Diet, PA, smoking) Greaney et al 2009 (Diet, PA) Kegler et al 2008 (Diet, PA) Russell et al 2013 (Diet, PA)</p>	Yes	All studies (education and training content)	Fruit and veg – reduction in effectiveness over time found in meta-regression analyses	N/A
	<p>Stress and emotions/mental states Bove & Olson 2008 (Diet and PA) Condon et al 2008 (Diet, PA, smoking, alcohol misuse) Greaney et al 2004 (Diet, PA, smoking) Greaney et al 2009 (Diet, PA) Higgins et al 2006 (Diet, PA, smoking) Peterson et al 2013 (Diet, PA) Russell et al 2013 (Diet, PA)</p>	No	No studies reported this	Not reported	<p>CALO-RE taxonomy: Stress management/emotional control training</p> <p>Behaviour change wheel: training</p>
	<p>Impact of health status and physiological factors Folta et al 2008 (Diet and PA)</p>	People with physical conditions excluded from review	Although some studies of older adults adapted studies to take into the physical limitations of older adults (enablement): Burton 1995: provision of additional	N/A	N/A

	Koshy et al 2012; Leslie et al 2012 (Diet, smoking) Peterson et al 2013 (Diet, PA)		counselling and behaviour review for participants with more complex health needs Lee 2011: conducting the intervention in participants' homes and providing telephone/email support		
Knowledge/Awareness (13 papers reporting on 12 studies)	Knowledge/awareness about risk behaviours and disease Bove & Olson 2008 (Diet and PA) Farooqi et al 2000 (Diet, PA, smoking, alcohol misuse) Folta et al 2008 (Diet and PA) Gettleman & Winkleby, 2000 (Diet, PA, smoking) Greaney et al 2009 (Diet, PA) Higgins et al 2006 (Diet, PA, smoking) Thornton et al 2006 (Diet, PA)	Yes	All studies (educational content)	Not reported	N/A
	Perceived importance of healthy lifestyle behaviours Greaney et al 2009 (Diet, PA) Koshy et al 2012 (Diet, smoking) Russell et al 2013 (Diet, PA)	Yes	All studies (educational content)	Not reported	N/A
	Communication with health professionals/instructors Higgins et al 2006 (Diet, PA, smoking) Leslie et al 2013 (Diet, smoking) Peterson et al 2013 (Diet, PA) Russell et al 2013 (Diet, PA) Thornton et al 2006 (Diet, PA)	No	No studies reported this	Not reported	Future qualitative studies may examine further whether this is a common barrier. And if so how to improve communication between healthcare professionals and the public.
	Strategies used to maintain healthy behaviours Doldren & Webb 2013 (Diet and PA) Farooqi et al 2000 (Diet, PA, smoking, alcohol misuse) Folta et al 2008 (Diet and PA) Greaney et al 2004 (Diet, PA, smoking)	Yes	All studies (training)	Not reported	N/A

	<p>Greaney et al 2009 (Diet, PA)</p> <p>Impact of culture and religion on knowledge/awareness, beliefs and lifestyle behaviours</p> <p>Doldren & Webb 2013 (Diet, PA)</p> <p>Farooqi et al 2000 (Diet, PA, smoking, alcohol misuse)</p> <p>Russell et al 2013 (Diet, PA)</p> <p>Thornton et al 2006 (Diet, PA)</p>	Yes (but only African American and Hispanic groups)	Studies targeting African Americans and Hispanic Americans (enablement): Campbell et al 2004 (Diet and PA) Resnicow et al 2005 (Diet and PA) Wilcox et al 2013 (Diet and PA) Yanek et al 2001 (Diet and PA) Peragallo et al 2012 (alcohol misuse and sexual risk behaviour)	Not reported	<p>Cultural and religious barriers of South Asians in UK not targeted.</p> <p>Also needs of Black British groups and other minority ethnic groups in the UK may be different from those in the USA</p> <p>CALO-RE taxonomy: - environmental restructuring</p> <p>-plan social support/social change</p> <p>Behaviour change wheel: -environmental restructuring</p> <p>-enablement</p>
Interventions (8 papers reporting on 7 studies)	<p>Perceptions and ideas relating to lifestyle interventions</p> <p>Farooqi et al 2000 (Diet, PA, smoking, alcohol misuse)</p> <p>Folta et al 2008 (Diet and PA)</p> <p>Gettleman & Winkleby, 2000 (Diet, PA, smoking)</p> <p>Greaney et al 2009 (Diet, PA)</p> <p>Higgins et al 2006 (Diet, PA, smoking)</p> <p>Leslie et al 2012 (Diet, smoking)</p> <p>Russell et al 2013 (Diet, PA)</p>	Yes	<p>Most suggestions were already found in included studies:</p> <p>Skills training (e.g. cooking lessons)</p> <p>Education</p> <p>Use of exercise DVDs</p> <p>Eating plans</p> <p>Cooking lessons</p> <p>Need for social support</p> <p>Portion sizes</p>	Not reported	N/A
	<p>The process of changing <i>multiple</i> risk behaviours</p> <p>Koshy et al 2012 (Diet and smoking)</p> <p>Russell et al 2013 (Diet, PA)</p>	Yes	<p>One study specifically examined the process of changing multiple risk behaviours</p> <p>Vandelandotte et al 2008</p> <p>We were also able to examine correlations in changes between risk</p>	Not reported	Further work building on these studies is needed to further understand the change process when targeting multiple behaviours

			behaviours in multivariate meta-analyses		
Personal responsibilities (9 studies)	Being a role model and responsible for others Doldren & Webb 2013 (Diet and PA) Gettleman & Winkleby, 2000 (Diet, PA, smoking) Greaney et al 2004 (Diet, PA, smoking) Peterson et al 2013 (Diet, PA) Russell et al 2013 (Diet, PA)	No	No studies reported this (but unclear if family intervention studies have) But there were attempts to do this in a different context (church interventions): Campbell et al 2004 (Diet and PA) Resnicow et al 2005 (Diet and PA) Wilcox et al 2013 (Diet and PA) Yanek et al 2001 (Diet and PA)	Not reported	Future interventions should include specifically for women taking into account their role in their families: CALO-RE taxonomy: Prompt identification as role model/position advocate [social] environmental restructuring Behaviour change wheel: [social] environmental restructuring
	Competing time demands Farooqi et al 2000 (Diet, PA, smoking, alcohol misuse) Folta et al 2008 (Diet and PA) Gettleman & Winkleby, 2000 (Diet, PA, smoking) Greaney et al 2009 (Diet, PA) Kegler et al 2008 (Diet, PA) Peterson et al 2013 (Diet, PA) Russell et al 2013 (Diet, PA)	Yes	Almost all studies included some training intervention content (e.g. goal setting, action plans, etc)	Not reported	N/A
	Disruption to routine Greaney et al 2004 (Diet, PA, smoking) Russell et al 2013 (Diet, PA)	No	No studies reported this	Not reported	CALO-RE taxonomy: relapse prevention/coping planning Behaviour change wheel: training
Social network (13 studies)	Family habits during childhood and adolescence Doldren & Webb 2013 (Diet and PA) Farooqi et al 2000 (Diet, PA, smoking, alcohol misuse) Folta et al 2008 (Diet, PA)	Family interventions Excluded from review	N/A	N/A	N/A

	Greaney et al 2004 (Diet, PA, smoking) Russell et al 2013 (Diet, PA)				
	Influence from family and/or friends in adulthood Bove & Olson 2008 (Diet and PA) Folta et al 2008 (Diet and PA) Greaney et al 2004 (Diet, PA, smoking) Greaney et al 2009 (Diet, PA) Higgins et al 2006 (Diet, PA, smoking) Kegler et al 2008 (Diet, PA) Peterson et al 2013 (Diet, PA) Russell et al 2013 (Diet, PA) Thornton et al 2006 (Diet, PA)	Family interventions Excluded from review	N/A	N/A	N/A
	Support groups Gettleman & Winkleby, 2000 (Diet, PA, smoking) Leslie et al 2012 (Diet, smoking) Russell et al 2013 (Diet, PA)	Yes	Intervening in pre-existing social groups (African American Churches): Campbell et al 2004 (Diet and PA) Resnicow et al 2005 (Diet and PA) Wilcox et al 2013 (Diet and PA) Yanek 2001 (Diet and PA) Trying to develop social support among intervention group members: Simkin-Silverman et al 1998 (Diet and PA) Weisman et al 2011 (Diet and PA)	Difficulty engaging with lay leaders of interventions: Campbell et al 2004 (Diet and PA) Yanek et al 2001 (Diet and PA)	Target Black British churches, South Asian British communities (e.g. mosques, temples), pre-existing social meeting places for low income populations
	Social occasions Folta et al 2008 (Diet and PA) Gettleman & Winkleby, 2000 (Diet, PA,	No	Most studies included some training in problem solving But no studies specifically addressed this	Not reported	CALO-RE taxonomy: Barrier identification/problem solving

	smoking) Greaney et al 2009 (Diet, PA) Thornton et al 2006 (Diet, PA)		barrier.		Behaviour change wheel: enablement
Geographical (exo-system)					
Geographical location and environment (10 studies)	Access to physical activity spaces and equipment Bove & Olson 2008 (Diet and PA) Condon et al 2008 (Diet, PA, smoking, alcohol misuse) Greaney et al 2009 (Diet, PA) Kegler et al 2008 (Diet, PA) Peterson et al 2013 (Diet, PA) Russell et al 2013 (Diet, PA)	Yes	Studies provided some equipment such as pedometers and resistance bands, exercise DVDs Burke et al 2013 (Diet, PA, sedentary) Hui et al 2012 (Diet and PA) Lombard et al 2009 (Diet and PA) Resnicow et al 2005 (Diet and PA) Enablement (in combination with education and training) was associated with greater improvement in physical activity in the meta-regression analyses		This barrier to physical activity was specifically noted in people from rural locations – therefore future interventions may focus on specific groups where location is a barrier to physical activity CALO-RE taxonomy: Prompt practice Behaviour change wheel: Enablement
	Access to healthy foods Bove & Olson 2008 (Diet, PA) Condon et al 2008 (Diet, PA, smoking, alcohol misuse) Folta et al 2008 (Diet and PA) Greaney et al 2009 (Diet, PA) Higgins et al 2006 (Diet, PA, smoking) Kegler et al 2008 (Diet, PA) Peterson et al 2013 (Diet, PA) Russell et al 2013 (Diet, PA) Thornton et al 2006 (Diet, PA)	No	No studies reported this	Not reported	CALO-RE taxonomy: Environmental restructuring Behaviour change wheel: Environmental restructuring
	Influence of local environment on smoking Condon et al 2008 (Diet, PA, smoking, alcohol misuse) Gettleman & Winkleby, 2000 (Diet, PA, smoking) Russell et al 2013 (Diet, PA)	No	No studies reported this	Not reported	It appeared prison was a facilitator for reducing smoking for many participants in the qualitative synthesis – therefore unlikely to need to target this in intervention

	Personal safety Higgins et al 2006 (Diet, PA, smoking) Kegler et al 2008 (Diet, PA) Peterson et al 2013 (Diet, PA)	No	No studies reported this	Not reported	CALO-RE taxonomy: Barrier identification/ problem solving Behaviour change wheel: Enablement Intervention content where personal safety is a barrier may include: encouraging people to attend an exercise class/gym as a group, finding alternatives that involve exercising at home
	Weather Folta et al 2008 (Diet and PA) Peterson et al 2013 (Diet, PA) Russell et al 2013 (Diet, PA)	No	No studies reported this	Not reported	CALO-RE taxonomy: Barrier identification/ problem solving Behaviour change wheel: Enablement Where weather is a particular barrier to physical activity encouraging exercise at home or other indoor locations may be targeted
Structural (macro-system)					
Income status and availability of resources (4 studies)	Influence of low or unstable income on lifestyle behaviours Bove & Olson 2008 (Diet and PA) Greaney et al 2009 (Diet and PA) Higgins et al 2006 (Diet, PA, smoking) Thornton et al 2006 (Diet,PA)	No	7 studies specifically targeted low income groups but none specifically looked at environmental restructuring: Burke et al 2013 (Diet, PA, sedentary) Emmons 2005 (Diet and PA) Hillier et al 2012 (Diet and PA) Jackson et al 2011 (Diet and PA) Keyserling et al 2008	Not reported	CALO-RE taxonomy: -Environmental restructuring -Barrier identification/ problem solving Behaviour change wheel: --Environmental restructuring -Enablement

			(Diet and PA) Staten et al 2004 (Diet and PA) Weisman et al 2011 (Diet and PA)		
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