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This report

Abstract

Multiple versus single risk behaviour interventions for people with severe mental illness: a network meta-analysis and qualitative synthesis

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Background: People with severe mental illness die 15–20 years earlier than the general population. Reasons why include that people with severe mental illness are more likely to smoke and be physically inactive as a result of social inequalities.

Objectives: (1) Evaluate the clinical effectiveness of multiple risk behaviour interventions on behaviour change (e.g. smoking abstinence), and outcomes affected by behaviours (e.g. weight loss). (2) Compare the clinical effectiveness of interventions targeting multiple and single risk behaviours. (3) Examine the factors affecting outcomes (e.g. intervention content). (4) Assess the factors affecting experiences of interventions (e.g. barriers and facilitators).

Data sources: The Cochrane Central Register of Controlled Trials (CENTRAL), EMBASE™ (Elsevier, Amsterdam, the Netherlands), MEDLINE, PsycInfo® (American Psychological Association, Washington, DC, USA) and Science Citation Index (Clarivate Analytics, Philadelphia, PA, USA) were searched from inception to October 2018, and an updated search was conducted in March 2020. An Applied Social Sciences Index and Abstracts (ASSIA) search and an updated Cochrane Central Register of Controlled Trials search were undertaken in September 2020.

Study selection: Randomised controlled trials targeting single or multiple health risk behaviours among people with severe mental illness were included. Qualitative evidence on factors affecting the effectiveness of risk behaviour interventions was included.

Study appraisal: Network meta-analyses were conducted to compare the effectiveness of multiple and single risk behaviour interventions. The mean differences were estimated for continuous outcomes; if this was not possible, standardised mean differences were calculated. Thematic syntheses of qualitative studies were conducted.

Results: A total of 101 studies (67 randomised controlled trials and 34 qualitative studies) were included. Most outcomes were smoking abstinence, weight and body mass index. Just over half of studies were rated as having a high overall risk of bias. Trials focusing on smoking alone led to greater abstinence than targeting smoking and other behaviours. However, heterogeneity means that other explanations cannot be ruled out. For weight loss and body mass index, single risk behaviour (e.g. physical activity alone) and multiple risk behaviour (e.g. diet and physical activity) interventions had positive but modest benefits. For example, any risk behaviour intervention led to a 2 kg greater weight loss (−2.10 kg, 95% credible interval −3.14 to −1.06 kg) and approximately half a point (i.e. 0.5 kg/m^2) greater body mass index reduction (−0.49 kg/m^2, 95% credible interval −0.97 to −0.01 kg/m^2) than treatment as usual. There were potential synergies for targeting multiple health behaviours for reduction in systolic and diastolic blood pressure. No evidence was found of a deterioration in mental health for people with severe mental illness engaging in interventions to reduce health risk behaviours. Qualitative studies found that people with severe mental illness favoured interventions promoting physical and mental health together, and that took their condition into account. However, trials focused mainly on promoting physical health.

Limitations: Most quantitative studies focused on weight and body mass index; few assessed behavioural outcomes. Qualitative studies often addressed different aims.

Conclusions: Multiple and single risk behaviour interventions were associated with positive but modest benefits on most outcomes. Interventions seeking to promote physical health were not associated with deterioration in mental health. There was a lack of overlap between quantitative and qualitative studies.

Future work: Further research is needed to investigate whether or not health behaviour changes are maintained long term; tailoring weight-loss interventions for people with severe mental illness; and in terms of methods, co-production and mixed-methods approaches in future trials.

Study registration: This study is registered as PROSPERO CRD42018104724.

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Contents

CONTENTS

List of tables

List of figures

List of abbreviations

ASSIA	Applied Social Sciences Index and Abstracts
BCT	behaviour change technique
BCTT	behaviour change technique taxonomy
BCTT v1	Behaviour Change Technique Taxonomy version 1
BMI	body mass index
CASP	Critical Appraisal Skills Programme
CENTRAL	Cochrane Central Register of Controlled Trials
CERQual	Confidence in the Evidence from Reviews of Qualitative research
CI	confidence interval
CrI	credible interval
DIC	deviance information criterion
GRADE	Grading of Recommendations Assessment, Development and Evaluation
HDL	high-density lipoprotein
LDL	low-density lipoprotein
MD	mean difference
MRB	multiple risk behaviour intervention
NMA	network meta-analysis
OR	odds ratio
PANSS	Positive and Negative Syndrome Scale
PPI	patient and public involvement
PRISMA	Preferred Reporting Items for Systematic Reviews and Meta-Analyses
RCT	randomised controlled trial
SBP	systolic blood pressure
SD	standard deviation
SMD	standardised mean difference
SMI	severe mental illness
SRB	single risk behaviour intervention
TAU	treatment as usual

Plain English summary

Introduction

People with severe mental illness die, on average, 15–20 years earlier than the rest of the population.

Many of us are unhealthy in several ways. Does tackling multiple health risks together lead to greater benefit?

Intervention benefits

This project reviewed 101 studies. Of these, 67 studies looked at the health benefits of interventions, and 34 studies asked about experiences of improving physical health. Just over half of these studies had important problems, so it may not be possible to trust their findings.

Most health improvements were small. For example, people who took part in an intervention lost 2 kg more weight than those who did not receive an intervention. This weight loss is in line with the general population, but the starting weight of people with severe mental illness is often greater.

Focusing on quitting smoking seems better than changing other behaviours (e.g. eating unhealthy food) at the same time. But more studies are needed.

No evidence was found that trying to improve physical health worsened the mental health of people with severe mental illness.

Experiences of interventions

Interventions focused on promoting physical health. But people with severe mental illness preferred to manage mental and physical health together. People with severe mental illness should be more involved in future studies, as this would make the studies more relevant.

People with severe mental illness also valued interventions that considered their mental health condition.

Limitations

Most studies looking at intervention benefits focused on weight and body mass index; few studies asked if people's behaviour changed. There was also a lack of overlap between studies interested in intervention benefits and experiences of interventions.

Conclusions

Most health improvements were small. No evidence was found that people with severe mental illness trying to improve physical health made their mental health worse.

Future work

More research is needed on adapting interventions for people with severe mental illness. We also need to see if people can maintain improvements long term. This may be difficult if people with mental health symptoms get worse or if they need to spend time in hospital.

Scientific summary

Background

People with severe mental illness die 15–20 years earlier than the general population and are two to three times more likely to experience long-term conditions. Health risk behaviours (e.g. smoking, physical inactivity) are associated with increased risk for developing long-term conditions (such as cancer, cardiovascular diseases).

People with severe mental illness engage in multiple risk behaviours more frequently than the general population; for example, smoking prevalence is three times higher than in the general population. Unhealthy diet and physical inactivity are also more likely. Reducing these health inequalities, the so-called 'mortality gap' between people with severe mental illness and the general population, is a key priority for the NHS.

Health risk behaviour interventions are a potentially important way to promote health among people with severe mental illness. But there are important questions relating to the evidence. For example, as most people with severe mental illness engage in more than one health risk behaviour, should we target the reduction of multiple risk behaviours in parallel (e.g. target two or more behaviours simultaneously), or target one behaviour at a time?

Therefore, the aim of this review was to examine the clinical effectiveness of multiple risk behaviour interventions, compared with single risk behaviour interventions. We also aimed to identify 'active ingredients' of these interventions, and to identify factors affecting the clinical effectiveness of risk behaviour interventions among people with severe mental illness using data from qualitative studies.

Objectives

The objectives were to:

- evaluate the clinical effectiveness of multiple risk behaviour interventions for behaviour change (e.g. smoking abstinence) targeted by the intervention, and for change in outcomes affected by these behaviours (e.g. weight loss)
- compare the clinical effectiveness of interventions targeting multiple and single risk behaviours on behaviour change and outcomes affected by these behaviours
- examine factors affecting outcomes, including intervention content and participant characteristics
- assess what factors affect experiences of health risk behaviour interventions (e.g. barriers and facilitators) among people with severe mental illness.

Methods

Data sources
We searched the Cochrane Central Register of Controlled Trials (CENTRAL), EMBASE™ (Elsevier, Amsterdam, the Netherlands), MEDLINE, PsycInfo® (American Psychological Association, Washington, DC, USA) and Science Citation Index (Clarivate Analytics, Philadelphia, PA, USA) in October 2018, and updated the search in March 2020. We searched Applied Social Sciences Index and Abstracts (ASSIA), and conducted an updated Cochrane Central Register of Controlled Trials search, in September 2020.

Inclusion criteria

- Population: adults (aged ≥ 18 years) with severe mental illness (psychoses, bipolar disorder or psychotic depression).
- Intervention: any behavioural intervention targeting at least one of the following risk behaviours – smoking, unhealthy diet, physical inactivity, excess alcohol consumption or drug use.
- Comparator: treatment as usual, treatment as usual with additional active content (e.g. attentional control).
- Outcomes: behavioural outcomes (e.g. smoking abstinence, diet intake, total physical activity), outcomes affected through behaviours targeted by the intervention (e.g. weight, body mass index), quality of life, and mental health outcomes (e.g. as measured by the Positive and Negative Syndrome Scale).

Data extraction

We categorised behaviour change techniques using the Behaviour Change Technique Taxonomy version 1. A risk-of-bias assessment of included randomised controlled trials was conducted using the Cochrane Risk of Bias tool. For included qualitative studies, quality assessment was conducted using the Critical Appraisal Skills Programme tool for qualitive studies and the Confidence in the Evidence from Reviews of Qualitative research (CERQual) to assess the certainty of findings.

Data synthesis

Data from quantitative studies were analysed using network meta-analyses, which take into account all direct and indirect evidence within a network of interventions. Evidence proceeded in three stages. Model 1 investigated the clinical effectiveness of interventions targeting multiple and single health risk behaviours. Model 2 investigated if there were positive or negative synergies when interventions targeted multiple risk behaviours. Model 3 investigated the impact of behaviour change techniques on the clinical effectiveness of health risk behaviour interventions.

Data from qualitative studies were analysed using thematic synthesis to identify recurring and emergent themes, and were presented in a narrative synthesis. Initial coding was descriptive, remaining close to original reports and began without hierarchical structure. Translation of coding was iterative and analytical themes were developed through refining coding, comparing primary data with developing themes.

We also investigated whether or not overall themes and subthemes from the synthesis of qualitative studies were investigated in quantitative data in a narrative synthesis. When qualitative and quantitative data overlapped, we assessed their relationship according to four categories: silence (no overlap), partial agreement (complementary findings), agreement (coherence between quantitative and qualitative data) and dissonance (conflicting findings from quantitative and qualitative data).

Results

Quantitative data

We identified a growing literature on smoking (eight trials were included in the narrative synthesis of smoking abstinence and seven trials for number of cigarettes smoked). Interventions focusing on smoking alone were more effective than controls in increasing the odds of abstinence, whereas studies targeting smoking in addition to other risk behaviours (e.g. unhealthy diet, physical inactivity and alcohol misuse) did not find evidence of increased abstinence. However, there was a great deal of conceptual heterogeneity, including the intensity of control groups and smoking interventions across trials. Data on reducing the number of cigarettes smoked varied widely between studies. For all other behavioural outcomes, data were limited. Just over half of included studies in the network meta-analysis were rated as having a high overall risk of bias.

The most reported outcomes were weight (30 trials included in the network meta-analysis) and body mass index (36 trials included in the network meta-analysis). Interventions targeting diet alone, physical activity alone or diet and physical activity concurrently all appeared to be effective in promoting weight loss (e.g. any intervention vs. treatment as usual: –2.10 kg, 95% credible interval –3.14 to –1.06 kg) and body mass index reduction (e.g. any intervention vs. treatment as usual: –0.49 kg/m^2, 95% credible interval –0.97 to –0.01 kg/m^2). The magnitude of weight loss and reduction in body mass index did not differ substantially between studies targeting diet or physical activity alone and studies targeting them concurrently. We also did not find evidence of positive synergies in targeting diet and physical activity to promote weight loss or reduction in body mass index.

Improvements in blood pressure and cholesterol outcomes were modest (e.g. systolic blood pressure, any intervention vs. treatment as usual: –1.33 mmHg, 95% credible interval –3.13 to 0.44 mmHg). But, in contrast to the outcomes discussed previously, targeting multiple risk behaviours appeared to result in greater improvements. Targeting diet (e.g. systolic blood pressure: 0.25 mmHg, 95% credible interval –4.65 to 4.98 mmHg) or physical activity alone (e.g. systolic blood pressure: –0.43 mmHg, 95% credible interval –5.58 to 4.76 mmHg) led to modest improvements, whereas effect estimates were higher in trials targeting diet and physical activity (e.g. systolic blood pressure: –1.64 mmHg, 95% credible interval –4.50 to 0.99 mmHg), and also in trials targeting diet, physical activity, alcohol use and smoking (e.g. systolic blood pressure: –2.26 mmHg, 95% credible interval –5.28 to 0.59 mmHg). This potentially reflects synergies in targeting multiple health behaviours in reducing systolic and diastolic blood pressure.

Fewer data were reported on quality of life and mental health outcomes. We found no evidence that interventions aiming to reduce physical health risk behaviours in people with severe mental illness led to negative impacts on mental health (Positive and Negative Syndrome Scale total score 0.03, 95% credible interval –2.56 to 2.65) or mental health-related quality of life (standardised mean difference –0.06, 95% credible interval –0.31 to 0.19). However, there was also no evidence that interventions promoted physical health-related quality of life (standardised mean difference –0.08, 95% credible interval –0.35 to 0.28).

There was limited overlap between behaviour change techniques in included studies; this reduced our ability to assess the impact on clinical effectiveness and how behaviour change techniques interacted with one another. Goal-setting was associated with weight loss (–2.22 kg, 95% credible interval –4.54 to –0.44 kg) and a reduction in body mass index (–1.85 kg/m^2, 95% credible interval –2.91 to –0.69 kg/m^2). Instruction on how to perform the behaviour was also associated with weight loss (–2.10 kg, 95% credible interval –3.42 to –0.45 kg) and a reduction in body mass index (–1.19 kg/m^2, 95% credible interval –1.85 to –0.55 kg/m^2). Self-monitoring of behaviour was associated with a reduction in body mass index (–0.70 kg/m^2, 95% credible interval –1.42 to 0.07 kg/m^2), although it was not possible to rule out no benefit.

Interventions focusing on delivery to individuals were more effective than group-delivered interventions on weight loss (–2.70 kg, 95% credible interval –4.69 to –0.75 kg) and reduction in body mass index (–1.11 kg/m^2, 95% credible interval –2.15 to –0.01 kg/m^2).

Qualitative data
Data were organised around four higher-tier themes: interaction of physical and mental health, motivational contexts for change, barriers to behaviour change, and experiences of interventions. All themes were rated to be of moderate certainty according to their Confidence in the Evidence from Reviews of Qualitative research (CERQual) evidence profiles.

Interaction of mental and physical health
Engaging in health behaviours was reported to improve mental health and well-being, with mental health changes affecting the ability to engage in healthy behaviours. Individuals wanted to be treated

holistically as a person, but interventions tended to have an impersonal focus on behaviours. There were also data reporting on 'self-medicating' through smoking, alcohol use and drug use to manage mental health symptoms.

Motivational contexts for behaviour change
Holding on to a personal motivation was important, and reports varied from managing health and improving physical appearance, to working towards a positive future. Family and friends were an important source of social support and motivation, providing feedback and reinforcement of positive change. Interventions were interpreted as a safe and stable environment to create change from, offering accountability, which helped in making changes.

Barriers to behaviour change
Mental health symptoms affected the ability to engage with healthy behaviours, such as low mood and lack of motivation, challenging the ability to engage in physical activity. Social support from family and friends could also act as barriers, for instance encouraging engagement in alcohol use or unhealthy eating. A lack of social support was also a barrier to persevering with behaviour change. Environmental factors could act as triggers for unhealthy behaviours, such as living in group homes where peers shared their experiences of engaging in risk behaviours.

Experiences of behaviour change interventions
Tailoring interventions for people with severe mental illness was a prominent concern; it was suggested that tailoring could take the form of additional help in providing structure and organisation in the daily lives of participants. Interventions providing education and skills to promote healthy behaviours were also considered beneficial. Group interventions were helpful for building peer support and meeting others, and also as a point of comparison with others, which could be double-edged if used to police behaviour. Interventions that could adapt behaviour change according to needs, abilities and preferences were positively received. A wealth of data reported the impact of interventions reaching beyond health behaviours and into leading meaningful, active lives, which was highly valued in reports. Interventions also built confidence in the ability to make further positive changes beyond the intervention and in other aspects of life.

Integration of quantitative and qualitative data
The integrative synthesis generally showed limited overlap between quantitative and qualitative studies. Many of the themes in qualitative studies, such as importance of interventions benefiting the person holistically, rather than specific health-related outcomes, were not directly addressed in quantitative studies. The lack of overlap between the quantitative and qualitative evidence may suggest the importance of people with severe mental illness contributing to the design and delivery of interventions. Such interventions may go some way to addressing the needs and preferences of people with severe mental illness, especially in relation to addressing both physical and mental health together. People with severe mental illness also valued interventions that took into account the challenges of their mental health condition. However, the quantitative data rarely reported on this.

Quantitative and qualitative studies agreed on the importance of gaining knowledge and skills to live healthier lives. This theme from the qualitative literature was backed up by the component network meta-analyses that found that the behaviour change technique instruction to perform behaviour was associated with weight loss and reduction in body mass index.

Limitations

Most quantitative studies focused on weight and body mass index; few studies assessed behavioural outcomes. There was also a lack of overlap between quantitative and qualitative studies.

Conclusions

Implications for health care

We found preliminary evidence that focusing on smoking alone may be more effective than targeting smoking along with other health risk behaviours, although heterogeneity in how studies were designed means confounding cannot be ruled out.

The systematic review found no evidence that interventions promoting health behaviours were associated with deterioration in mental health symptoms or mental health-related quality of life. Group discussions and polls from our webinar suggested that this was a key finding. This was rated as the key implication for practice and was a common theme in discussions.

Another key implication from the systematic review was the need for communication between staff and people with severe mental illness on the goals of health risk behaviour interventions. Qualitative data found that people with severe mental illness favoured holistic approaches to well-being that integrated the promotion of physical and mental health, whereas the quantitative data, mainly led by researchers and health-care professionals, consisted of trials focused on weight loss and smoking cessation. This may reflect important differences in the aims of such interventions between people with severe mental illness and professionals delivering interventions. In addition, this may reflect a distinction between how services are currently configured (i.e. physical and mental health care often treated separately) and how people with severe mental illness would like to receive their health care (i.e. integration of physical and mental health care).

Future work

The lack of overlap in findings between the quantitative and qualitative studies is an important gap. Therefore, more mixed-methods approaches are needed that include substantial input from people with severe mental illness in the design and evaluation of interventions.

Identifying how best to adapt interventions for the needs of people with severe mental illness was the key research recommendation identified in our webinar poll, and a common theme in group discussions. Although qualitative data showed that people with severe mental illness valued the availability of choice and the potential adaptation of interventions, the trial data rarely investigated how best to tailor interventions (particularly in trials aiming to promote weight loss). A recent trial has shown the benefits of adapting smoking cessation interventions for people with severe mental illness.

A qualitative investigation of adapting and tailoring interventions to people with severe mental illness would address a gap in the literature and inform any quantitative analyses. Benefits and consequences of interventions reach beyond the quantifiable, so a qualitative study could capture these effects.

We also found few studies with follow-up data of ≥ 12 months post intervention, although current data suggest that, at ≤ 6 months' follow-up, body mass index and weight loss are maintained. These findings need to be confirmed in future research assessing the long-term benefits of health risk behaviour interventions, as well as potential barriers, such as the impact of episodic depression and anxiety or periods spent as an inpatient in a psychiatric facility.

We found few trials that directly compared interventions targeting multiple health risk behaviours with interventions targeting single health risk behaviours. Targeting smoking alone may be more effective than targeting smoking in combination with other behaviours. Future research is needed to clarify which combinations of behaviours to target for interventions.

Study registration

This study is registered as PROSPERO CRD42018104724.

Funding

Chapter 1 Background

Epidemiology

General health risks associated with multiple risk behaviours

Health risk behaviours (e.g. smoking, physical inactivity, unhealthy diet, excess alcohol consumption and illicit drug use) are common in the UK and internationally. Smoking is the single largest directly avoidable cause of death in the UK, and a major cause of respiratory disease, cancer and cardiovascular disease.[1] Physical inactivity and unhealthy diet are strongly associated with weight gain, obesity, cancer, cardiovascular disease and type 2 diabetes.[2] Excessive alcohol consumption is also associated with greater risk for cancer, liver disease and cardiovascular disease.[3] Drug use is associated with greater risk of developing human immunodeficiency virus, hepatitis C and tuberculosis infections.[4]

There is good evidence, both in the UK and internationally, that health risk behaviours cluster.[5] The majority of adults report engaging in two or more risk behaviours, and approximately one-quarter engage in three or more risk behaviours.[6] A 2017 Norwegian population-based cohort study[7] of > 30,000 participants found a dose–response relationship between number of risk behaviours and all-cause mortality (i.e. increase in risk of all-cause mortality of 1.55-fold for two behaviours, 2.26-fold for three behaviours and 3.16-fold for four behaviours). There was a similar dose–response effect for risk of stroke in a large UK study of > 20,000 participants: the relative risks for people who engaged in four risk behaviours were 2.31 when compared with people who engaged in no risk behaviours, 2.18 when compared with people who engaged in one risk behaviour, 1.58 when compared with people who engaged in two risk behaviours and 1.15 when compared with people who engaged in three risk behaviours.[8] There is strong evidence that social and health inequalities are associated with engaging in multiple risk behaviours. People in the UK who do not complete secondary school or who have an unskilled occupation are three to five times more likely to engage in multiple risk behaviours.[9]

Multiple risk behaviour interventions in general populations were associated with small reductions in smoking, unhealthy diet and physical inactivity, but there is currently insufficient evidence for reductions in alcohol and drug use.[10] In addition, small benefits were found in terms of reductions in weight, blood pressure and total cholesterol in the general population.[10]

Health risk and inequalities in severe mental illness populations

Preventing long-term conditions has been a key policy priority for some time, and people with severe mental illness (SMI) constitute a particularly vulnerable subgroup of the population.

Risk of cardiovascular mortality is two to three times higher in people with SMI[11] and life expectancy is 15–20 years lower than that of the general population.[12] This substantial risk is probably driven and sustained by complex interactions between social inequalities[13], genetics, neurobiology, psychosocial impairment and symptoms associated with SMI,[14] side effects of medication[15,16] and a lack of access to physical and mental health interventions.[13]

Smoking is the largest cause of premature mortality in the UK, and the biggest contributor to health inequalities among people with a mental health condition.[17] Therefore, it is particularly concerning that smoking is up to three times as prevalent in SMI populations than the general population, and even higher in certain subgroups (e.g. mental health inpatients). Although the prevalence of smoking in the general population has reduced by one-quarter in the past 25 years, the change in prevalence for smoking among people with a mental health condition in the same period is negligible.[1] This means that 42% of all cigarettes in the UK are now smoked by people with a mental health condition,[1] who have been shown to lose, on average, 17 years of life as a result of tobacco smoking.[18]

Similarly, people with schizophrenia are more likely to engage in an unhealthy diet, including lower fibre and fruit intake and higher saturated fat and calorie intake than the general population.[19] A study of people with SMI in psychiatric rehabilitation programmes found that only 4% met physical activity guidelines.[20] People with schizophrenia engaging in multiple risk behaviours are more likely to be overweight, to have high low-density lipoprotein (LDL) cholesterol, to have low high-density lipoprotein (HDL) cholesterol and to have increased fasting glucose levels.[19] Antipsychotic treatment, and other commonly prescribed medications, are associated with increased weight gain, particularly within the first years of psychosis. For example, a systematic review estimated an average 12-kg weight increase in the first 24 months of taking antipsychotics.[21] Similarly, Kahn *et al.*[22] found that people with first-episode psychosis experienced a 7% increase in body weight during the first year of treatment.

However, it should also be noted that, although antipsychotic use may increase risk of cardiovascular disease, there is also evidence that antipsychotic use overall may be associated with improvements in mortality in people with schizophrenia.[23]

People with SMI are also substantially more likely to engage in substance use. A large US study of > 20,000 participants found that people with psychosis were four times more likely to engage in heavy alcohol use, cannabis use and use of other recreational drugs.[24] A UK study found that 30% of people with first-episode psychosis engaged in illicit drug use, 25% engaged in both alcohol misuse and illicit drug use and 10% engaged in excess alcohol consumption.[25]

People with SMI are more likely to engage in multiple health risk behaviours. For example, in one study, on average, people with SMI were found to engage in five risk behaviours.[26] Therefore, an important question is whether to target these risk behaviours concurrently (i.e. multiple risk behaviour interventions) or to focus on a particular behaviour alone (i.e. single risk behaviour intervention).

Why this research is needed

Reducing risk behaviours in people with SMI is a clear priority for the NHS. These aims relate to wider initiatives such as the Mental Health Taskforce's *Five Year Forward View for Mental Health*,[27] which highlights the importance of integrating physical and mental health care. However, there are key evidence gaps that are important in informing practice:

- Most people with SMI engage in multiple risk behaviours – a key question is whether interventions should target multiple risk behaviours in parallel or target single behaviours.
- The importance of investigating factors that are likely to influence the clinical effectiveness of risk behaviour interventions in this population (e.g. intervention delivery, frequency) has been recognised.

Multiple compared with single risk behaviour interventions
There are several systematic reviews that have focused on the effectiveness of interventions among people with SMI for particular behaviours: smoking,[28] unhealthy diet and/or physical activity.[29–31]

Despite a relatively developed literature of primary studies in this area, to our knowledge, there are currently no systematic reviews specifically focused on multiple risk behaviour interventions in people with SMI. It is not possible from current systematic reviews to delineate the benefits of focusing on a particular risk behaviour, compared with targeting multiple behaviours concurrently, in a SMI population. Risk behaviours cluster; therefore, it is important to question whether services should seek to reduce risk behaviours in parallel or to target risk behaviours one at a time, as interventions to promote change in a health risk behaviour have important implications for engaging in other behaviours. For example, our systematic review of multiple risk behaviour interventions in general populations[10] found that changes in diet were positively associated with changes in physical activity, and that both, in turn, were associated with increased weight loss. This is consistent with evidence from qualitative studies; for example, people with diabetes reported that improvements in physical activity acted as a 'gateway' to changes in diet.[32] Conversely, changing some risk behaviours may have negative consequences for engaging in others.

Identifying 'active ingredients' of risk behaviour interventions

Behaviour change interventions are typically complex with multiple interacting components. Therefore, behaviour change technique taxonomies (BCTTs) have been developed to help identify the effective components in these interventions to help inform future research [e.g. which behaviour change techniques (BCTs) should be included in future trials] and implementation in services.[33] We are unaware of any systematic reviews that have investigated the impact of intervention content using these methods in SMI populations.

Qualitative studies on barriers to and facilitators of change and experiences of risk behaviour interventions

There is an important need to synthesise qualitative data on the experiences of people with SMI to inform interpretation of the quantitative data and future trial design. For example, qualitative data are important for identifying barriers to and/or facilitators of behaviour change. This enables us to compare which barriers or facilitators were addressed in trials and to identify intervention content for future trials. Similarly, we can compare the extent to which the reported experiences of people with SMI in the qualitative data reflect findings from the quantitative data. As far as we are aware, this is the first systematic review to have synthesised this literature specifically focused on multiple risk behaviour interventions, especially in a SMI population.

Chapter 2 Methods of effectiveness review, meta-analysis and qualitative review

The systematic review protocol was registered with PROSPERO (CRD42018104724).

Objectives

We aimed to provide a comprehensive and objective summary of available primary research about the clinical effectiveness of health risk behaviour interventions in people with SMI.

More specifically, the objectives of the systematic review were to:

- provide a descriptive overview of all the evidence for multiple health risk behaviour interventions on behaviour change (e.g. fat intake, smoking abstinence) targeted by the intervention, and change in outcomes affected by these behaviours [e.g. weight, body mass index (BMI), blood pressure]
- examine the clinical effectiveness of multiple risk behaviour interventions, compared with single risk behaviour interventions, using network meta-analyses (NMAs), in terms of their impact on behavioural outcomes (e.g. smoking abstinence) and outcomes affected by changes in behaviour (e.g. weight, BMI).
- examine the effect of study-level intervention content (e.g. using BCTTs) and participant characteristics (e.g. targeted by study for physical comorbidities) as moderators of effectiveness of risk behaviour interventions using meta-regression and component NMAs.
- explore, through qualitative evidence, factors affecting the clinical effectiveness of risk behaviour interventions (including barriers and facilitators) for people with SMI.

Literature searches

Searches were carried out in October 2018 in the Cochrane Central Register of Controlled Trials (CENTRAL), EMBASE™ (Elsevier, Amsterdam, the Netherlands), MEDLINE, PsycInfo® (American Psychological Association, Washington, DC, USA) and Science Citation Index (Clarivate Analytics, Philadelphia, PA, USA). The date range searched was inception to October 2018. The searches identified 27,795 records, which was reduced to 18,513 records after deduplication using EndNote (Clarivate Analytics) bibliographic software.

Updated searches were carried out in March 2020 in EMBASE, MEDLINE, PsycInfo and the Science Citation Index; these identified a further 2822 records, which was reduced to 1433 records after deduplication. It was not possible to download records from CENTRAL owing to issues with the database at the time of the updated search (28 March 2020). We searched Applied Social Sciences Index and Abstracts (ASSIA) (date range inception to September 2020), and conducted an updated CENTRAL search in September 2020. The updated search of CENTRAL identified a further 1843 records, which was reduced to 1579 after deduplication. The search of ASSIA identified 658 records, which was reduced to 151 after deduplication.

The strategies used for both the original and updated searches are reproduced in *Appendix 1*.

Study selection

Population

Adults (aged ≥ 18 years) diagnosed with SMI (defined as schizophrenia or other psychoses, depression with psychotic features, or bipolar disorder) were included. Interventions aimed at people with SMI who were overweight or obese, had long-term conditions or risk factors for long-term conditions (e.g. high blood pressure, high cholesterol) were also included.

Interventions

Behavioural interventions were included with no restrictions on whether the focus of the intervention content was psychological, educational or environmental, nor were any restrictions applied based on setting.

For some health risk behaviours (e.g. smoking, excess alcohol consumption, opioid use), pharmacological treatment may be a component of standard care. When this was the case, behavioural interventions in combination with standard pharmacological interventions were included. However, studies were excluded if they primarily aimed to evaluate the effectiveness of pharmacological interventions.

Single health risk behaviour interventions were included if they aimed to change one of the following risk behaviours: smoking, unhealthy diet, physical inactivity, excess alcohol consumption or drug use. Multiple health risk behaviour interventions were included if they aimed to change two or more of these behaviours.

Comparators

- No intervention.
- Treatment as usual (TAU).
- Treatment as usual with additional active control elements (e.g. attention control).

Outcomes

For quantitative studies, we included data on the following outcomes:

- changes in behaviours directly targeted by the intervention (smoking, diet, physical activity, alcohol use, drug use)
- anthropometric measures [weight (kg), BMI]
- metabolic outcomes (systolic blood pressure, diastolic blood pressure, HDL cholesterol, LDL cholesterol, total cholesterol)
- quality of life
- mental health symptoms.

Study designs

For the clinical effectiveness analyses, we included randomised controlled trials (RCTs).

In addition, we included qualitative studies assessing the experiences of behaviour change in people with SMI (including barriers and facilitators).

Methods of effectiveness review and meta-analysis

Data extraction and screening

Data extraction, screening and risk-of-bias assessment were conducted by one reviewer and checked by a second reviewer. Discrepancies were resolved by discussion, with involvement of a third reviewer if necessary.

The data extraction form was piloted on a selection of studies by three reviewers to ensure consistency. Data from multiple publications of the same study (or data set) were extracted and reported as a single study. When there were data from multiple time points, we grouped these data into the following categories: end point, ≤ 6 months post intervention, 6–12 months post intervention, and ≥ 12 months post intervention.

Two reviewers extracted information about the content of each intervention and control, including which risk behaviours were targeted, whether the choice of risk behaviour was fixed or tailored to the individual, background/expertise of the intervention provider, mode of delivery (e.g. group or individual focused), intensity of intervention (duration of sessions, duration of intervention, etc.), setting (e.g. outpatient, inpatient), and adaptation of content for people with SMI. BCTs were categorised using the Behaviour Change Technique Taxonomy version 1 (BCTT v1).[33]

The participant characteristics extracted included mental health diagnoses, whether or not the intervention was given at first initiation of antipsychotics, antipsychotic use (proportion of participants receiving antipsychotics, and which type of antipsychotic), physical health comorbidities, age, sex and ethnicity.

Risk-of-bias assessment
The risk of bias of the individual studies was assessed using the Cochrane Risk of Bias tool version 2 for RCTs.[34] As per recommendations, we conducted separate risk-of-bias assessments for the key outcomes: the most widely reported behavioural outcomes (smoking abstinence) and the most widely reported outcomes affected by behaviour (weight and BMI).

Data analysis
All analyses were performed in a Bayesian framework with a random-effects model using WinBUGS (MRC Biostatistics Unit, Cambridge, UK),[35] taking into account the correlation between multiarm trials when appropriate. However, when there were sparse networks (and potentially insufficient data to reliably estimate between-study heterogeneity), we compared the goodness of fit of fixed-effect and random-effects models and used data from the better-fitting model. When both models fitted equally well, we selected the simpler model.

A binomial likelihood was used for dichotomous data and a normal likelihood for continuous data. We assumed a common between-study heterogeneity variance of the relative treatment effects for every treatment comparison. We used vague prior distributions for trial baselines, heterogeneity and relative treatment effects. For WinBUGS code (including prior distributions), see WinBUGS code for models (see the National Institute for Health Research Journals Library projects web page; URL: www.journalslibrary.nihr.ac.uk/programmes/hsdr/170588/#/). Network geometry for NMAs was illustrated using network diagrams (see *Appendix 7*).

We assessed convergence of two chains based on visual inspection of history, Brooks–Gelman–Rubin and autocorrelation plots.

Network meta-analysis enables the estimation of indirect comparisons not addressed in the primary trials.[36] Such analyses assume consistency in the evidence network between indirect and direct evidence. Unfortunately, few trials compared single or multiple risk behaviour interventions directly; therefore, there were insufficient data to assess the consistency of direct and indirect evidence.

Intervention effects were estimated along with 95% credible intervals (CrIs). Continuous outcomes were usually pooled mean differences (MDs) on natural units such as number of cigarettes, weight (kg), BMI (kg/m^2) and blood pressure (mmHg). Some outcomes, such as physical activity and alcohol use, were measured in various ways across studies, so we used standardised mean differences (SMDs) to analyse these data.

The analysis proceeded in three stages.

Model 1: intervention effects model
Across studies, interventions targeted a range of single (e.g. unhealthy diet alone, physical inactivity alone) or multiple health risk behaviours (e.g. unhealthy diet and physical inactivity). We used NMAs to assess the effectiveness of targeting these different combinations of risk behaviours.

Studies varied in terms of participant (e.g. targeting people with SMI who also had comorbid physical illness) and intervention characteristics (e.g. whether studies were primarily delivered to groups or individuals). Therefore, we extended the model to include covariates estimating the association between these participant and intervention characteristics and intervention effectiveness.

Model 1a: effectiveness of targeting different combinations of risk behaviours

1. Targeting any risk behaviour.
   We used a random-effects NMA model to compare any health risk behaviour intervention with TAU. Studies with TAU with additional active components (hereafter referred to as TAU+) as a comparator were also included in the network to inform estimates.
2. Targeting combinations of risk behaviours.
   We used a similar random-effects NMA model, as model 1a:1, but, instead of comparing any intervention with TAU, we assessed the impact of targeting different health risk behaviours compared with TAU.

Model 1b: impact of intervention and participant characteristics
Second, we assessed the impact of intervention and participant characteristics on effectiveness estimates by adding the following covariates to model 1a:

- participants selected for physical comorbidities (yes/no)
- intervention delivered primarily to individuals (yes/no)
- intervention setting (inpatient or not inpatient)
- authors reported tailoring the intervention for people with SMI (yes/no).

We assessed the impact of these intervention and participant characteristics by assessing the magnitude of the covariate estimate, along with its 95% CrI. In addition, we conducted a more global assessment, comparing the goodness of fit of model 1b with covariates and model 1a without covariates in terms of deviance information criterion (DIC), total residual deviance and between-study standard deviation (SD).

Model 2: does targeting multiple risk behaviours lead to positive or negative synergies (interaction model)?
Model 1 gives some insight into the benefits of targeting different combinations of risk behaviours. But it does not directly assess whether or not targeting multiple risk behaviours leads to positive or negative synergies (e.g. does targeting diet and physical activity together result in greater or fewer benefits than expected from the sum of their effects?).

There were sufficient data to conduct interaction models for weight and BMI models only. We used a components NMA approach,[37] where μ_j is the mean weight (kg) or BMI (kg/m^2) for the TAU group b_i in trial j. θ_{jk} is mean weight (kg) or BMI for any risk behaviour intervention k from trial j:

$$\theta_{jk} = \begin{cases} \mu_j, & \text{Intervention } b_j \\ \mu_j + \delta_{jk}, & \text{Intervention } k \end{cases}$$ (1)

where

$$\delta_{jk} \sim \text{Normal}\big((d_k - d_{b_j}), \tau^2\big).$$ (2)

δ_{jk} represents the MD between TAU and any risk behaviour intervention k, compared with TAU b_j, in trial j, with between-study SD τ; d_k is the pooled estimate of the MD comparing any risk behaviour intervention with TAU.

Model 2 is an extension of model 1a:1, in which the MD d_k was the MD comparing any intervention with TAU, which assumed that:

$$d_k = d. \tag{3}$$

Model 2 allowed for each component to have its own independent impact on the MD. For example, targeting diet and physical activity together may each have contributed separately to reductions in weight or BMI. The model also allows components to interact with each other. For example, targeting diet and physical activity may lead to greater reductions (positive synergies) in weight or BMI than would be expected by the sum of these components. Model 2 also allowed for lesser reductions in weight or BMI than would be expected if the components were summed (negative synergies). We did not include targeting alcohol or smoking as separate effects as all interventions in the analyses targeting one of these behaviours also targeted diet and physical activity:

$$d_k = d_{diet} + d_{PA} + d_{diet \times PA} + d_{diet \times PA \times smoking \times alcohol}, \tag{4}$$

where PA = physical activity.

Model 3: effectiveness of behaviour change techniques

Risk behaviour interventions vary not only in terms of which behaviours are targeted, but also in terms of the BCTs included in these interventions.

We therefore fitted models that classified interventions in terms of BCTs (using the BCTT v1).[33] We fitted two models and compared them in terms of goodness of fit (total residual deviance, between-study SD and DIC). As above, there were sufficient data to conduct these analyses for only weight and BMI.

Model 3a: additive model (independent model)

Similar to model 2, we fitted a model that allowed each BCT to have an independent impact on the MD (d_k) between any risk behaviour intervention compared with TAU. The BCTs included in the weight and BMI models were largely the same, but with slight variation, depending on what studies reported these outcomes.

For weight, the following BCTs were independent components contributing to the MD between any intervention and TAU:

$$d_k = d_{goal} + d_{prob} + d_{feedback} + d_{mon} + d_{soc\_sup} + d_{inst} + d_{info} + d_{demonst}. \tag{5}$$

For BMI, the following BCTs contributed to the MD between any intervention and TAU:

$$d_k = d_{goal} + d_{prob} + d_{feedback} + d_{mon} + d_{soc\_sup} + d_{inst} + d_{info} + d_{action}. \tag{6}$$

The models included a total of nine BCTs [BCTT v1: 1.1 goal-setting ('goal'), 1.2 problem-solving ('prob'), 1.4 action-planning ('action'), 2.2 feedback on behaviour ('feedback'), 2.3 self-monitoring of behaviour ('mon'), 3.1 social support (unspecified) ('soc_sup'), 4.1 instruction on how to perform a behaviour ('inst'), 5.1 information about health consequences ('info') and 6.1 demonstration of the behaviour ('demonst')] that were used in at least five studies.

Model 3b: two-way interaction model (interaction model)

We extended model 3a to allow for pairs of BCTs to interact with one another. There was little overlap between BCTs used across studies, which limited the extent to which we could explore interactions.

For weight, the interaction model included only two further parameters in the model (studies that included BCTT v1 4.1 instruction in how to perform a behaviour and BCTT v1 1.2 problem-solving, and studies that included BCTT v1 4.1 instruction in how to perform a behaviour and BCTT v1 2.3 self-monitoring of outcomes):

$$d_k = d_{soc\_sup} + d_{inst} + d_{demonst} + d_{info} + d_{goal} + d_{prob} + d_{mon} + d_{feedback} + d_{inst \times prob} + d_{inst \times mon}. \tag{7}$$

For BMI, it was possible to include further interaction parameters in the model:

$$d_k = d_{soc\_sup} + d_{inst} + d_{action} + d_{info} + d_{goal} + d_{prob} + d_{mon} + d_{feedback} + d_{inst \times info} + d_{inst \times prob} + d_{inst \times mon} + d_{info \times mon}$$
$$+ d_{goal \times mon} + d_{prob \times mon}. \tag{8}$$

Methods of the qualitative review

Objective
The objective of the qualitative review was to address the following question (with consideration for methodological quality and certainty of evidence):

What are service user perspectives on the acceptability and feasibility of using risk behaviour interventions to change behaviour and improve physical health-related outcomes, with specific reference to intervention uptake, adherence and service experience?

Quality assessment
Established guidelines by the Grading of Recommendations Assessment, Development and Evaluation (GRADE) Working Group [www.gradeworkinggroup.org (accessed 3 February 2020)] and the Cochrane Qualitative and Implementation Methods Group [cqim.cochrane.org (accessed 3 February 2020)] were followed, to implement the Confidence in the Evidence from Reviews of Qualitative research (CERQual)[38] approach to assess both the methodological limitations of individual studies and the coherence of our review findings.

The Critical Appraisal Skills Programme (CASP) tool [https://casp-uk.net/casp-tools-checklists/ (accessed 3 February 2020)] was used to assess limitations of the methods used in included studies, per GRADE–CERQual guidance.

The CASP tool is not a rating system, but facilitated transparent assessment across 10 prompts relating to the quality of the design and reporting of studies. Each prompt on the checklist was answered with a 'no', 'yes', or 'cannot tell'. 'Cannot tell' was allocated when authors' reporting did not allow reviewers to make a clear decision.

The CERQual approach is similar to GRADE in that both approaches aim to assess the certainty of (or confidence in) the evidence, and both also rate this certainty for each finding across studies, rather than for each individual study. Unlike GRADE, which is only relevant to evaluations of effectiveness, CERQual offered a framework to evaluate the certainty of evidence that addresses questions beyond effectiveness of interventions, such as acceptability. Coherence of the review was assessed by identifying patterns across the data contributed by each of the individual included studies, for example when findings are consistent across multiple settings or different subgroups of people with SMI. The certainty of evidence in each individual study was rated as being high, moderate or low, and ranked according to the methodological limitations and coherence of each finding of our review.

Data analysis
Papers were read in detail to identify core ideas for comparison across studies based on quotations from participants. Interpretations from authors of the included studies were not extracted unless required to contextualise an abbreviated quotation from a participant.

Drawing on guidance for qualitative syntheses to inform policy-making and research prioritisation, a narrative synthesis approach was used.[39] This approach gave a descriptive account that forms the basis of an interpretative synthesis. Published data were analysed using principles of thematic synthesis, as described by Thomas and Harden,[40] to facilitate the identification of recurring and emergent themes. Themes within and between transcripts were categorised, with iterative classification, development and refining of categories.[41]

Initial line-by-line coding of participant quotations was undertaken in NVivo version 12 (QSR International, Warrington, UK) by one reviewer, and data extraction was a function of coding. The data could be used to support the development of different, but overlapping, themes. Initial coding was descriptive, remaining close to original reports and began without hierarchical structure. Translation of codings was iterative.

Analytical themes were developed through further refinement of coding, comparing primary data with developed themes. This process was repeated within themes to draw out subthemes. A second reviewer helped reduce repetition and overlap, thereby producing more focused themes.

Greater emphasis was placed on studies with in-depth examinations of user experience. Studies that lacked this detail were used to augment and contextualise the findings. The relative contribution of individual studies, the impact of methodological limitations and certainty on the findings were summarised narratively, in line with the CERQual approach.

Methods for integrating quantitative and qualitative data

There remains a lack of consensus on the most appropriate methods for integrating quantitative and qualitative data. Our approach used methods commonly used in systematic reviews that were also appropriate for the nature of our data.[42,43]

The overall themes and subthemes identified in the synthesis of qualitative studies were used as the basis for examining whether or not the findings from the quantitative data approximated those found in the qualitative data. For example, when a particular factor was identified as a barrier or facilitator in the qualitative data, we examined whether or not intervention content seeking to address this barrier or facilitator affected the effectiveness estimates using meta-regression analyses (based on the magnitude of the covariate and precision of the 95% CrI). If these meta-regression analyses were unplanned, we conducted these analyses post hoc, when possible.

For each theme, we investigated whether or not we could identify an analogue of this theme in the included quantitative studies. We then categorised the relationship between findings from the qualitative and quantitative data according to four categories adapted from a recent study:[44] silence (no overlap between quantitative and qualitative data), dissonance (conflicting findings), partial agreement (complementary findings, but limited overlap) and agreement (convergence in the data). However, when there was overlap in quantitative and qualitative findings, but the data were insufficiently precise to categorise, the finding was labelled inconclusive.

Methods for patient and public involvement

People with lived experience of SMI and carers contributed significantly to all stages of the project. Sophie Corlett (Director of External Relations, Mind) was a member of our advisory group that provided oversight on the progress of the project.

We also formed two patient and public involvement (PPI) groups that met throughout the course of the project. One group began meeting in York and consisted of four members. The group was chaired by a relative of a person with SMI (DS), and also included one peer researcher (CD) and a peer researcher who is also a carer (HK). One further group member (a carer) was no longer able to attend after the first meeting because of other commitments.

We also regularly met with two peer researchers (MS and GJ) who are members of the Lived Experience Research Collective hosted by the Mental Health Foundation.

All the members of our PPI groups were included as authors of the report, reflecting their substantial contribution to the project. The PPI groups decided on the name of the project (HEALTH study), provided extensive comments on the protocol, contributed to interpretations of the study results, played a key role in disseminating the findings of the project, participated in the webinar and provided feedback on an animation summarising the findings of this project. For further details, see *Chapter 7*.

Chapter 3 Search results

Flow of studies included

The original searches were carried out in October 2018 using CENTRAL, EMBASE, MEDLINE, PsycInfo and the Science Citation Index. The date range searched was inception to October 2018. The searches identified 27,795 records, which reduced to 18,513 records after deduplication using EndNote bibliographic software.

Updated searches were carried out in March 2020 using EMBASE, MEDLINE, PsycInfo and the Science Citation Index; these identified a further 2822 records, which reduced to 1433 after deduplication. An updated search of CENTRAL in September 2020 identified a further 1843 records, reduced to 1579 after deduplication. A search of ASSIA in September 2020 identified 658 records, reduced to 151 after deduplication (the date range searched was inception to September 2020). An additional record was located through reference-checking. Therefore, 21,677 titles and abstracts were screened in total.

Of these, 436 full-text records were then double-screened, and 276 were subsequently excluded, as summarised in the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) flow diagram in *Figure 1*. A table of excluded studies with rationale for exclusion can be found in *Appendix 2*.
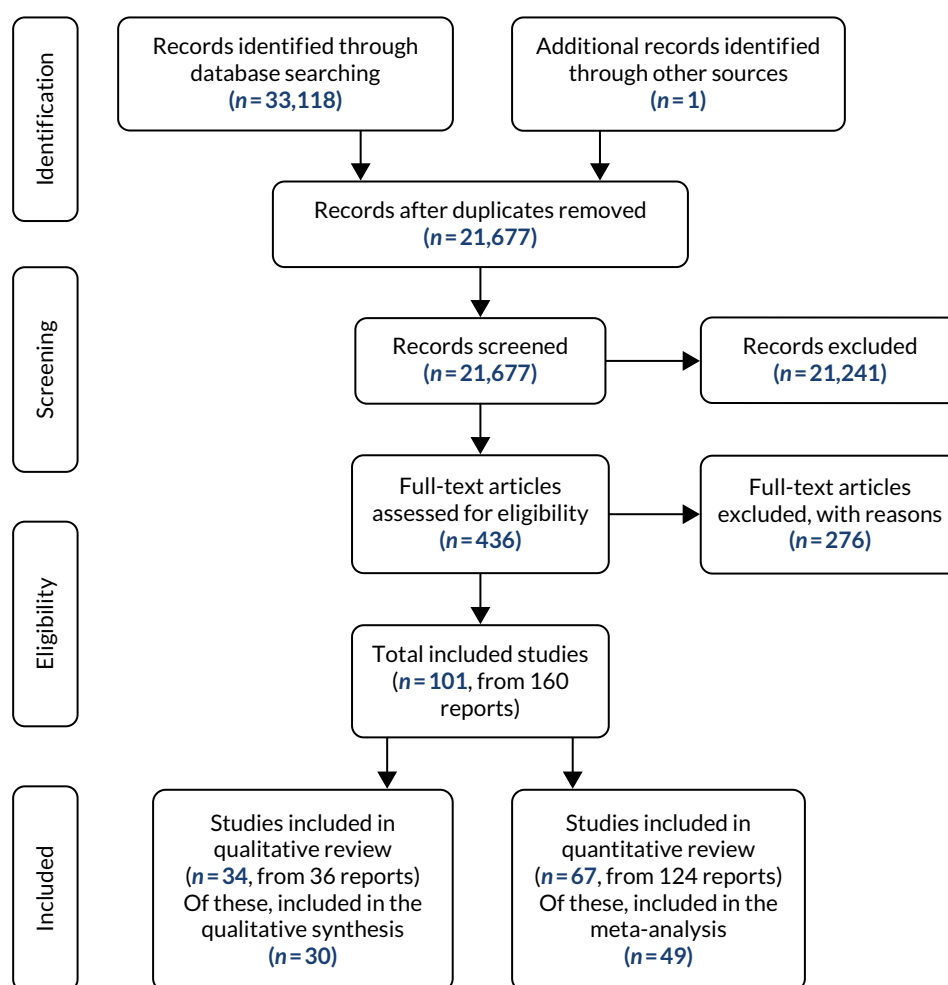
FIGURE 1 The PRISMA flow diagram summarising the flow of studies.

Studies included

Overall, 101 studies were included. Of these, 67 were RCTs included in the effectiveness review,[45–111] and 34 studies (reported in 36 records) using a qualitative study design were included in the review of qualitative studies.[112–147]

Characteristics of the randomised controlled trials included

For detailed summaries of population characteristics of included RCTs, see *Appendix 3*; for detailed summaries of intervention characteristics, see *Appendix 4*. Descriptions of the interventions are provided in *Appendix 5*. The majority were conducted in the USA (*n* = 22[50,51,54,55,57–59,61,65,68,72,77,81,83,84,89,95,96,103,105,108,111]) and the UK (*n* = 12[57,67,69,71,75,76,78,88,93,94,100,109]), followed by other European countries [Italy (*n* = 5[48,52,87,92,99]), Switzerland (*n* = 3[53,70,80]), Denmark (*n* = 3[73,74,102]), Spain (*n* = 2[63,86]), Germany (*n* = 2[49,60]), Sweden (*n* = 1[64]), the Netherlands (*n* = 1[98]), Greece (*n* = 1[79]) and Croatia (*n* = 1[101])], Asian countries [Thailand (*n* = 2[91,106]), China (*n* = 1[110]), Japan (*n* = 1[104]), India (*n* = 1[66]) and the Republic of Korea (*n* = 1[82])], then Australia (*n* = 4[46,47,62,107]), Canada (*n* = 2[85,97]), Israel (*n* = 1[90]) and Brazil (*n* = 1[45]).

Of the included trials, 43 investigated multiple health risk behaviour interventions, and 24 investigated single health risk behaviour interventions. Risk behaviours were mostly targeted in pairs (*n* = 33), with few studies targeting three or more risk behaviours (*n* = 10). The most commonly targeted risk behaviours were physical inactivity (*n* = 48 studies) and unhealthy diet (*n* = 41 studies), which were also commonly targeted in combination.

Across included studies, the most commonly reported BCTs were instruction on how to perform behaviours (BCTT v1: 4.1; *n* = 40), social support (unspecified) (BCTT v1: 3.1; *n* = 27), self-monitoring of behaviour (BCTT v1: 2.3; *n* = 23), problem-solving (BCTT v1: 1.2; *n* = 23), information about health consequences (BCTT v1: 5.1; *n* = 23), goal-setting (BCTT v1: 1.1; *n* = 21), action-planning (BCTT v1: 1.4; *n* = 15), feedback on behaviour (BCTT v1: 2.2; *n* = 14) and social support (emotional) (BCTT v1: 3.3; *n* = 10). The totals reported here are much greater than the number of included studies as most interventions used several BCTs. For details of all BCTs reported across studies, see *Appendix 4*.

Fifty-two RCTs were included in the meta-analysis (see *Figure 1*).[45–49,54–56,59–64,67–70,72–76,78–87,89–91,93,94,96–99,101,102,104–111]

Characteristics of the qualitative studies included

The flow of studies can be seen in the PRISMA diagram in *Figure 1*. Thirty-four studies (from 36 reports) were included;[112–147] three records were based on the same cohort and so represent one study,[126–128] and four conference abstracts were also included in the systematic review, but not in the synthesis, owing to limited data.[112–115] Therefore, 30 studies were included in the synthesis. Included studies used qualitative designs such as interviews and focus groups, and applied qualitative data analysis techniques such as the interpretative phenomenological approach and thematic analysis. Further details on population characteristics and study designs can be found in *Appendix 6*.

Multiple risk behaviours were considered in 18 studies,[116,117,121,122,126,132,133,135–137,139–141,143–147] and 12 considered single risk behaviours.[118–120,123–125,129–131,134,138,142] Multiple risk behaviours were most commonly considered in pairs (14/18 studies);[116,117,122,126,132,133,135–137,140,141,145–147] the most common combination of risk behaviours was physical activity and diet (11 studies).[116,117,122,126,135,137,140,141,145–147] Two studies[139,143] addressed risk behaviour outcomes in a way that did not appropriately fit with the risk behaviour targets of this review and, therefore, were classified as 'other'. One considered health promotion (classified as a multiple risk intervention)[143] and the other considered weight loss (also classified as a multiple risk behaviour intervention).[139] The most commonly addressed single risk behaviour was physical activity (6/11 studies).[118–120,124,125,134] See *Appendix 6* for further details.

Chapter 4 Results of effectiveness review

Summary of network meta-analyses results

Model 1: intervention effects models

Network diagrams for all outcomes are provided in *Appendix 7*. Although most trials aimed to change behaviour, few studies directly reported behavioural data. Weight and BMI were, by far, the most commonly reported outcomes. Smoking-related outcomes (quit rates and number of cigarettes smoked) were the most common behavioural outcomes reported. However, these data were too heterogeneous to combine in NMAs, so we conducted narrative syntheses for smoking outcomes. There were insufficient data to conduct NMAs of multiple and single risk behaviour interventions (i.e. model 1a:2) for diet, physical activity, alcohol use and cannabis use outcomes.

Table 1 summarises the results of the NMAs (model 1a) where it was possible to assess the clinical effectiveness of multiple and single risk behaviour interventions. All models converged after 20,000 iterations. Effect estimates are based on a further 60,000 iterations after discarding earlier iterations.

TABLE 1 Model 1a: interventions compared with TAU at the end point – effect estimate (95% CrI)

Risk behaviours targeted	Outcome, MD (95% CrI)				
	Weight (kg) (30 RCTs, $n = 2614$)	BMI (kg/m^2) (36 RCTs, $n = 3308$)	Blood pressure (mmHg) (SBP: 15 RCTs, $n = 1790$; DBP: 13 RCTs, $n = 1489$)	Cholesterol (mmol/l) (HDL: 15 RCTs, $n = 2121$; LDL: 9 RCTs, $n = 1071$; total cholesterol: 11 RCTs, $n = 1727$)	Quality of life (9 RCTs, $n = 1853$), SMD (95% CrI)
Any risk behaviour	−2.10 (−3.14 to −1.06)	−0.49 (−0.97 to −0.01)	• SBP: −1.23 (−3.34 to 0.68) • DBP: −1.55 (−3.72 to 0.30)	• HDL: 1.53 (−0.30 to 3.34) • LDL: 0.65 (−7.12 to 9.49) • Total cholesterol: −2.72 (−9.36 to 4.11)	• Mental health: −0.04 (−0.14 to 0.06) • Physical health: 0.06 (−0.04 to 0.16)
Diet alone	−2.27 (−6.22 to 1.60)	−0.04 (−1.72 to 1.65)	• SBP: 0.42 (−4.52 to 5.30) • DBP: −1.60 (−6.37 to 2.94)	• HDL: 4.88 (0.02 to 9.66) • LDL: 5.79 (−18.12 to 29.77) • Total cholesterol: 18.86 (−9.31 to 47.03)	–
Physical activity alone	−1.40 (−6.00 to 2.99)	−1.23 (−2.63 to 0.20)	• SBP: −0.26 (−5.43 to 4.97) • DBP: 0.34 (−3.80 to 4.25)	• HDL: 2.99 (−1.42 to 7.26) • LDL: −3.67 (−20.39 to 12.99) • Total cholesterol: −3.91 (−21.15 to 13.23)	–

continued

TABLE 1 Model 1a: interventions compared with TAU at the end point – effect estimate (95% CrI) (*continued*)

Risk behaviours targeted	Outcome, MD (95% CrI)				
	Weight (kg) (30 RCTs, $n = 2614$)	BMI (kg/m²) (36 RCTs, $n = 3308$)	Blood pressure (mmHg) (SBP: 15 RCTs, $n = 1790$; DBP: 13 RCTs, $n = 1489$)	Cholesterol (mmol/l) (HDL: 15 RCTs, $n = 2121$; LDL: 9 RCTs, $n = 1071$; total cholesterol: 11 RCTs, $n = 1727$)	Quality of life (9 RCTs, $n = 1853$), SMD (95% CrI)
Smoking alone	–	–	–	–	• Mental health: 0.01 (–0.14 to 0.16) • Physical health: 0.19 (0.05 to 0.34)
Diet + physical activity	–2.12 (–2.94 to –1.34)	–0.53 (–1.07 to 0.04)	• SBP: –1.56 (–4.42 to 0.98) • DBP: –1.06 (–4.04 to 1.48)	• HDL: 0.15 (–2.46 to 2.40) • LDL: –1.64 (–8.15 to 4.92) • Total cholesterol: –3.79 (–8.58 to 0.89)	• Mental health: –0.09 (–0.25 to 0.07) • Physical health: 0.02 (–0.14 to 0.18)
Diet + physical activity + alcohol misuse + smoking	1.27 (–1.46 to 3.42)	–0.02 (–1.05 to 0.98)	• SBP: –2.17 (–5.46 to 0.87) • DBP: –2.04 (–5.76 to 1.23)	• HDL: 2.59 (–0.53 to 5.78) • LDL: 0.01 (–0.20 to 0.21) • Total cholesterol: –0.10 (–0.34 to 0.15)	• Mental health: –0.09 (–0.32 to 0.14) • Physical health: –0.21 (–0.43 to 0.02)

DBP, diastolic blood pressure; SBP, systolic blood pressure.

Note
n in table headings indicates sample size.

Smoking

Smoking abstinence
Eight trials[46,47,55,67–69,102,148] were included in the narrative synthesis for smoking abstinence.

Figure 2 summarises the risk-of-bias judgements across studies measuring smoking abstinence. Just over half of included studies in the NMA were rated as having a high overall risk of bias. The most common reason for studies being judged to have a high risk of bias was missing outcome data (e.g. uncertainty over whether or not missing data depended on the outcome's true value). Bias arising from the randomisation process was the next most common risk of bias (e.g. allocation concealment not reported and important baseline differences between groups).

Given the diversity of the data, we conducted narrative syntheses rather than NMAs on smoking abstinence. Five trials targeted smoking alone.[46,55,68,69,148] Controls ranged from very low intensity[46] and low intensity[69,148] to high intensity.[55,68] Interventions in all five trials were high intensity.

Four of these trials found that interventions targeting smoking alone may be more effective than controls (*Figure 3*) in promoting smoking abstinence.[46,55,69,148] Odds ratios (ORs) for these studies ranged from 1.60 [95% confidence interval (CI) 0.91 to 2.82][69] to 5.99 (95% CI 0.64 to 55.94),[55] but effect estimates were imprecise for all studies. One trial[68] targeting smoking alone did not favour the intervention over the control, although the CI was very wide (OR 1.02, 95% CI 0.29 to 3.58). This trial included a high-intensity control, which may potentially explain different effects, compared with other included studies.
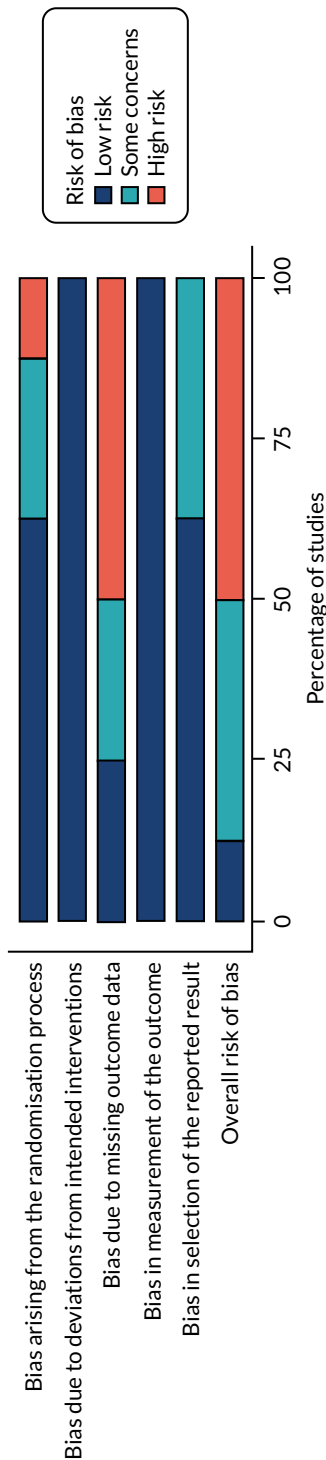
FIGURE 2 Summary of risk of bias across studies measuring smoking abstinence.
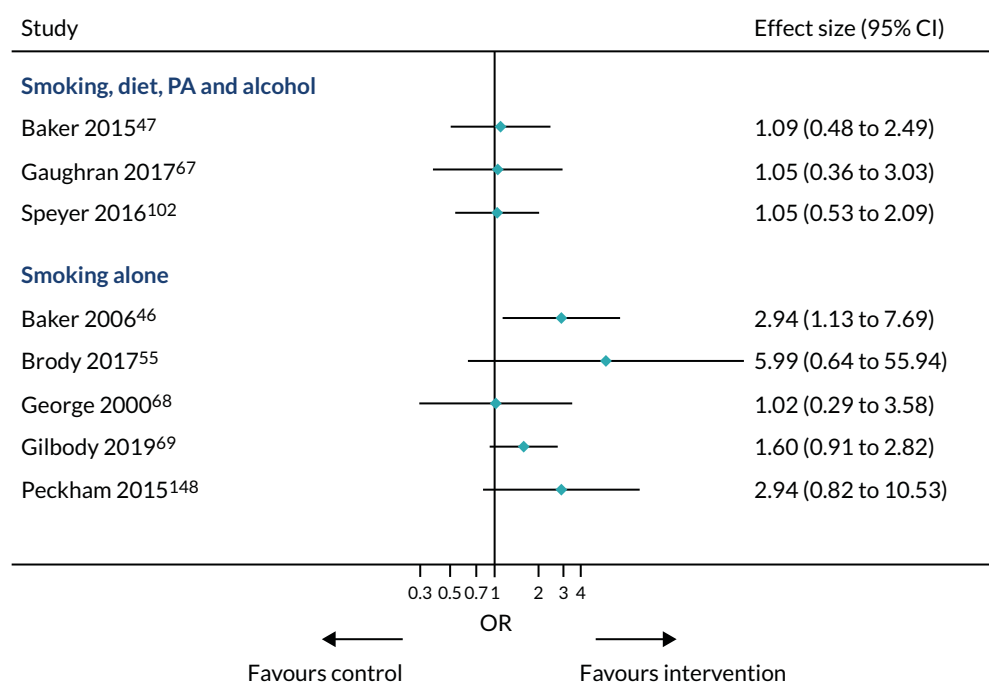
FIGURE 3 Forest plot comparing smoking abstinence in interventions targeting smoking either alone or in combination with other behaviours. PA, physical activity.

Three trials targeted smoking with other risk behaviours (including unhealthy diet, physical inactivity and excess alcohol consumption).[47,67,102] Controls ranged from very low intensity[67,102] to medium intensity.[47] One intervention was of low intensity,[67] one was of medium intensity[102] and another was of high intensity.[47] The results were very similar in these three trials that targeted smoking in combination with other behaviours such as diet, physical activity and alcohol use. ORs ranged from 1.05 to 1.09, suggesting that there may be no difference between intervention and control in promoting smoking abstinence, although 95% CIs were consistent with both increased and reduced odds.

Number of cigarettes smoked

Seven trials[47,55,59,67,69,73,148] were included in the narrative synthesis for assessing the number of cigarettes smoked.

There was a high level of variability between studies (*Figure 4*). Similar to *Smoking abstinence*, trials focusing on smoking along with other risk behaviours showed limited evidence of effectiveness in reducing the number of cigarettes smoked. Trials focusing on smoking alone found mixed evidence for reducing the number of cigarettes smoked. Two studies found evidence of effectiveness in reducing number of cigarettes,[55,59] whereas two other studies did not.[69,148]

Cannabis

Four trials, with 716 participants providing data, were included in the NMA on cannabis use.[47,49,67,74]

Each trial targeted a different combination of risk behaviours: alcohol, drugs or both;[49] diet, physical activity, smoking and alcohol;[47] physical activity, smoking and alcohol;[73] and smoking, diet, physical activity, alcohol, any drug use.[67]

Therefore, there were sufficient data to only compare any intervention with TAU at the end point. Given the sparse nature of the network, we decided to use a fixed-effects model, as there were insufficient data to reliably estimate between-study heterogeneity.
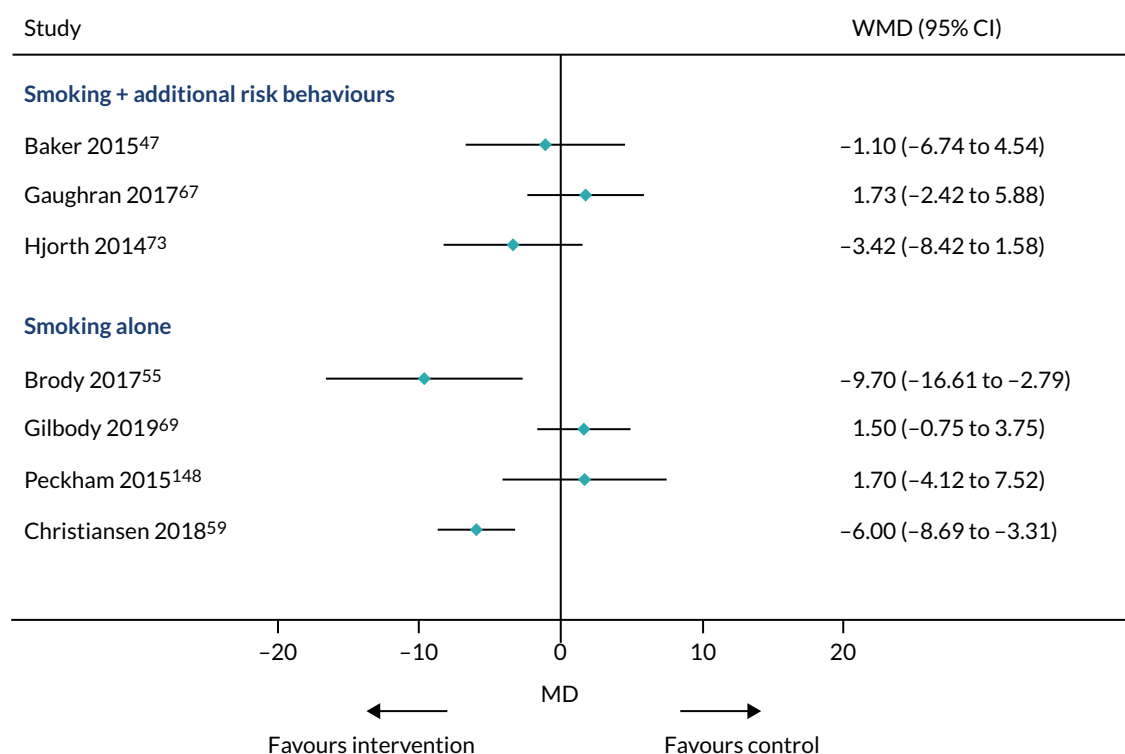
FIGURE 4 Summarising effect estimates of the number of cigarettes smoked at the end point for studies targeting smoking alone or with additional risk behaviours. WMD, weighted mean difference.

Goodness of fit was acceptable for the model (total residual deviance was 3.14 data points, compared with 4 data points). There was no evidence that interventions reduced cannabis use (SMD –0.05, 95% CrI –0.25 to 0.15). However, CrIs were relatively wide, indicating uncertainty about this effect estimate.

Alcohol misuse

Five trials (731 participants) were included in the NMA on alcohol use.[47,49,67,73,78] Trials targeted a range of combinations of risk behaviours: alcohol alone;[78] alcohol, drugs or both;[49] diet, physical activity, smoking and alcohol use;[47] physical activity, smoking and alcohol use;[73] and smoking, diet, physical activity, alcohol use and drug use.[67]

There were sufficient data to only compare any intervention with TAU at the end point. Goodness of fit was acceptable for the model (total residual deviance was 5.25 data points, compared with 5 data points) and the between-study SD was 0.36 (95% CrI 0.02 to 2.01, SMD scale). There was no evidence that interventions reduced alcohol misuse (SMD 0.14, 95% CrI –0.71 to 1.00). CrIs were very wide, indicating considerable uncertainty about this effect estimate.

Physical activity

Seven trials[45,67,86,89,105,109,149] reported data on physical activity. Most of these trials measured total physical activity (including self-report measures, such as the International Physical Activity Questionnaire, and objective measures, such as an accelerometer).

Five trials[45,75,86,89,105] targeted diet and physical activity; one trial targeted physical activity and sedentary behaviour;[109] and one trial targeted diet, physical activity, smoking, alcohol misuse and drug misuse.[67]

Therefore, there were sufficient data to conduct only meta-analyses of any intervention and TAU. Goodness of fit for this model was acceptable [total residual deviance was 8.51 data points, compared with 7 data points and between-study SD was 0.23 (95% CrI 0.01 to 0.96)]. Evidence was very limited for the effect of any interventions compared with TAU for improving total physical activity (SMD 0.10, 95% CrI –0.25 to 0.49).

Diet

Six trials[45,47,67,88,89,93] reported data on diet. Diet was measured using a diverse range of outcomes: calorie intake,[89] fat intake[45,67,93] and fruit and vegetable intake.[47,88] We considered these outcomes too diverse to combine in meta-analyses. Therefore, despite an unhealthy diet being one of the most commonly targeted health risk behaviours, it is difficult to conclude how effective interventions are at promoting a healthier diet.

Anthropometric outcomes

Weight (kg)

Thirty trials[45,47,48,54,56,60–64,76,80,82,84,85,87,89,91,96,97,99,101,102,104,105,107,108,110,149,150] with data from 2614 participants were included in the NMA of weight outcomes at the end point.

Figure 5 summarises the risk-of-bias judgements across studies measuring weight loss. Just over half of the included studies in the NMA were rated as having a high overall risk of bias. The most common reason for studies being judged to have a high risk of bias was missing outcome data. Bias arising from the randomisation process was the next most common.

Figure 6 illustrates the different risk behaviours targeted by weight loss interventions and their comparators. By far the most commonly targeted risk behaviours for intervention were diet and physical activity compared with TAU (17 trials)[45,54,56,60–62,70,75,76,84,87,91,96,104,105,107,108] or TAU+ (five trials).[64,80,82,89,110] Interventions targeted diet alone and TAU in two trials,[99,104] and diet alone and TAU+ in one trial.[101] Three trials targeted physical activity alone and TAU,[48,85,97] and none targeted physical activity alone and TAU+. Interventions targeted diet, physical activity, smoking and alcohol use and TAU in two trials,[63,102] and diet, physical activity, smoking and alcohol use and TAU+ in one trial.[47]

Total residual deviance did not suggest problems with model fit (mean 59.5 data points, compared with 63 data points) and between-study SD was 0.71 [95% CrI 0.04 to 1.89, MD on weight (kg) scale].

Targeting diet alone was the most effective intervention, although it was not possible to rule out a lack of effectiveness or weight gain (MD –2.27 kg, 95% CrI –6.22 to 1.60 kg). Targeting both diet and physical activity was a little less effective at reducing weight than TAU (MD –2.12 kg, 95% CrI –2.94 to –1.34 kg). However, CrIs were narrower, as more studies directly compared these interventions with TAU. Targeting physical activity alone was the next most effective strategy for reducing weight, compared with TAU (MD –1.40 kg, 95% CrI –6.00 to 2.99 kg). Interventions targeting diet, physical activity, smoking and alcohol misuse were unlikely to be effective on weight loss, compared with TAU (MD 1.27 kg, 95% CrI –1.46 to 3.42 kg), and may potentially lead to a mild weight increase.

The effect estimate comparing any risk behaviour intervention with TAU was similar to that found for interventions targeting diet and physical activity (MD –2.10 kg, 95% CrI –3.14 to –1.06 kg). This is probably because interventions targeting these risk behaviours had most weight in the NMA (see *Figure 6*).

Follow-up data were relatively sparse; there were sufficient data to only assess effectiveness at ≤ 6 months' follow-up. All six trials targeted diet and physical activity.[60,62,80,84,91,150] Effectiveness at ≤ 6 months post intervention was similar to that found at the end point (MD –2.88 kg, 95% CrI –7.09 to 0.42 kg).

Body mass index

The most common reported outcome in all included studies was BMI. The NMA included data from 36 trials and 3308 participants.[45,47,48,54,60–64,73,75,76,79,80,82–87,89–91,93,97–99,101,102,104,105,107,108,110,111,150]
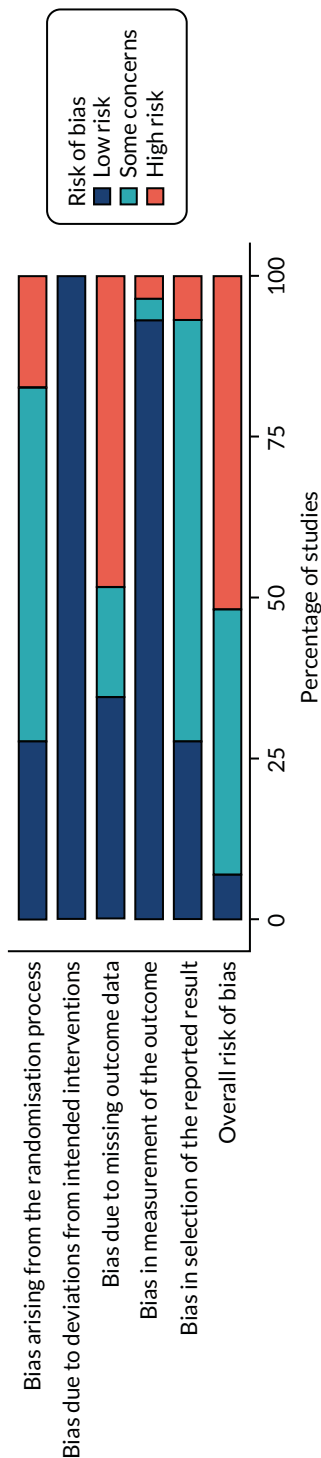
FIGURE 5 Summary of risk of bias across studies measuring weight loss.
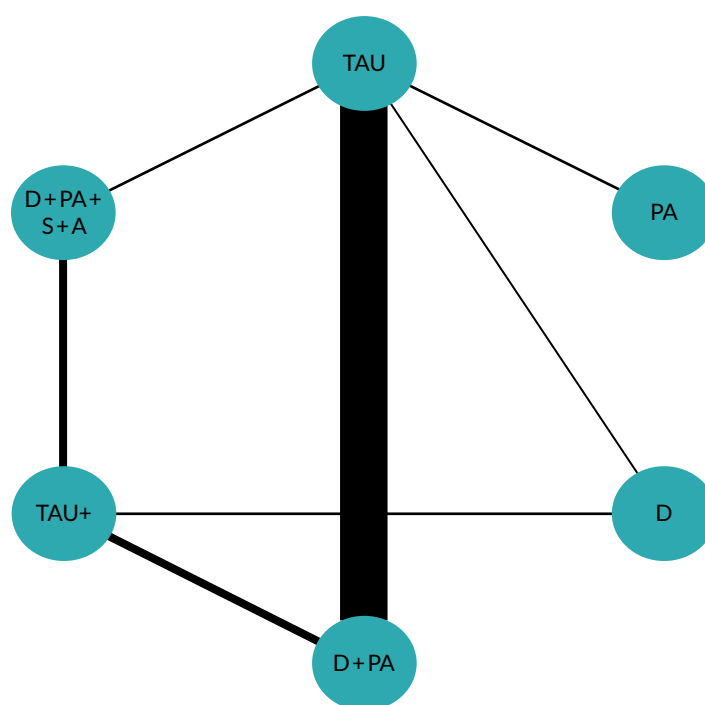
FIGURE 6 Network diagram illustrating risk behaviours targeted in weight loss interventions (thickness of edge is weighted by sample size). A, alcohol use; D, diet; PA, physical activity; S, smoking.

Figure 7 summarises the risk-of-bias judgements across studies measuring BMI. Just under half of the included studies in the NMA were rated as having a high overall risk of bias. The most common reason for studies being judged to have a high risk of bias was missing outcome data. Bias arising from the randomisation process was the next most common reason.

Figure 8 shows that most data were available for the comparison of interventions targeting diet and physical activity (17 trials) with TAU.[45,54,61,62,70,75,76,84,86,87,89,91,104,105,107,108,111] A further five RCTs compared diet and physical activity with TAU+.[64,80,82,90,110] Interventions targeting diet, physical activity, alcohol use and smoking were next most common (four trials compared such interventions with TAU[60,63,73,102] and two trials compared them with TAU+[47,102]).

There were very limited data on interventions targeting physical activity alone (five trials[48,79,83,85,97] compared such interventions with TAU and one trial[101] compared them with TAU+) or diet (two trials[99,104] compared such interventions with TAU and one trial[101] compared them with TAU+).

The total residual deviance suggested that there were no problems with model fit (mean 71.77 data points, from 75 data points), and between-study SD was 0.89 (95% CrI 0.57 to 1.36; BMI scale).

Interventions targeting physical activity alone were most effective, compared with TAU, in reducing BMI (MD -1.23 kg/m^2, 95% CrI -2.63 to 0.20 kg/m^2). Interventions targeting diet and physical activity were the next most effective (MD -0.53 kg/m^2, 95% CrI -1.07 to 0.04 kg/m^2), compared with TAU. There was no evidence that either targeting diet alone (MD -0.04 kg/m^2, 95% CrI -1.72 to 1.65 kg/m^2) or targeting diet, physical activity, alcohol misuse and drug misuse concurrently (MD -0.02 kg/m^2, 95% CrI -1.05 to 0.98 kg/m^2) were effective in reducing BMI.

Follow-up data were also scarce for BMI; there were sufficient data to only assess effectiveness at ≤ 6 months' follow-up. Seven trials targeted diet and physical activity[62,70,80,81,84,89,91] and two trials targeted a broader range of behaviours (including diet, physical activity, smoking and alcohol misuse).[60,93]
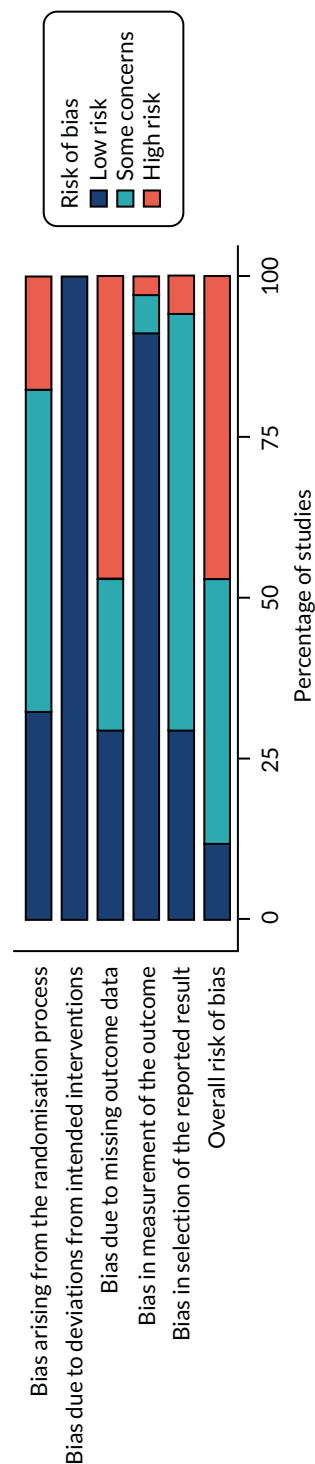
FIGURE 7 Summary of risk of bias across studies measuring BMI.
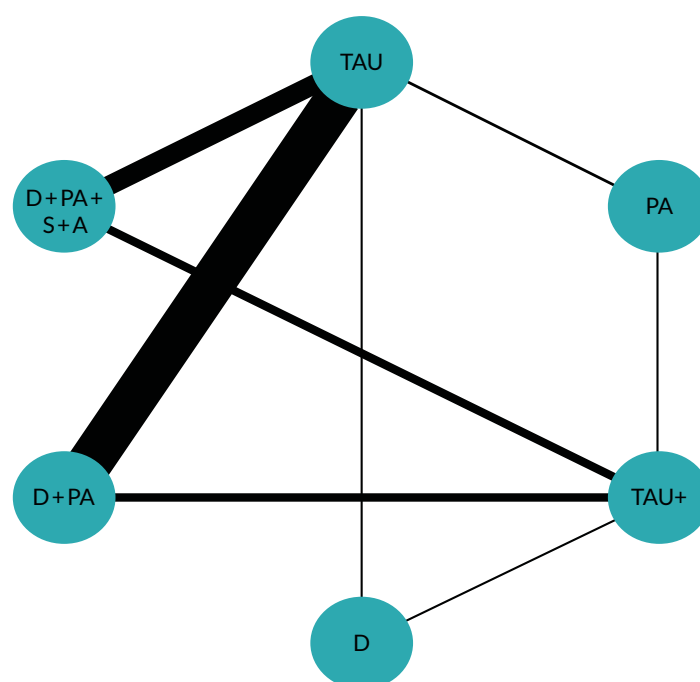
FIGURE 8 Network diagram illustrating risk behaviours targeted in interventions to promote reduction in BMI (thickness of edge weighted by sample size). A, alcohol use; D, diet; PA, physical activity; S, smoking.

Given the lack of diversity of risk behaviours targeted, we were able to conduct an analysis only on any intervention and TAU. Effectiveness at $\leq$ 6 months' follow-up was similar to that found at the end point (MD −1.33 kg/m^2, 95% CrI −2.65 to −0.10 kg/m^2).

Cardiovascular-related outcomes

Systolic blood pressure

Fifteen trials[45,47,54,61,63,64,83,89,93,97,98,101,102,104,150] with 1790 participants were included in the NMA.

Similar to anthropometric outcomes, trials targeting both diet and physical activity compared with TAU were most common (five trials); [45,54,61,70,104] two further trials compared interventions with TAU+.[64,89] Four trials targeted diet, physical activity, smoking and alcohol use compared with TAU.[47,63,93,102] Only one trial targeted diet alone and TAU,[104] and one trial targeted diet alone and TAU+.[101] Two trials targeted physical activity alone and TAU,[83,97] and one trial targeted physical activity alone and TAU+.[98]

Total residual deviance did not identify any problems with model fit (mean 29.54 data points, compared with 32 data points), and between-study SD was 1.45 (95% CrI 0.07 to 3.95; MD scale for systolic blood pressure).

In contrast to the risk behaviours and anthropometric outcomes, studies targeting multiple risk behaviours were more effective in reducing systolic blood pressure than those targeting single behaviours. The most effective interventions targeted diet, physical activity, smoking and alcohol misuse concurrently (MD −2.17 mmHg, 95% CrI −5.46 to 0.87 mmHg), although the CrI did not rule out no benefit. Interventions targeting diet and physical activity were the next most effective (MD −1.56 mmHg, 95% CrI −4.42 to 0.98 mmHg), although the CrI did not rule out no effect. Substantially lower effect estimates and wide CrIs were found for studies targeting diet alone (MD 0.42 mmHg, 95% CrI −4.52 to 5.30 mmHg) or physical activity alone (MD −0.26 mmHg, 95% CrI −5.43 to 4.97 mmHg).

Diastolic blood pressure

Thirteen trials[45,47,61,63,64,83,89,93,97,98,101,104,150] were included in the NMA, comprising data on 1489 participants.

Total residual deviance did not identify any problems with model fit (mean 26.78 data points, compared with 27 data points), and between-study SD was 1.78 (95% CrI 0.16 to 4.27; MD scale on diastolic blood pressure).

Credible intervals were wide for all comparisons, indicating uncertainty about their effectiveness. The most effective interventions in reducing diastolic blood pressure targeted diet, physical activity, smoking and alcohol misuse (MD –2.04 mmHg, 95% CrI –5.76 to 1.23 mmHg). The next most effective intervention targeted diet alone (MD –1.60 mmHg, 95% CrI –6.37 to 2.94 mmHg), followed by interventions targeting diet and physical activity (MD –1.06 mmHg, 95% CrI –4.04 to 1.48 mmHg), and, finally, interventions targeting physical activity alone were not associated with any benefit (MD 0.34 mmHg, 95% CrI –3.80 to 4.25 mmHg).

High-density lipoprotein cholesterol

Fifteen trials[45,61,63,64,67,83,89,93,97,98,101,102,104,149,150] were included in the NMA, with data from 2121 participants. Total residual deviance did not identify any problems with model fit (mean 33.95 data points, compared with 32 data points), and between-study SD was 1.75 (95% CrI 0.18 to 4.26).

Most trials targeted diet and physical activity together compared with TAU (five trials)[45,61,70,75,104] or compared with TAU+ (two trials).[64,89] Four trials targeted diet, physical activity, smoking and alcohol use compared with TAU,[63,67,93,102] and one trial targeted diet, physical activity, smoking and alcohol compared with TAU+.[102] Interventions targeted diet alone and TAU in one trial,[104] and diet alone and TAU+ in another trial.[101] Interventions targeted physical activity alone and TAU in two trials,[83,97] and physical activity alone and TAU+ in one trial.[98]

The most effective interventions for increasing HDL cholesterol targeted diet alone (MD 4.88 mg/dl, 95% CrI –0.02 to 9.66 mg/dl), although it was not possible to rule out no benefit. Physical activity alone (MD 2.99 mg/dl, 95% CrI –1.42 to 7.26 mg/dl) was the next most effective intervention, but the 95% CrI was wide. Targeting diet, physical activity, smoking and alcohol misuse was a little less effective (MD 2.59 mg/dl, 95% CrI –0.53 to 5.78 mg/dl). There was limited evidence for the benefits of targeting diet and physical activity (MD 0.15 mg/dl, 95% CrI –2.46 to 2.40 mg/dl).

Low-density lipoprotein cholesterol

Nine trials[45,61,67,83,89,93,97,101,150] were included in the NMA, comprising 1071 participants.

Given the sparse nature of the network, and concerns over whether or not there were sufficient data to estimate between-study heterogeneity, we compared the goodness of fit between a random-effects and fixed-effects model. The greater complexity of the random-effects model did not result in a better fit (random-effects model: DIC = 111.65, total residual deviance 17.24 data points; fixed-effects model: DIC = 110.62, total residual deviance 18.00 data points; compared with 18 data points); therefore, we used a fixed-effects model for the analysis of LDL cholesterol.

Data were imprecise for all interventions; therefore, it was not possible to draw conclusions on the effectiveness of reducing LDL cholesterol.

Total cholesterol

Eleven trials,[45,61,67,83,86,89,93,97,101,149,150] with 1727 participants, were included in the NMA.

Both the fixed-effects and random-effects models were an acceptable fit (random-effects model: total residual deviance 21.09 data points; fixed-effects model: total residual deviance 22.36 data points; compared with 22 data points). But the greater complexity of the random-effects model meant that the fixed-effects model was preferred (random-effects model DIC = 138.95, fixed-effects model DIC = 137.99).

Data were imprecise for all interventions; therefore, it was not possible to draw conclusions on the effectiveness of reducing total cholesterol.

Quality of life
Quality-of-life data help to assess the overall self-reported benefits of interventions to physical health. In addition, these data help to assess if there are any self-reported benefits or deterioration to mental health-related quality of life.

Physical health
Nine trials,[45–47,67,69,81,86,107,148] with 1853 participants, were included in the NMA.

Three trials targeted smoking alone and TAU; intensity of TAU was judged similar enough to be included in the NMA. Interventions targeted diet and physical activity and TAU in three trials, and diet and physical activity TAU+ in one trial. One trial targeted diet, physical activity, smoking and alcohol use and TAU, and a further trial targeted these behaviours and TAU+.

Total residual deviance was low for the random-effects (6.21 data points, compared with 9 data points) and fixed-effects (5.72 data points, compared with 9 data points) models, possibly indicating overfitting. Because of the greater complexity of the random-effects model, we preferred the fixed-effects model, as there was no difference in goodness of fit (random-effects model DIC = −5.68, fixed-effects model DIC = −7.43).

Interventions targeting smoking alone improved physical health-related quality of life (SMD 0.19, 95% CrI 0.05 to 0.34). There appeared to be no difference between interventions targeting diet and physical activity and TAU in physical health-related quality of life (SMD 0.02, 95% CrI −0.14 to 0.18). Interventions targeting diet, physical activity, smoking and alcohol misuse may have led to a small reduction in physical health-related quality of life (SMD −0.21, 95% CrI −0.43 to 0.02).

Mental health
Nine trials[45–47,67,69,81,86,107,148] were included in the NMA, with 1853 participants.

Total residual deviance was low for the random-effects (6.09 data points, compared with 9 data points) and fixed-effects (5.31 data points, compared with 9 data points) models, possibly indicating overfitting. Because of the greater complexity of the random-effects model, we preferred the fixed-effects model, as there was no difference in goodness of fit (random-effects model DIC = −5.72, fixed-effects model DIC = −7.74).

Three trials targeted smoking alone and TAU;[46,69,148] the intensity of TAU (i.e. low to very low) was judged to be similar enough to be included in the NMA. Interventions targeted diet and physical activity and TAU in three trials,[45,86,107] and diet and physical activity TAU+ in one trial.[81] One trial targeted diet, physical activity, smoking and alcohol use and TAU,[67] and one trial targeted these behaviours and TAU+.[47]

There was no evidence that either single (interventions targeting smoking alone: SMD 0.01, 95% CrI −0.14 to 0.16) or multiple risk behaviour (interventions targeting diet and physical activity: SMD −0.09, 95% CrI −0.25 to 0.07; diet, physical activity, smoking and alcohol misuse: SMD −0.09, 95% CrI −0.32 to 0.14) interventions led to a reduction in mental health-related quality of life. This is an important finding, given concerns that trying to promote physical health may lead to deterioration in mental health.

Positive and Negative Syndrome Scale
The Positive and Negative Syndrome Scale (PANSS) was the most commonly reported mental health outcome measure; it is designed to monitor symptom severity in people with schizophrenia. We used these data to assess whether or not risk behaviour interventions had adverse effects on mental health for people with SMI.

There were insufficient data to assess the impact of which behaviours were targeted; therefore, we assessed differences between any risk behaviour intervention and TAU on the PANSS. As there were only two comparisons in the network, this was equivalent to conducting a pairwise meta-analysis. In addition, only data on the PANSS total score[51,54,60,67,79] were sufficiently reported to conduct meta-analyses.

Given that only five trials were included in the analysis, and concerns about whether or not there were sufficient data to estimate between-study heterogeneity, we compared the goodness of fit between a random-effects and a fixed-effects model. The greater complexity of the random-effects model did not result in a better fit with the data (random-effects model DIC = 56.91, total residual deviance = 10.25 data points; fixed-effects model DIC = 56.63, total residual deviance = 11.09 data points, compared with 10 data points); therefore, we used a fixed-effects model for the analysis of the PANSS total score.

There was no evidence on the PANSS total score (MD 0.03, 95% CrI −2.56 to 2.65) that any risk behaviour intervention had a harmful effect on mental health in people with schizophrenia, although the CrI was wide, suggesting uncertainty on estimating the true effect.

Model 1b: meta-regression analyses to investigate the impact of intervention and participants characteristics on effectiveness
There were only sufficient data to conduct meta-regression analyses for weight and BMI outcomes (*Table 2*).

Weight
We investigated the impact of including five study characteristic covariates to NMA model 1a: behaviour change intervention at initiation of antipsychotic treatment, if participants were targeted for specific comorbid conditions (e.g. diabetes), if the intervention was delivered to individuals, if the intervention was delivered in an inpatient setting and if the intervention was tailored for people with SMI. We then compared the goodness of fit of this covariate model with model 1 without covariates.

We compared model 1b (covariate model) with model 1a (model without covariates). Total residual deviance showed that goodness of fit was acceptable in both models (model 1b = 55.30 data points, model 1a = 60.00 data points, compared with 63 data points). The DIC did not substantially differ between models (model 1b = 279.52, model 1a = 282.17).

However, the inclusion of covariates in model 1b explained some of the heterogeneity, indicated by a reduction in the between-study SD (model 1b: SD 0.44, 95% CrI 0.02 to 1.54; model 1a: SD 0.69, 95% CrI 0.04 to 1.78).

TABLE 2 Assessing the association between study and participant characteristics and weight and BMI

Covariate	Beta (95% CrI)	
	Weight (kg)	BMI (kg/m^2)
Initiation of antipsychotic treatment	0.36 (−2.69 to 3.37)	0.34 (−1.27 to 2.12)
Targeting people with comorbid physical conditions	−0.74 (−11.61 to 10.18)	−0.39 (−2.34 to 1.61)
Individual-based intervention	−2.70 (−4.69 to −0.75)	−1.11 (−2.15 to −0.01)
Inpatient setting	3.18 (0.21 to 6.12)	0.45 (−1.29 to 2.23)
Tailoring for people with SMI	1.31 (−0.66 to 3.32)	−0.16 (−1.32 to 0.98)

Interventions delivered to individuals were more effective than those delivered to groups (beta −2.70, 95% CrI −4.69 to −0.75). In addition, interventions delivered in inpatient settings were less effective than interventions delivered in community settings (beta 3.18, 95% CrI 0.21 to 6.12). CrIs were very wide for all other covariates.

Body mass index

Differences in DIC values indicated that the covariate model (model 1b: DIC = 186.91) fitted the data better than the model without covariates (model 1a: DIC = 196.76), although the covariates included in the model reduced the between-study SD only a little (model 1b: SD 0.83, 95% CrI 0.46 to 1.40; model 1a: SD 0.88, 95% CrI 0.56 to 1.35).

Total residual deviance was acceptable for the covariate model (mean 68.53 data points, compared with 70 data points). Similar to weight outcomes, interventions delivered to individuals were more effective than those delivered to groups (beta −1.11, 95% CrI −2.15 to −0.01). All other covariates had very wide CrIs.

Model 2 (interaction model): does targeting multiple risk behaviours lead to positive or negative synergies?

The preceding analyses provide some insight on how targeting particular risk behaviours affects outcomes. A different way of exploring that question is to assess whether or not targeting risk behaviours together results in positive (i.e. larger benefits than would be expected from the sum of their effects alone) or negative synergies (i.e. less benefits than expected from the sum of their effects). There were sufficient data to explore these interactions on weight and BMI only (*Table 3*).

Weight

Model fit was acceptable (mean total residual deviance = 58.42 data points, compared with 63 data points). The findings were similar to those of model 1. We did not find evidence of positive interactions. There did not appear to be additional benefits of targeting diet and physical activity concurrently, compared with summing the effects of targeting each of these behaviours alone (MD 1.88 kg, 95% CrI −4.02 to 7.57 kg).

There was evidence of negative synergistic effects when targeting diet, physical activity, smoking, alcohol misuse and drug misuse. Benefits on weight loss were less than would be expected if these behaviours were targeted alone (2.97 kg, 95% CrI 1.03 to 4.84 kg).

Body mass index

Model fit was acceptable (total residual deviance was 71.78 data points, compared with 75 data points). Targeting physical activity was associated with a small reduction in BMI (MD −1.08 kg/m^2, 95% CrI −2.28 to 0.13 kg/m^2). There was insufficient evidence for the effectiveness of targeting diet alone (MD −0.01 kg/m^2, 95% CrI −1.65 to 1.67 kg/m^2).

TABLE 3 Examining interaction effects of targeting multiple risk behaviours on weight and BMI

Risk behaviours	Outcome (95% CrI)	
	Weight (kg)	BMI (kg/m^2)
Diet	MD −2.56 (−6.34 to 1.35)	MD −0.01 (−1.65 to 1.67)
Physical activity	MD −1.61 (−6.09 to 2.67)	MD −1.08 (−2.28 to 0.13)
Diet and physical activity	MD 1.88 (−4.02 to 7.57)	MD 0.56 (−1.48 to 2.61)
Diet, physical activity, smoking, alcohol misuse and drug misuse	MD 2.97 (1.03 to 4.84)	MD 0.66 (−0.43 to 1.68)
Total residual deviance	Mean 58.42	Mean 71.78
Between-study SD	0.77 (0.05 to 1.73)	0.86 (0.56 to 1.31)

There was no evidence of a positive interaction when targeting diet and physical activity concurrently (0.56 kg/m^2, 95% CrI −1.48 to 2.61 kg/m^2). There was also no evidence of a positive interaction when targeting diet, physical activity, smoking and alcohol misuse (MD 0.66 kg/m^2, 95% CrI −0.43 to 1.68 kg/m^2).

Model 3: effectiveness of behaviour change techniques

We fitted component NMA models to evaluate the effectiveness of BCTs in models assuming these BCTs affected outcomes independently of one another (independent model) and in models allowing for interaction effects between these BCTs (interaction model) (*Table 4*).

Weight

Goodness of fit was acceptable for both models (independent model: total residual deviance = 59.42 data points, interaction model: total residual deviance = 58.46 data points, compared with 63 data points).

The DIC values (independent model: DIC = 281.67, interaction model: DIC = 282.37) and between-study SDs were similar (independent model: SD 0.81, 95% CrI 0.03 to 2.22; interaction model: SD 0.91, 95% CrI 0.04 to 2.43). This may reflect that there were sufficient data for only two interactions to be included in the interaction model and that both covariates were very imprecise. Therefore, the summary of results will focus on the simpler independent model.

TABLE 4 Independent and interaction models assessing the effectiveness of BCTs for weight and BMI

BCTs (BCTT v1)	Model 3a: independent model (95% CrI)		Model 3b: interaction model (95% CrI)	
	Weight (kg)	BMI (kg/m^2)	Weight (kg)	BMI (kg/m^2)
1.1 Goal-setting (behaviour)	−2.22 (−4.54 to −0.44)	−0.61 (−1.53 to 0.28)	−2.26 (−4.68 to −0.25)	−1.85 (−2.91 to −0.69)
1.2 Problem-solving	3.61 (1.18 to 5.32)	1.56 (0.61 to 2.36)	3.82 (0.36 to 7.03)	1.46 (0.11 to 2.67)
1.4 Action-planning	–	−0.61 (−1.29 to 0.27)	–	−0.34 (−1.07 to 0.42)
2.2 Feedback on behaviour	−0.83 (−2.70 to 1.77)	−0.58 (−1.43 to 0.28)	−0.67 (−2.73 to 1.97)	0.02 (−0.78 to 0.84)
2.3 Self-monitoring of behaviour	−0.12 (−1.91 to 1.78)	−0.35 (−0.96 to 0.40)	−0.96 (−3.55 to 1.38)	−0.70 (−1.42 to 0.07)
3.1 Social support (unspecified)	0.84 (−1.48 to 2.65)	−0.24 (−1.04 to 0.51)	0.47 (−2.25 to 2.83)	−0.42 (−1.12 to 0.32)
4.1 Instruction on how to perform the behaviour	−2.10 (−3.42 to −0.45)	−0.59 (−1.10 to −0.02)	−2.50 (−4.40 to −0.34)	−1.19 (−1.85 to −0.55)
5.1 Information about health consequences	−0.94 (−2.75 to 1.30)	0.69 (−0.11 to 1.38)	−0.60 (−2.59 to 1.81)	0.05 (−1.23 to 1.29)
6.1 Demonstration of the behaviour	−0.94 (−2.75 to 1.30)	–	−0.85 (−3.24 to 1.56)	–
4.1 × 5.1	–	–	–	1.71 (0.44 to 3.00)
4.1 × 1.2	–	–	−1.43 (−5.54 to 2.31)	−0.84 (−2.10 to 0.45)
4.1 × 2.3	–	–	2.10 (−1.06 to 5.53)	0.93 (−0.05 to 1.96)
5.1 × 2.3	–	–	–	0.07 (−1.23 to 1.38)
1.1 × 2.3	–	–	–	1.11 (−0.54 to 2.51)
1.2 × 2.3	–	–	–	0.75 (−0.52 to 2.12)

The strongest evidence was found for goal-setting (behaviour) (MD –2.22 kg, 95% CrI –4.54 to –0.44 kg) and instruction on how to perform the behaviour (MD –2.10 kg, 95% CrI –3.42 to –0.45 kg).

In addition, problem-solving was associated with weight gain (MD 3.61 kg, 95% CrI 1.18 to 5.32 kg).

Body mass index
Goodness of fit was acceptable for both models (independence model: total residual deviance = 77.86, interaction model: total residual deviance = 73.31).

The interaction model (DIC = 192.86) fitted the data better than the independent model (DIC = 198.84) and explained more of the heterogeneity [between-study SD: interaction model, 0.21 (95% CrI 0.01 to 0.74); independence model, 0.55 (95% CrI 0.12 to 1.07)]. Therefore, the summary will focus on results from the interaction model.

Similar to the weight NMA, the strongest evidence was found for goal-setting (behaviour) (MD –1.85 kg/m^2, 95% CrI –2.91 to –0.69 kg/m^2), instruction on how to perform a behaviour (MD –1.19 kg/m^2, 95% CrI –1.85 to –0.55 kg/m^2) and self-monitoring of behaviour (MD –0.70 kg/m^2, 95% CrI –1.42 to 0.07 kg/m^2), although it was not possible to rule out negligible benefits for self-monitoring of behaviour.

As for weight, problem-solving was associated with a worsening of BMI outcomes (MD 1.46 kg/m^2, 95% CrI 0.11 to 2.67 kg/m^2).

Chapter 5 Results of the qualitative review

Quality of included studies

Methodological limitations of included studies were assessed using the CASP tool. Reporting was generally acceptable across studies, allowing for consideration of most, if not all, prompts in the CASP tool for each study. However, authors' consideration of the relationship between researcher and participant (question 6) was consistently poorly addressed. Only 4 of the 25 included studies addressed this issue adequately.

One consideration that was addressed well was ethics issues (question 7), which require sufficient detail in gaining ethics approval and informed consent of participants. When this did not score 'yes', it was because of an apparent lack of reporting.

Results of the GRADE–CERQual assessment per subtheme can be found in *Appendix 8*. There was moderate to high confidence in the evidence presented by the subthemes reported here. The four components of CERQual also raised only very minor to moderate concerns. Methodological limitations (as assessed by the CASP tool) were not a general concern: coherence was largely assessed as a minor concern; adequacy was mostly assessed as a very minor to minor concern; and relevance was a slightly larger concern, predominantly assessed as being of minor to moderate concern.

Narrative synthesis

Here we are going to address the question: what are service user perspectives on the acceptability and feasibility of using risk behaviour interventions to change behaviour and improve physical health-related outcomes, with specific reference to intervention uptake, adherence and service user experience?

Data from primary studies organised around four higher-tier themes: interaction of physical and mental health, motivational contexts for change, barriers to behaviour change, and experiences of interventions.

Interaction between physical and mental health
Across the studies, data highlighted the reciprocal nature of physical and mental health. Participants reported the impact of mental health states on their engagement in healthy behaviours, and there was an emerging consensus that physical health risk behaviours had the potential to affect mental health negatively.

Healthy behaviours improving mental health and well-being
People with SMI reported that physical activity was helpful in changing mental health. But, overall, mental health and a sense of well-being were valued more than changes in activity.

When discussing physical activity, data gathered around two core ideas: physical activity to refresh the mind and physical activity for symptomatic relief. Engaging in activity was frequently reported to result in mental clarity:

> . . . I'd notice, after I'd done the gym sessions, I felt really fresh. Like, afterwards, like my mind felt kind of washed, if you like.
>
> *Firth* et al.,[119] *single risk behaviour intervention (SRB), physical activity*

Healthy behaviours were also used for immediate symptom relief in one study:

> . . . when I feel like I'm just so angry, and stuff like that, I've gone training, I've done press-ups and stuff at home and it's cleared my head, killed me anger . . .
>
> *Firth* et al.,[119] *SRB, physical activity*

An overarching concept from this theme related to participants' desire to find a suitable space to bring about positive mental change:

> *[The gym] gives me somewhere to go to vent out stress.*
>
> *Jimenez* et al.,[127] *multiple risk behaviour intervention (MRB), physical activity and diet*

Similarly, reports of physical activity to relieve mental health symptoms spoke of exercise as a mental release, and relieving SMI symptoms:

> *Exercise relieves stress, sweat relieves stress; those two things, I really use them. There's all kinds of ways you can relieve stress. I think exercise helps me to relieve stress.*
>
> *Jimenez* et al.,[127] *MRB, physical activity and diet*

> *The voices, I do not hear them as much.*
>
> *Forsberg* et al.;[121] *MRB; physical activity, diet, alcohol, drug use, smoking*

There was also widespread recognition that exercise could have immediate impact on well-being, as well as physiological benefits:

> *. . . physical exercise, it lets endorphins off in your brain, doesn't it. So even if you are a bit depressed, it can, erm, make you not depressed [laughs], or make you slightly more happy.*
>
> *Firth* et al.,[119] *SRB, physical activity*

Being considered more holistically

One of the core components of participants' preferences and expectations for engaging with behaviour change revolved around their desire to be treated as a whole person. In studies, participants wanted to be recognised in totality as individuals, rather than as a collection of risk behaviours to be changed. According to authors in one study, participants expressed dislike for the term 'intervention', perceiving it as:

> *Someone else intervening.*
>
> *Bauer* et al.,[117] *MRB, physical activity and diet*

When trying to improve health risk behaviours, there was a sense that outcomes such as weight loss were secondary to the overarching idea of well-being:

> *Even if I don't necessarily lose so much weight, but just living healthier, eating healthier, being healthier is enough.*
>
> *Yarborough* et al.,[147] *MRB, physical activity and diet*

Mental and physical health were not necessarily viewed as separate, which may be critical to multiple risk behaviour interventions:

> *[M]y big goal is to be fully recovered from all the physical and psychological problems I've got. That's my goal, to be fully recovered.*
>
> *Forsberg* et al.;[121] *MRB; physical activity, diet, alcohol, drug use, smoking*

Self-medicating

Smoking, drug use, and/or alcohol use emerged as key behaviours that typified the ways in which participants sought relief from symptoms or were proactive in trying to change unhelpful mental states. Behaviours related to addictive substances were used to cope with, and manage, mental health symptoms. In one study, engaging in a risk behaviour was experienced as taking positive action to change health state:

> [Smoking] gives you the feeling that you're doing something about it.
>
> *Thornton* et al.,[142] *SRB, smoking*

Smoking was sometimes interpreted as a coping strategy for mental health symptoms, which can be considered a misattribution of relief from nicotine withdrawal, and viewed as a 'high[ly] addictive antidepressant',[142] and was perceived to be used to provide immediate relief of depression:

> [I]t gives you that instant effect that you've had some sort of mood relaxant . . . a bit of a stress relief against depression . . .
>
> *Thornton* et al.,[142] *SRB, smoking*

For some participants, addictive behaviours were part and parcel of their existence and biographical memory, and were perceived as reliable, and even comforting, behaviours:

> With the bipolar illness, it's hard for me to remember things, but something that I've always done is smoke and that's something that I've, you know, it's just been there all along.
>
> *Heffner* et al.,[123] *SRB, smoking*

Other studies also mirrored this supportive role of risk behaviours; in one study, such behaviours were conceptualised as a companion:

> You have nobody to talk to, you have nobody to do things with. All you have is that drug; that drug keeps you company.
>
> *Maisto* et al.,[133] *MRB, alcohol and drug use*

The stable support that risk behaviours can offer was exemplified as something to retreat to, when managing schizophrenia and depression:

> I find myself escaping back to drugs.
>
> *Maisto* et al.,[133] *MRB, alcohol and drug use*

There were also reports that highlighted that, for some participants, their relationship with addictive substances was driven by their mental health:

> [T]he stress that I'm under, the anxiety that I'm under all the time just forces me right back to drink again.
>
> *Maisto* et al.,[133] *MRB, alcohol and drug use*

Motivational contexts for change

Motivations and motivational contexts for change were broadly grouped into three subthemes: individual factors, social factors and environmental factors.

Individual factors

Various personal motivations to change were reported. Identifying and holding on to a personal motivation was noted as an important guiding light:

> I think it's important to, you know, like, have a, like, a north star like that to look at, like, this is why I'm doing it and this is why it's important.
>
> *Heffner* et al.,[123] *SRB, smoking*

The commitment to succeed, in the face of challenges presented by SMI, was also important:

> ... I felt as though I took it serious and I wanted to do it, and then something would come along and sort of like take my mind off everything.
>
> *Knowles* et al.,[131] *SRB, smoking*

Motivation stemming from concerns with physical appearance and weight were reported in some studies: 'I'm a bit fat and have a big stomach.' (Forsberg *et al.*,[121] MRB; physical activity, diet, alcohol, drug use, smoking), and they remember being 'skinny ... proportioning' (Jimenez *et al.*,[127] MRB, physical activity and diet). Concerns over personal appearance could also affect concerns for romantic lives (related to concepts of confidence and acceptance; see *Valued benefits of behaviour change interventions*):

> I want to get married one day or have a girl and girls don't like fat guys. I want to be able to have a girl and be confident.
>
> *Jimenez* et al.,[127] *MRB; physical activity and diet*

This sense of participants wanting to promote a more positive future version of themselves extended to how they looked to protect themselves from the negative health outcomes associated with long-term conditions and ageing:

> I will soon be over 50 years old; you must be aware of the blood sugar and such values ... It can change. It gives the desire to keep good values and not to get diabetes and other diseases.
>
> *Rönngren* et al.,[140] *MRB, physical activity and diet*

For others, motivations to change to healthier patterns of behaviour stemmed from an awareness of familial risks and the impact of witnessing others suffer health consequences of weight gain and smoking:

> It seems there's a lot of health issues with family and that plays a part in wanting to exercise and lose weight because I'm at severe risk of getting all these things.
>
> *Jimenez* et al.,[126] *MRB, physical activity and diet*

> My dad, as he's got a diseased lung ... he smokes a lot and just watching him, cos he's a pack a day smoker, I don't want to be that.
>
> *Thornton* et al.,[142] *SRB, smoking*

In contrast to these direct health concerns, one study reported motivation stemming from particular scenarios, such as avoiding associated risks of possible surgery for weight loss:

> I don't want to have to go through any weight loss surgery and stuff like that. That's stuff I worry about.
>
> *Yarborough* et al.,[147] *MRB, physical activity and diet*

Social factors

Feedback and reinforcement of positive messaging from family and friends was also critical to some participants' motivations to engage in more positive health behaviours:

> 'Gee, you look better', so I'm on the right road.
>
> *Aschbrenner* et al.,[116] *MRB, physical activity and diet*

> My family is starting to notice that I'm losing weight. I like the positive comments.
>
> *Yarborough* et al.,[147] *MRB, physical activity and diet*

A sense of belonging could also be found in motivation from peers, and group interventions were reported as a good starting point to engaging in exercise:

> *Exercise in a group could be a good way to start when it comes to engaging in physical activity.*
>
> <div align="right">Rönngren et al.,[141] MRB, physical activity and diet</div>

The presence of help suggested increased engagement with support. Having 'someone to call and talk things over with . . . 24 hours a day every day' (Maisto *et al.,*[133] MRB, alcohol and drug use). The idea of the intervention as a constant to return to was also present:

> *So maybe if you just keep . . . keep going back to them. You're saying 'look, we're here and we'll keep letting you know we're here'.*
>
> <div align="right">Knowles et al.,[131] SRB, smoking</div>

However, verbal support alone did not necessarily translate into helpful actions (needing to be seen as credible), as, in one study, someone reported:

> *My husband verbally supports me but he eats whatever he wants to eat and has it in the house.*
>
> <div align="right">Yarborough et al.,[147] MRB, physical activity and diet</div>

The presence of key others could positively support behaviour change, but not always, with some studies reporting that goals to enact behaviour change were viewed with scepticism:

> *[W]hen I was talking about quitting there was [sic] a couple of people that were like would verbally basically be like, 'Yeah, right, I'll believe it when I see it.'.*
>
> <div align="right">Heffner et al.,[123] SRB, smoking</div>

Accountability to friends, family and intervention groups was a prominent component of this subtheme. Group interventions offered inherent accountability among peers. Interpersonal relationships with family and friends offered the ability to monitor behaviour, which was supportive of positive efforts made by individuals.[133] In one study, participants arranged accountable relationships between themselves, calling each other.[126]

Peer support was important for some participants, who derived a sense of accountability to each other by their membership and participation of intervention groups:

> *The accountability of being part of the group is very important.*
>
> <div align="right">Yarborough et al.,[147] MRB, physical activity and diet</div>

This level of accountability to the group often translated into supporting each other to adhere to positive behaviour change:

> *He'll ask, 'Did you go to the gym?' If I say no, he'll say, 'I'm disappointed at you.'. But you see, that's all we got, is this friendship. We have nothing, so we make the best of nothing.*
>
> <div align="right">Jimenez et al.,[126] MRB, physical activity and diet</div>

In another instance, the support of friends was often experienced in direct and instructional ways:

> *I have this friend, she has this attitude, if I say that I'm not going somewhere she's like, 'You're so going. Get dressed.'. Then I have to go.*
>
> <div align="right">Jimenez et al.,[126] MRB, physical activity and diet</div>

Another component of this subtheme was surveillance and scrutiny from others. Familial involvement or surveillance could stir individuals into action, not necessarily for themselves, but to appeal to the desires and wishes of others and preserve good relations with significant others:

> . . . *my parents told me that this treatment was a gift – the sort of habits and things that I was getting into wasn't something that my parents could tolerate forever.*
>
> *Luciano* et al.,[132] *MRB, alcohol and drug use*

In another study, motivation to change stemmed from a desire to not become stigmatised or attract negative attention:

> *I don't want to have to deal with people's negative comments about me smoking because I already feel that in other areas.*
>
> *Heffner* et al.,[123] *SRB, smoking*

Environmental factors

Having a safe and stable place might be the foundation for people with SMI to consider the challenges of behaviour change:

> *Safe environments are the most important thing to people with mental illness.*
>
> *Huck* et al.,[125] *SRB, physical activity*

Therefore, environmental factors refers to the external context of an individual on a micro level, for example where they live, and structures created by, or imposed on, a person.

Creating schedules was an important means to shape and structure environments for individuals. Scheduling also offered accountability and was interpreted as motivating. This included scheduling intervention meetings or even behaviour change activities. For physical activity, this notion of environmental scheduling related to practical elements such as specific times, locations and goals that could be set objectively. By structuring their environments through scheduling, participants were, in some senses, bound to complete tasks linked to behaviour change:

> *I guess it's because it's a little motivator. It's like I can't get away with it [skipping the gym].*
>
> *Aschbrenner* et al.,[116] *MRB, physical activity and diet*

Pacing the frequency of intervention meetings was an important consideration. Meetings may prompt behaviour change, rather than just acting as check-in points. For one participant, if the meetings were too infrequent, then they would engage in risk behaviours and:

> . . . *a week later [as the monthly meeting approaches] I'll try to improve on it.*
>
> *Yarborough* et al.,[147] *MRB, physical activity and diet*

A feature of environmental factors contributing to motivation to change were interactions with formal health care. Appointments with intervention providers were another form by which environmental scheduling drove engagement with positive health behaviours. Here 'providers' refers to those providing, organising and/or delivering the intervention, whether medical professional or community organiser. The authority held by a provider could increase the sense of accountability felt by participants to stick to their schedules. One participant stated:

> *You see, when I got an appointment or something I'm very faithful to that. Like he tells me, 'Come tomorrow', I got it in my mind I gotta come to him tomorrow. So I won't miss that appointment.*
>
> *Jimenez* et al.,[126] *MRB, physical activity and diet*

Providers could set the tone and make participants feel welcome and bring a sense of humanity:

> *I enjoyed the warmth of the welcome I got from the staff and the interest they showed.*
>
> *Roberts and Bailey,[139] MRB, other – weight*

> *My therapist, even though I'm a mentally ill psychiatric patient in a mental institution, she still treats me like everybody else.*
>
> *Maisto et al.,[133] MRB, alcohol and drug use*

In one instance, a provider was described as confrontational, but also as a source of stability to promote change:

> *She used to confront me on it like that . . . she didn't push me away . . . it helped me quit.*
>
> *Maisto et al.,[133] MRB, alcohol and drug use*

Positive relationships with providers were interpreted as supportive. Providers could be personal cheerleaders or provide a touchpoint for change:

> *He was like persuading us on like 'come on you can do it, you can do it!' when he says things like that it makes me more activate.*
>
> *Firth et al.,[119] SRB, physical activity*

> *[O]nce [the exercise physiologist and nursing staff] helped me out I began to get fitter, not a great deal fitter, just enough to get through the day.*
>
> *Fogarty and Happell,[120] SRB, physical activity*

A positive relationship could also benefit perceptions of intervention providers, as one participant was unaware of their positive impact:

> *I didn't know they could do some good things, some of them, I didn't really know that.*
>
> *Forsberg et al.;[121] MRB; physical activity, diet, alcohol, drug use, smoking*

Barriers to behaviour change
As with motivations to change, we found that barriers to behaviour change were broadly grouped under three subthemes: individual factors, social factors and environmental factors.

Individual factors
One of the main contributors to individual barriers to change was SMI symptoms. Across studies, SMI symptoms presented challenges to engaging in behaviour change interventions, as exemplified in participants' accounts about difficulties with concentrating and difficulties accepting information when delusional:

> *Many of us can get tired and lose concentration . . . When you've had a psychosis you work a lot with thoughts darting around inside your head.*
>
> *Wärdig et al.,[144] MRB; physical activity, diet, alcohol use and smoking*

> *[I] probably just think it's a load of rubbish or, you know . . . Because like when you're delusional you don't, well I know that . . . I don't believe anything.*
>
> *Thornton et al.,[142] SRB, smoking*

Deteriorations in mental health were often emphasised by participants as their main concern; therefore, enacting positive behaviour change was of secondary importance:

> *It's hard to make changes in your diet and follow the routine . . . when you're at a point where you just don't care.*
>
> *Yarborough* et al.,[147] *MRB, physical activity and diet*

Mental health treatments were also identified as restricting the scope to change behaviours through their impact on bodily systems:

> *When I am feeling down or depressed, I have almost no energy. In these periods, I have to take more psychotropic drugs, resulting in even less energy.*
>
> *Verhaeghe* et al.,[143] *MRB, other – health promotion*

Poorer mental health on the part of participants had the capacity to magnify barriers that might have ordinarily been surmountable:

> *My husband drives me there [to the gym] even when I don't want to be there. I can walk. It's not that far from my house to the gym [. . .].*
>
> *Aschbrenner* et al.,[116] *MRB, physical activity and diet*

However, reluctance to engage in physical activity was not always associated with mental health status:

> *I just get lazy sometimes. I just don't want to do it, so I sit on the couch and watch TV.*
>
> *Yarborough* et al.,[147] *MRB, physical activity and diet*

Another feature of individual barriers to behaviour change was derived from participants' responses about their self-efficacy to enact change. A lack of knowledge or skill affected participants' capability to carry out healthy behaviours. For example, not understanding how to use exercise equipment as part of a gym routine was cited as a block to effectively engaging in physical activity:

> *[Knowing] how many repetitions and how to use the handles and set the chair and everything, that would've made it a lot more enjoyable for me.*
>
> *Huck* et al.,[125] *SRB, physical activity*

In the case of taking exercise in public, stigma around body image was prohibitive of activity:

> *I hate getting into that pool because I think people are staring at me . . . but it's that whole confidence thing . . . you see those skinny people . . . that's what helps to put you off . . .*
>
> *Roberts and Bailey,[139] MRB, other – weight*

Physiological as well as psychological barriers emerged as common factors in this theme about individual-level barriers to behaviour change. Cravings for addictive substances were commonly reported among participants with histories of addictive behaviours such as smoking, alcohol use and drug use. Cravings appeared to be powerful and intangible, described as 'screaming' (Thornton *et al.*,[142] SRB, smoking) and like a 'forcefield' (Maisto *et al.*,[133] MRB, alcohol and drug use) that could trap people in cycles of negative behaviours.

An element of timing was also present, as cravings were reported at the beginning of a transition:

> *The first week I felt like every cell in my body wanted a cigarette.*
>
> *Heffner* et al.,[123] *SRB, smoking*

Distractions were used in response to a craving to engage in a risk behaviour, and building a resilience over time was described:

> *Maybe call a sponsor, call a friend, go for a walk, and go to the gym. The cravings do pass, and they do pass more easily when you have longer-term sobriety under your belt.*
>
> *Luciano* et al.,[132] *MRB, alcohol and drug use*

This progression was challenged in one report, as overcoming cravings was described as 'almost impossible',[142] even when presented with visual consequences of smoking:

> *[E]ven with those pictures sitting right in front of me because my body is asking me for that.*
>
> *Thornton* et al.,[142] *SRB, smoking*

Social factors

Influences of the social and cultural contexts were a rich subtheme of data. People with SMI reported the benefits of positive peer support, but also the difficulties with negative peer group pressure.

Participants typically remarked that obligations to family and the cultural significance of dietary behaviours could prevent behaviour change. Eating together was seen as part of their 'identity' in a study of a Latino subpopulation:

> *. . . being together, eating our traditional food with our family, and remembering.*
>
> *Jimenez* et al.,[126] *MRB, physical activity and diet*

Such family gatherings were an example of social challenges to healthy diet and alcohol consumption:

> *'One plate isn't going to hurt you', but the plate is like this [gestures] big, and it's all mounded, it's huge, and then everyone had to have a drink, and I'm like, 'I don't drink anymore'.*
>
> *Aschbrenner* et al.,[116] *MRB, physical activity and diet*

Engagement in risk behaviours (such as smoking) was often encouraged rather than restrained by others:

> *People are just like, 'Dude, if you need to smoke, smoke.'.*
>
> *Heffner* et al.,[123] *SRB, smoking*

The absence of social support was also detrimental to healthy behaviours. In a few studies, there were reports of the negative impacts of loneliness:

> *The biggest culprit is loneliness, a terrible problem, I think. Nobody feels good when they're alone.*
>
> *Rönngren* et al.,[141] *MRB, physical activity and diet*

Interventions that built in behaviour change activities into people's schedule interrupted the sense of loneliness felt by some:

> *[I]t just helps to get me out really, that's what it does, for people that are isolated like me, that do suffer from mental illness and do find it hard to go out and about.*
>
> *Hodgson* et al.,[124] *SRB, physical activity*

Environmental factors

The subtheme of environmental barriers to behaviour change emerged from reports about how certain environments induced rather than prevented health risk behaviours.

In some situations, environments were sources of behavioural triggers that were difficult to avoid and promoted engagement in risk behaviours:

> *You're sitting there watching it and it'll come on and triggers cigarette thoughts and . . . instead of putting you off, it would make you want to have a cigarette . . .*
>
> *Thornton et al.,[142] SRB, smoking*

> *I'd been smoking for so many years that there's so many situations where it was extremely automatic for me to smoke.*
>
> *Heffner et al.,[123] SRB, smoking*

In one study, there were reports of individuals seeking new residences to change environmental triggers around them. However, group homes could also be a trigger, as occupants' shared experiences made for talking points with unintended side effects:

> *[A]ll those war stories used to get me excited about [using alcohol and drugs].*
>
> *Maisto et al.,[133] MRB, alcohol and drug use*

Another component of environmental barriers to behaviour change was the interface with formal health care. Intervention providers and prescribers are gatekeepers for interventions, with the power to bestow decisions on who gets access to opportunities and support to promote positive behaviour change. This was illustrated through reports of the difficulties participants faced in being prescribed antismoking treatment, as well as in collecting prescriptions:

> *'We're not putting you on the Champix' [Champix®; Pfizer Inc., New York, NY, USA] and the other one as well, 'Not putting you on them'. And that was it. I was out the door, gone.*
>
> *Knowles et al.,[131] SRB, smoking*

Providers may be considered a natural authority in an intervention, which lends their advice legitimacy, as providing advice suggests that there is improvement to be made:

> *When she [nurse] gives me advice how to cook using healthy ingredients or to go to the fitness, I would follow this advice. The fact that she mentions it means for me that here is a problem.*
>
> *Verhaeghe et al.,[143] MRB, other – health promotion*

However, the naturally authoritative role of providers was sometimes perceived by participants as obstructive. This was especially true when participants perceived that providers lacked knowledge about their lived experience and were guilty of poorly expressing instructions:

> *How do they know it does that? You ever took drugs?*
>
> *Maisto et al.,[133] MRB, alcohol and drug use*

> *[H]e [therapist] says 'that's because you eat too much and don't get enough exercise'. That's pretty blunt, isn't it? If you're overweight, the last thing you want someone to tell you is that you're fat.*
>
> *Roberts and Bailey,[139] MRB, other – weight*

Support from health-care providers could also be construed as too sparse and restricted to addressing risk behaviours in isolation from other issues, thereby limiting the relevance of advice:

> *[O]nly really advice they give is, one time they said, 'Now really try this time, [patient name]. Really try'. And I was like 'alright'. They just signed the prescription and I take it away and try, so that was that.*
>
> *Knowles et al.,[131] SRB, smoking*

In a rehabilitation centre, a typically intense setting, care was not perceived as being supportive enough:

> *All they did was throw books and papers at you and told you to do this and talk about health, health food, and nothing about yourself.*
>
> *Maisto* et al.,[133] *MRB, alcohol and drug use*

Access to appropriate resources and practical barriers were other features of environmental barriers. The cost of healthy food was raised as a barrier to changing dietary behaviours. This may be common among a SMI population on a fixed income:

> *If you buy fresh, raw vegetables, they're expensive. And I'm on a fixed income.*
>
> *Jimenez* et al.,[126] *MRB, physical activity and diet*

Locating suitable spaces for physical activity was also a common problem that affected participants' ability to regularly and effectively take part in physical activity:

> *When we're at [nursing facility], you could go on a long walk, but it's all the way around the building and then you can't really stop anywhere to rest.*
>
> *Huck* et al.,[125] *SRB, physical activity*

Barriers can mount up and environmental constraints can be multiplicative, such as when bad weather impeded taking outdoor exercise among those with a relatively low tolerance for exercise:

> *. . . I was out walking and focusing on my diet. And then I got sloppy with that. I don't like to walk in the mall, and I don't like to walk in the cold, the rain.*
>
> *Yarborough* et al.,[147] *MRB, physical activity and diet*

Experiences of behaviour change interventions and success
This theme draws together data on participants' experiences of behaviour change interventions. In addition, more general benefits beyond the duration of a behaviour change intervention are also incorporated.

Tailoring interventions to severe mental illness populations
The most prominent intervention consideration reported by people with SMI was the role of mental health and SMI symptoms in behaviour change, as described in the subtheme of individual barriers to behaviour change. Symptoms of paranoia and delusion were highlighted as challenging for receiving information in one study that investigated perceptions of a population health intervention, for antismoking, in people with SMI.[142] This was the only study to consider the impacts of a population health intervention in this group. People with mental health problems are just as willing to bring about positive behaviour change as the general population. However, for some people with SMI, assistance in organising and structuring their lives to help them engage in positive behaviour change was seen as a vital first step:

> *[Talking in third person] because it's not that they can't think for themselves in the same way as other people, but it's more a case of they can't organise themselves or their thoughts in the same way as other people.*
>
> *Knowles* et al.,[131] *SRB, smoking*

In this sense, the structure and organisation of interventions themselves were positively associated with a greater sense of order and regularity on the part of participants. Engaging with an intervention created a basic schedule for participants:

> *[G]roups run regularly . . . there's a schedule every week.*
>
> *Maisto* et al.,[133] *MRB, alcohol and drug use*

The structure provided by this was touched on in different ways, and described as helping to provide order to life more generally:

> It means, how shall I say it? Maybe a bit more order in my life. You see, I have Tuesday and Thursday and I know that time I will . . . That will be, yes . . .
>
> *Forsberg* et al.;[121] *MRB; physical activity, diet, alcohol, drug use, smoking*

A feature of structure that was present in some interventions was record keeping, particularly for diet and physical activity, but also applied to other behaviours. Having this organisational reference point seemed to link with self-education about personal health:

> Well, it wasn't until I started writing things down that I realized my intake was terrible.
>
> *Yarborough* et al.,[147] *MRB, physical activity and diet*

Participants suggested that the routine and structure gained from interventions were important to continuing progress beyond the intervention:

> Some of the most helpful things, it's a combo, the structure and the day-to-day routine that I developed there. It has helped me for when I'm on my own.
>
> *Luciano* et al.,[132] *MRB, alcohol and drug use*

Such organisation was also interpreted as applicable to participants' cognitive approach:

> [B]y maintaining an active, healthy lifestyle, helps me take the reins of my life [. . .].
>
> *Jimenez* et al.,[127] *MRB, physical activity and diet*

Knowledge and skills to enact behaviour change

Psychoeducation and knowledge provision components were common among interventions. In studies, individuals reported awareness of the consequences of risk behaviours:

> As [service provider] has told me, if I don't start [exercising], COPD [chronic obstructive pulmonary disease], and that's all I got to say.
>
> *Huck* et al.,[125] *SRB, physical activity*

However, people with SMI may be less informed about behaviour change strategies and healthy choices. Some participants found education necessary, and being taught skills to practice healthy behaviours was enabling and enhanced their self-efficacy. While in a physical activity intervention, fear of incorrectly implementing change as a result of a lack of knowledge was prohibitive to taking action:

> SMART [self-management and recovery training] gave me the information I needed no matter what I did.
>
> *Penn* et al.,[138] *SRB, alcohol*

> There are different ways to walk. It was a big step because I have a lack of knowledge of what is good.
>
> *Rönngren* et al.,[140] *MRB, physical activity and diet*

The way in which knowledge was imparted by providers was also crucial to how participants responded to advice and encouragement. Non-tailored communication was especially obstructive and led to disengagement from positive behaviour change:

> Sometimes I don't understand [my therapist]. I let her say what she's got to say, and I just stay quiet.
>
> *Maisto* et al.,[133] *MRB, alcohol and drug use*

In other instances, participants recalled that providers had withheld information and not prepared them for what was to come, leading to only partial engagement in activities that they would have preferred to excel at:

> *I wish I had been pushed more, it would have been good if I could have been on Survivor on TV.*
> *Wärdig et al.,[144] MRB; physical activity, diet, alcohol use and smoking*

Physical activity was often referred to as a work in progress, that led to incremental change over time:

> *We did some small things and then we built up . . . we just walked around the back alley way quite a few times . . . flat ground so we didn't have to walk up hills . . .*
> *Fogarty and Happell,[120] SRB, physical activity*

Being prepared to experience physical exertion was cited as a necessary precursor to taking exercise, as individuals who were not comfortable might disengage before starting. Other paths to exercise were reliant on taking personal responsibility for following advice:

> *The program works if you follow the steps and the things you do. You get what you put into it I guess.*
> *Luciano et al.,[132] MRB, alcohol and drug use*

Intentions to enact behaviour change were also prompted in response to receipt of educational interventions that focused on the poor health consequences of negative health behaviours:

> *I learned a lot of stuff from the group . . . like how . . . beer and alcohol . . . [do] to your body . . . I'm going to be more careful . . .*
> *Maisto et al.,[133] MRB, alcohol and drug use*

> *Finding out that I'm a borderline diabetic . . . about six months ago . . . was also a push too.*
> *Yarborough et al.,[147] MRB, physical activity and diet*

A counterpoint to this sense of personal responsibility to change was noted in responses to public health antismoking campaigns, whereby shocking facts and imagery did not prohibit smoking; instead, people interpreted the risks as possible outcomes that were unlikely to affect them:

> *One's [antismoking campaign] sitting right in front of me and I'm still smoking a cigarette, but yeah there is a lot of campaigns to scare people from smoking.*
> *Thornton et al.,[142] SRB, smoking*

For others, the risk of poorer health outcomes was divorced from a sense of responsibility for their own health; instead, they perceived the likelihood of being unwell as being inevitable:

> *[S]ometimes I think it's in my DNA that . . . everything has been harder for me.*
> *Heffner et al.,[123] SRB, smoking*

Group delivery formats
A subtheme emerged about the merits of group delivery of interventions, and is related to broader themes about social motivations for behaviour change. This subtheme particularly highlighted the importance of how group formats fostered peer support and engendered a sense of togetherness:

> *I think a big part, if you're going to deal with this, is to have people in the same boat with you. That helped – I didn't know anyone else that would have been a dual diagnosis.*
> *Luciano et al.,[132] MRB, alcohol and drug use*

From bonding and togetherness came trust and understanding among participants and signalled how group delivery could also facilitate more tailored delivery to meet the needs of people with SMI. For example, in one study, it was reported that one individual experienced panic attacks during sessions. Peers understood their reactions and knew 'to leave me alone in that situation or come over and have a quick word or maybe give me a quick nudge to get back on the pitch, and I just think it's cus they know [pause] about your needs' (Hodgson *et al.*,[124] SRB, physical activity). Put simply, peers 'know where you're coming from' (Maisto *et al.*,[133] MRB, alcohol and drug use).

Another feature of group-based interventions was the point of comparison they provided. Within a group of peers experiencing the same intervention, there is an inherent comparison:

> [M]eeting once a week and comparing notes with people, and knowing that I'm not alone with all these obstacles, and that there are people that care.
>
> *Yarborough* et al.,[147] *MRB, physical activity and diet*

This could be a negative, as peers may also police engagement in interventions, as reported in a lifestyle intervention:

> Half of them don't listen. Many of them didn't even wear that pedometer, and I always wore mine. Even when I slept I wore it. I think I was the most diligent one of us all.
>
> *Wärdig* et al.,[144] *MRB; physical activity, diet, alcohol use and smoking*

Choices and adapting interventions to suit the individual

In the context of group interventions, it was apparent that, for some participants, the chance to draw up personalised approaches to behaviour change was an important driver for success. This was especially apparent among those taking part in physical activity interventions:

> It was good that we got to choose something out of like a list. We could have done all different things . . . I thought the options were quite good. But I would have like to have done boxercise as well.
>
> *Firth* et al.,[119] *SRB, physical activity*

Forewarning about the nature of interventions was also highlighted as critical to making informed choices about taking part in interventions:

> [P]eople turn up and then it's not right for them . . . if they'd had the information . . . they wouldn't have come, well waste their time really . . .
>
> *Roberts and Bailey,*[139] *MRB, other – weight*

Because individuals favoured interventions that offered choice, they adapted activities to suit their needs and capabilities, for example incorporating physical activity into their daily routine:

> This [exercise] is a really challenging thing for me. What I do is doing errands. I walk from place to place rather than take the bus and the train.
>
> *Jimenez* et al.,[126] *MRB, physical activity and diet*

Providers can help facilitate the tailoring of activities so that they are suitable for each individual:

> The health co-ordinators were great people who made everything feel spontaneous. They were good at finding the right level for each and every one.
>
> *Wärdig* et al.,[144] *MRB; physical activity, diet, alcohol use and smoking*

There were instances, however, when interventions had competing priorities owing to the focus on multiple risk behaviours; the delivery of such interventions did not always map to individual needs and preferences:

> [T]he walking [is helpful]. The exercise portion of the group, that can get set on the back burner. And I don't think it should be.
>
> *Yarborough* et al.,[147] *MRB, physical activity and diet*

Purpose to activity

Among studies, a subtheme on intervention activities providing a sense of purpose emerged:

> It's just that I've got an activity for the afternoon that I'm not sat watching TV, something like that.
>
> *Carless and Douglas,[118] SRB, physical activity*

Similarly, in two studies, interventions were seen as providing something to look forward to:

> [G]roup gives you a place to be, a reason to be there.
>
> *Maisto* et al.,[133] *MRB, alcohol and drug use*

> It's a routine you get used to I think. It's like football, I get excited about football on a Monday.
>
> *Carless and Douglas,[118] SRB, physical activity*

More broadly, the purpose of activity also related to the concepts of loneliness (see *Barriers to behaviour change, Social factors*). Purposeful activity could help resolve loneliness.

Valued benefits of behaviour change interventions

Across studies, the benefits of behaviour change interventions extended beyond health outcomes, with participants reporting improvements in well-being and ability to navigate day-to-day life. Interventions featuring physical activity were particularly prominent in this subtheme.

Cognitive benefits of behaviour change interventions included memory and decision-making:

> My memory has returned.
>
> *Rönngren* et al.,[140] *MRB, physical activity and diet*

> I wouldn't make any decisions, I was too worried about making the wrong one. I was very scared [pause] of stepping on people's feet and just everything like that, … now I just get on with it.
>
> *Hodgson* et al.,[124] *SRB, physical activity*

Valued benefits of intervention experiences also included opening doors for individuals' everyday functioning and socialising, with greater control over their lives. As interventions were structured, this, in turn, gave individuals a sense of order over their lives. It can be through simple routine to daily life, or returning to education, work and hobbies:

> I'm going to school, I'm looking for work, I go home every other week to see my family. I run, I've really gotten into that. I have friends now, I go fishing twice a week …
>
> *Luciano* et al.,[132] *MRB, alcohol and drug use*

> [B]y maintaining an active, healthy lifestyle, helps me take the reins of my life and have a connection with the outside and inside world.
>
> *Jimenez* et al.,[127] *MRB, physical activity and diet*

Some of the most generally affecting and prevalent benefits reported in the data were improved confidence, self-esteem and optimism. Confidence was described as part of a package of cognitive and emotional changes:

> *I think I'm in a much better mood . . . I am up, I'm confident, I'm sleeping well, my appetite is good, my self-esteem is healthy . . . I have a brighter outlook, you know.*
>
> *Heffner* et al.,[123] *SRB, smoking*

> *SMART [self-management and recovery training – the intervention] gave me pride. It showed me how to get self-worth. It was basically building me up in order to be receptive to everything else. It started with me.*
>
> *Penn* et al.,[138] *SRB, alcohol*

Participants' expressions of excitement and fulfilment in achieving change could bring about greater confidence that, in turn, acted as a spur to continue to engage with interventions:

> *I love it. It's just like, thinking yeah, I couldn't do this 4 months ago, now look at me doing it comfortably. Let's throw it up a gear!*
>
> *Firth* et al.,[119] *SRB, physical activity*

This positive change, was summed up in feeling the beginning of a fresh start:

> *I feel like this program has benefited me and I feel like I've got my second wind out of this program.*
>
> *Fogarty and Happell,*[120] *SRB, physical activity*

Chapter 6 Integration of quantitative and qualitative findings

*T*able 5 presents a matrix comparing the findings of the qualitative and quantitative studies included in our systematic review. We investigated whether or not overall themes and subthemes from the synthesis of qualitative studies were investigated in the quantitative data. We noted narratively if there was any overlap and investigated whether or not it was possible to conduct meta-regression analyses, component NMAs or multivariate meta-analyses related to these themes. When qualitative and quantitative data overlapped, we assessed the relationship according to four categories: silence (no overlap), partial agreement (complementary findings), agreement (coherence between quantitative and qualitative data) and dissonance (conflicting findings from quantitative and qualitative data). When there was overlap in quantitative and qualitative data but the relationship between the findings was unclear, we categorised this as inconclusive.

TABLE 5 Comparing the overlap and agreement between included qualitative and quantitative data

Themes from qualitative studies	Were the themes from the qualitative studies addressed in the quantitative studies?	Comparing quantitative and qualitative data
Interaction of mental and physical health		
Health behaviours improving mental health and well-being: engaging in healthy behaviours was reported to improve mental health. In addition, mental health symptoms were reported as a barrier to engaging with behaviour change	Partially, although trials focusing on improving physical health outcomes also measured mental health outcomes. However, interactions between these outcomes were not assessed	Partial agreement: NMAs of mental health-related quality of life included nine trials that targeted smoking alone; diet and physical activity; or diet, physical activity, alcohol and smoking. These studies show that there is currently no evidence that trying to improve physical health worsens mental health
Being considered holistically: participants reported that interventions were sometimes experienced as impersonal and not taking into account the needs of the person as a whole	No – we did not identify intervention content that specifically reported emphasising the importance of considering people holistically	N/A
Self-medicating: participants reported using smoking, alcohol and cannabis as a way of managing their mental health	No – we did not identify intervention content that specifically reported targeting self-medicating	N/A
Motivational contexts and barriers to change		
Individual: importance of personal motivations for change. These included managing health, improving physical appearance and working to a positive future • Barriers included concentrating when receiving complex educational materials, mental health symptoms affecting motivation, stigma about body image	Partially – several studies included BCTs related to identifying individual motivations or barriers. However, the focus of the qualitative studies and quantitative studies was quite different	Inconclusive – there were insufficient data to explore this further in component NMAs

continued

TABLE 5 Comparing the overlap and agreement between included qualitative and quantitative data (*continued*)

Themes from qualitative studies	Were the themes from the qualitative studies addressed in the quantitative studies?	Comparing quantitative and qualitative data
Social: feedback and reinforcement from family and friends was often motivating, group interventions sometimes led to a sense of belonging with peers	BCTs related to social support were common in quantitative studies	Inconclusive – it was inconclusive whether or not social support improved effectiveness based on component NMAs
• Family and friends could also act as barriers when they encouraged unhealthy behaviours; others reported lack of social support as a barrier		
Environmental: some reported the importance of a safe and stable place as a foundation for change, an intervention could also provide a schedule and structure that helped facilitate change	Not specifically addressed in quantitative studies	N/A
• Environments could also act as triggers for unhealthy behaviour: group homes sometimes led to unhelpful sharing of previous experiences with substance use, lack of space and resources were reported as barriers to physical activity		
Experiences of behaviour change interventions		
Tailoring interventions to SMI: some mentioned the need for extra help with providing structure and organisation as a platform for change	Several studies reported tailoring interventions for the benefit of people with SMI. Although tailoring was mentioned in some quantitative studies, authors generally did not report the tailoring process with much detail	Inconclusive: it was inconclusive whether or not tailoring interventions to SMI improved effectiveness based on component NMAs
Knowledge and skills to enact behaviour change: education and skills training was reported as important for motivating and equipping people to change	Several studies included BCTs related to knowledge and skills	• Agreement: component NMAs found that instruction on how to perform the behaviour was associated with weight loss (-2.10 kg, 95% CrI -3.42 to -0.45 kg) and reduced BMI (-1.19 kg/m^2, 95% CrI -1.85 to -0.55 kg/m^2) • Inconclusive: however, it was inconclusive as to whether or not information about health consequences was associated with weight loss (-0.94 kg, 95% CrI -2.75 to 1.36 kg) or reduced BMI (0.05 kg/m^2, 95% CrI -1.23 to 1.29 kg/m^2) • Inconclusive: it was also inconclusive if demonstration of the behaviour was associated with reduced BMI (-0.94 kg/m^2, 95% CrI -2.75 to 1.30 kg/m^2), and there were insufficient data to assess impact on weight loss

TABLE 5 Comparing the overlap and agreement between included qualitative and quantitative data (*continued*)

Themes from qualitative studies	Were the themes from the qualitative studies addressed in the quantitative studies?	Comparing quantitative and qualitative data
Group delivery formats: some reported that group-based interventions promoted peer support, a feeling of belongingness and togetherness, and a useful point of comparison	Several quantitative studies were group focused and others were largely individual focused, providing opportunities to compare the impact on effectiveness of these delivery methods	• Disagreement/partial agreement: meta-regression analyses found that individual-focused interventions were associated with greater weight loss (−2.70 kg, 95% CrI −4.69 to −0.75 kg) and reduced BMI (−1.11 kg/m^2, 95% CrI −2.15 to −0.01 kg/m^2) • However, although quantitative data highlight the benefits of individually based interventions, they cannot rule out benefits of group interventions
Choices and adapting the intervention to suit the individual: the importance of adapting interventions for the needs and preferences of those participating	Partially: a small number of interventions sought to tailor intervention content and risk behaviour targets to the individual	Silence: there were insufficient studies to explore the impact of such approaches on effectiveness
Purpose to activity: some reported that interventions provided an overall sense of purpose beyond changing specific targeted behaviours	Not specifically addressed	Silence: no overlap between quantitative and qualitative studies
Valued benefits of behaviour change interventions: some reported experiencing additional benefits beyond the interventions, including greater confidence and wanting to build on what they'd already achieved	Not specifically addressed	Silence: minimal overlap between quantitative and qualitative studies

N/A, not applicable.

Interaction of mental and physical health

Health behaviours improving mental health and well-being
There were insufficient quantitative data to explore whether or not engaging in healthy behaviours (e.g. physical activity) contributed to mental well-being as characterised in the synthesis of qualitative studies. Trials did not directly assess the impact of improved physical health on mental health outcomes.

Another way of looking at this relationship between physical and mental health is to assess whether or not engaging in a behaviour change intervention is associated with a deterioration of mental health outcomes. Importantly, neither the quality of life nor PANSS outcomes found evidence that interventions targeting smoking; diet and physical activity; or diet, physical activity, alcohol and smoking led to deterioration of mental health symptoms or quality of life. However, as acknowledged previously, the data are currently limited and future research could change these conclusions.

Being considered holistically
The primary outcome in most intervention studies was either behavioural (e.g. smoking) or primarily related to markers of physical health (e.g. weight, BMI, blood pressure). This focus reflects the importance that researchers have placed on tackling the public health challenge of improving the physical health of people with SMI.

However, this subtheme from the synthesis of qualitative studies highlights that people with SMI may value responses to this public health challenge differently. Many people with SMI reported more holistic goals for well-being encompassing both physical and mental health. Attempts to change risk behaviours sit in a complex context of mental health, lifestyle and environment that interact with behaviours and affect the individual experience of change.

This difference in emphasis in the quantitative studies is reflected in the focus on outcomes related to those behaviours targeted in interventions. For example, quality of life was rarely a primary outcome (Gaughran *et al.*[67] was an exception). Mental health outcomes were even less often reported in health risk behaviour intervention studies, once more reflecting a slightly different focus in these interventions than that reported in the qualitative data.

The lack of overlap between the experiences of people with SMI and intervention design suggests that future intervention trials may benefit from greater input from people with SMI in both designing and delivering interventions.

Self-medicating

Another subtheme from the qualitative studies was the perception among participants that smoking, alcohol use and drug use played a role in managing their mental health symptoms (i.e. 'self-medicating'). This was indirectly targeted in some studies (e.g. by including BCTs related to mental health symptoms such as reducing negative emotions) or assessing whether or not participants increased cannabis use after quitting smoking.[69] However, interventions rarely reported strategies for tackling the problem of self-medicating directly.

Motivational contexts and barriers to change

For the sake of brevity, we considered motivational contexts and barriers to change in combination in this analysis, as there was a large overlap in content between the quantitative and qualitative findings.

Individual motivations and barriers to change

Evidence from the synthesis of qualitative studies identified a range of individual factors that acted as motivations or barriers to change. Several trials sought to address these factors using BCTs such as problem-solving, and pros and cons.

We investigated the impact of BCTs on outcomes using component NMAs. There were sufficient data for only weight and BMI outcomes. The component NMAs were inconclusive in terms of whether or not including these BCTs was associated with effective reduction of weight or BMI.

Social motivations and barriers to change

Evidence from the synthesis of qualitative studies identified a range of social factors that acted as motivations or barriers to change. Family and friends, as well as fellow participants in interventions, were often identified as sources of motivation to engage in behaviour change. However, these same people could also be unsupportive and overly critical, and their presence could act as barriers to change.

Several quantitative studies sought to use social support as a positive factor for encouraging behaviour change. These interventions included BCTs such as social support (unspecified), social support (practical) and social support (emotional).

There were sufficient data to explore the impact only of social support (unspecified) in component NMAs of weight and BMI. However, these analyses were inconclusive on the benefits of this BCT.

Environmental motivations and barriers to change

Qualitative studies reported the importance of environmental factors acting as barriers to change (e.g. participants sharing 'war stories' about previous use of alcohol and other drugs). We did not identify any quantitative studies that specifically addressed these barriers. In addition, it was not possible to assess if such barriers lead to unintentional adverse effects in interventions.

Participants also reported interventions as providing a helpful structure and accountability that helped them to engage in healthier behaviours. Although this was not specifically assessed in quantitative studies, the qualitative data provide further insights into contextual factors associated with intervention delivery that may have an impact on effectiveness. This further highlights the importance of including process measures in assessments of the delivery of BCT interventions.

Experiences of behaviour change interventions

Tailoring interventions to people with severe mental illness

One of the subthemes from qualitative studies was the need to tailor interventions for people with SMI. Various aspects of tailoring were discussed, including additional help to organise thoughts. Some reported difficulty with concentrating and also the challenge of accepting information when experiencing delusions. Others reported that interventions provided structure, routine and accountability that helped them to put into practice what they had learnt.

Although some quantitative studies reported tailoring interventions for people with SMI, often, little detail was reported. Therefore, although we could assess the impact of tailoring of interventions in the meta-regression analyses, it was difficult to tell the extent to which types of tailoring reported in qualitative studies mapped onto those reported in quantitative studies.

The meta-regression analyses found that there was insufficient evidence from quantitative studies to confirm that studies reporting tailoring of interventions for people with SMI were more effective in reducing weight or BMI.

Knowledge and skills to enact behaviour change

There was clearer agreement between the quantitative and qualitative evidence on the need for knowledge and skills acquisition as part of a behaviour change intervention. Qualitative studies found that people with SMI valued learning how to engage in more healthy behaviours and how to build on incremental changes.

This was confirmed in the component NMAs in which the BCT instruction on how to perform a behaviour was associated with effectiveness in reducing weight and BMI. However, the impact of the BCTs 'information about health consequences' and 'demonstration of the behaviour' were inconclusive in the component NMAs.

Group delivery formats

Data from qualitative studies identified several benefits of group interventions, including fostering peer support and providing a point of comparison to assess progress in changing a behaviour. However, a disproportionate number of included studies in the synthesis of qualitative studies were focused on experiences of group interventions. Therefore, the reported benefits of these interventions may have been over-represented in the review.

The meta-regression analyses that focused on delivering interventions to individuals were found to be more effective than interventions that focused on group delivery to reduce weight and BMI. This does not necessarily rule out the benefits of group interventions, but it may suggest that the benefits of group interventions (in terms of outcome) are different from those of individual interventions.

Therefore, it may be important for interventions to build on the different strengths of group-delivered and individually delivered approaches.

Choices and adapting the intervention to suit the individual

The value of adapting interventions to the needs and abilities of the person was commonly reported in qualitative studies.

However, there were insufficient studies that reported choice of which behaviours/activities to focus on, or adaptation of intervention content, to assess their impact on outcomes. Qualitative studies may have identified subtle distinctions in delivery between individuals that are not straightforward to quantify, but that may still be important when supporting people with SMI to change their behaviour.

Purpose to activity

Another subtheme from qualitative studies was that interventions provided a sense of purpose and routine to life. These wider benefits of interventions are difficult to quantify and, therefore, tend not to be addressed in quantitative research, although literature on the importance of purpose and its association with health outcomes is beginning to emerge.[151]

Valued benefits of behaviour change interventions

Other wider benefits of behaviour change (e.g. improvement in memory and cognition, self-esteem) were reported in qualitative studies. These broader outcomes were not commonly measured as part of quantitative studies, so we know little about these broader impacts in controlled studies.

Chapter 7 Patient and public involvement and dissemination of findings

Patient and public involvement

People with lived experience of SMI and carers significantly contributed to every stage of the project. Sophie Corlett (Director of External Relations, Mind) provided oversight on the progress of the project as a member of our multidisciplinary advisory group (including Dr Ian Kellar, health psychologist, University of Leeds; Dr Peter Coventry, health services researcher, University of York; Dr Stephen Wright, psychiatrist, Tees, Esk and Wear Valleys NHS Foundation Trust; and Professor Paul French, psychiatrist, Manchester Metropolitan University).

In January 2019, we presented the aims of the project and received feedback on the protocol from the York Service User Network (a PPI group connected to Tees, Esk and Wear Valleys NHS Foundation Trust).

We also formed two PPI groups that met throughout the course of the project. One group began meeting in York and consisted of four members, chaired by a carer for a relative with SMI (DS), one peer researcher (CD) and a peer researcher who is also a carer (HK). One further group member (a carer) was no longer able to attend after the first meeting because of other commitments.

We also regularly met with two peer researchers (MS and GJ) who are members of the Lived Experience Research Collective hosted by the Mental Health Foundation.

All the members of our PPI groups were included as authors of the report, reflecting their substantial contribution to the project. The PPI groups decided on the name of the project (HEALTH study), provided extensive comments on the protocol, contributed to interpretations of the study results, played a key role in disseminating the findings of the project, participated in the webinar and provided feedback on an animation summarising the findings of this project.

Dissemination activities

A study-specific Twitter account (@UoY_HEALTH_SMI, run by HM) (www.twitter.com; Twitter, Inc., San Francisco, CA, USA) was created and has developed a presence over the course of the study, engaging in promotion and dissemination activities, which are reported below.

On 2 March 2020, we published an article in *The Conversation* on the mortality gap in people with SMI.[152] At the time of writing (June 2020), the article had been read 14,742 times, with an audience mainly from the UK (1205 reads), USA (6785 reads) and India (2512 reads). The article was also widely shared on social media such as Twitter (14 times) and Facebook (737 times) (www.facebook.com; Facebook, Inc., Menlo Park, CA, USA).

We organised a webinar to communicate the findings of the study to people with SMI, carers, health and social care professionals, and researchers. To promote the webinar, peer researchers Gordon Johnston and Michel Syrett published a blog article in June 2020 on physical activity among people with SMI for the Mental Elf website.[153]

In addition, peer researcher Ceri Dare (see *Patient and public involvement*) was interviewed by Andre Tomlin for the Mental Elf website on 23 June 2020.[154]

On 24 June 2020, we live-streamed a webinar on Zoom (www.zoom.us; Zoom Video Communications, Inc., San Jose, CA, USA) and YouTube (www.youtube.com; YouTube, LLC, San Bruno, CA, USA).[155]

We received 128 registrations for the webinar, which included a combination of health professionals ($n = 56$), researchers ($n = 32$), people with lived experience ($n = 17$), family/carers ($n = 2$) and other ($n = 11$). Most were from the UK ($n = 116$). We posted the recorded webinar on YouTube[155] and received a further 100 views, at the time of writing.

We registered a hashtag (#HealthSMI) to monitor engagement with the webinar on Twitter. More than 100 people participated in the Twitter conversation. The webinar generated > 200 tweets and > 3,500,000 impressions.

The event was chaired by Andre Tomlin (the founder of the Mental Elf website) and included presentations from the research team (NM and HM), including a peer researcher (MS). There was a panel discussion with a carer, former general practitioner and researcher (DS); peer researcher (GJ); and a physiotherapist and researcher (Brendon Stubbs).

Audience members were also assigned to one of nine 'breakout rooms' for small group discussions on the implications for practice and research, facilitated by members of the research team (NM, HM, PC, ER, DS, SD and RC) and peer researchers (GJ and MS). Summaries and feedback from each small group were used to inform conclusions of the study. The webinar concluded with two Zoom polls (audience members rated their key implications for practice and further research) and a reflection from peer researchers (MS and GJ). Equal access for people with SMI to health risk behaviour interventions was, by far, the most popular implication for practice. Identifying how best to adapt health-promoting interventions for people with SMI was the most popular research recommendation.

We commissioned a production company to develop an animation summarising the findings of the study; this was disseminated through YouTube and Twitter from 7 July 2020.[156]

Through links with the UK Research and Innovation Closing the Gap Network, we have written an article summarising the findings from the synthesis of qualitative studies for the Equally Well blog, published on 11 August 2020.[157]

We also plan to continue disseminating the findings of the study in peer-reviewed publications in 2022.

Chapter 8 Discussion

Summary of findings

Summary of synthesis of quantitative studies

We identified a growing literature on smoking (eight trials were included in the narrative synthesis of smoking abstinence and seven trials were included in the narrative synthesis for number of cigarettes smoked). Interventions focusing on smoking alone were generally more effective than controls at increasing the odds of abstinence, whereas studies targeting smoking in addition to other risk behaviours (such as unhealthy diet, physical inactivity, alcohol misuse) did not find evidence of increased odds of abstinence. However, there was a great deal of conceptual heterogeneity, including the intensity of control groups and smoking interventions across trials.

Data on reducing the number of cigarettes smoked varied widely between studies. This made it difficult to draw conclusions on the clinical effectiveness of risk behaviour interventions for this outcome. For all other behavioural outcomes, data were limited.

By far the most commonly reported outcomes were weight (30 trials included in the NMA) and BMI (36 trials included in the NMA). Interventions targeting diet alone, physical activity alone or diet and physical activity concurrently all appeared to be effective in improving weight loss (e.g. any intervention vs. TAU: −2.10 kg, 95% CrI −3.14 to −1.06 kg) and BMI reduction (e.g. any intervention vs. TAU: −0.49 kg/m², 95% CrI −0.97 to −0.01 kg/m²). The magnitude of weight loss and reduction in BMI did not appear to differ substantially between studies targeting diet or physical activity alone and studies targeting diet and physical activity concurrently. We also did not find evidence of positive synergies in targeting diet and physical activity to promote weight loss or reduction in BMI.

Improvements in blood pressure and cholesterol outcomes as a whole were modest (e.g. systolic blood pressure, any intervention vs. TAU: −1.23 mmHg, 95% CrI −3.34 to 0.68 mmHg). However, in contrast to the other outcomes, targeting multiple behaviours appeared to result in greater improvements. Targeting diet (e.g. systolic blood pressure: 0.42 mmHg, 95% CrI −4.52 to 5.30 mmHg) or physical activity alone (e.g. systolic blood pressure: −0.26 mmHg, 95% CrI −5.43 to 4.97 mmHg) led to modest improvements, whereas effect estimates were higher in trials targeting diet and physical activity (e.g. systolic blood pressure: −1.56 mmHg, 95% CrI −4.42 to 0.98 mmHg) and also in trials targeting diet, physical activity, alcohol use and smoking (e.g. systolic blood pressure: −2.17 mmHg, 95% CrI −5.46 to 0.59 mmHg). This potentially reflects synergies in targeting multiple health behaviours in reducing systolic and diastolic blood pressure.

Fewer data were reported on quality of life and mental health outcomes. We found no evidence that interventions aiming to reduce physical health risk behaviours in people with SMI led to negative impacts on mental health (PANSS total score: 0.03, 95% CrI −2.56 to 2.65) or mental health-related quality of life (SMD −0.04, 95% CrI −0.14 to 0.06). However, there was also no evidence that interventions promoted physical health-related quality of life (SMD 0.06, 95% CrI −0.04 to 0.16).

There was limited overlap of BCTs in included studies, which reduced our ability to assess the impact on effectiveness and how BCTs interacted with one another. Goal-setting was associated with weight loss (−2.22 kg, 95% CrI −4.54 to −0.44 kg) and reduction in BMI (−1.85 kg/m², 95% CrI −2.91 to −0.69 kg/m²). Instruction on how to perform the behaviour was also associated with weight loss (−2.10 kg, 95% CrI −3.42 to −0.45 kg) and reduction in BMI (−1.19 kg/m², 95% CrI −1.85 to −0.55 kg/m²). Self-monitoring of behaviour was associated with reduction in BMI (−0.70 kg/m², 95% CrI −1.42 to 0.07 kg/m²), although it was not possible to rule out no benefit.

For BMI, we were able to include more interaction parameters in the model, and the interaction model appeared to fit the data better than the model that assumed BCTs acted independently of one another. However, all estimates of interactions were very imprecise, so we could not draw any conclusions on how the effects of specific BCTs interacted with each other.

Similarly, lack of reporting of data limited our abilities to explore the impact of other intervention and participant characteristics. However, we found that interventions focusing on delivery to individuals were more effective on weight loss than group-delivered interventions (–2.70 kg, 95% CrI –4.69 to –0.75 kg) and reduction in BMI (–1.11 kg/m^2, 95% CrI –2.15 to –0.01 kg/m^2).

Summary of synthesis of qualitative studies

We used the CERQual approach to rate the certainty of the evidence. All themes were rated to be of moderate certainty.

Interaction of mental and physical health

Participants reported that engaging in health behaviours improved their mental health and well-being, and mental health changes affected their engagement with healthy behaviours. Participants in the included studies wanted to be treated holistically, and sometimes felt that interventions had an impersonal focus on behaviours rather than people. There were also data reporting the use of smoking, alcohol use and drug use to help manage mental health symptoms.

Motivational contexts for behaviour change

A range of individual factors were reported to be personally motivating. These included managing health, improving physical appearance and working towards a positive future. Family and friends were also an important source of motivation, providing feedback and reinforcement of positive change. However, others could also be discouraging when they were careless with their words or actions. Interventions were interpreted as a safe and stable place to work on changing their unhealthy behaviours, also providing a schedule and accountability, which helped to make changes.

Barriers to behaviour change

Mental health symptoms affected individuals' ability to change. For example, it can be difficult to engage in physical activity when feeling a lack of motivation and low mood related to mental health state, likewise with difficulty concentrating when receiving information related to health. However, mental health symptoms were not the only factors affecting motivations. A general lack of motivation to change unhealthy behaviours was also unrelated to mental health for some. Stigma about body image was another factor considered to act as a barrier to change. Social support from family and friends, although often a positive influence, could also act as a barrier. For example, some family members encouraged unhealthy behaviours. Alternatively, a lack of social support was a barrier for persevering with behaviour change. Environmental factors could act as triggers for unhealthy behaviours (e.g. advertisements on television), as could living in group homes where peers shared their experiences of engaging in risk behaviours.

Experiences of behaviour change interventions

It was suggested that people with SMI needed additional help providing structure and assistance in organising their lives. This was considered an important aspect of tailoring interventions for people with SMI. Interventions providing education and imparting skills to promote healthy behaviours were also considered beneficial. Group interventions were helpful for building peer support and also as a point of comparison with others, which could be double-edged if used to police behaviour. Interventions that took into account the needs, abilities and preferences of participants were felt to be beneficial. A wealth of data reported that interventions had an impact on individuals' lives beyond just improving their health-related behaviours. For example, interventions sometimes provided a structure and purpose to everyday life. Interventions also helped to build confidence: if positive changes were made in one area of their lives, then it was thought possible in other aspects of life.

Integrative synthesis of quantitative and qualitative studies

The integrative synthesis generally showed limited overlap between quantitative and qualitative studies. Many of the themes in qualitative studies, such as importance of interventions benefiting the person as a whole rather than just specific health-related outcomes, were not directly addressed in quantitative studies. Similarly, qualitative studies reported that people with SMI engaging in physical activity interventions experienced wider benefits than simply improving their physical activity. Interventions often provided purpose and organisation to people's lives that affected their overall well-being. Although this was captured by trials measuring broader outcomes (such as quality of life) to some extent, interventions were rarely designed to take advantage of these benefits valued by many people with SMI. The lack of overlap between the quantitative and qualitative evidence may suggest the importance of people with SMI contributing to the design and delivery of interventions. Such interventions may go some way to addressing the needs and preferences of people with SMI, especially in relation to addressing both physical and mental health together.

Quantitative and qualitative studies agreed on the importance of gaining knowledge and skills to live healthier lives. This theme from the qualitative literature was backed up by the component NMAs that found that the BCT instruction to perform behaviour was associated with weight loss and reduction in BMI.

Strengths and limitations of the review

Strengths

This systematic review had a number of strengths. As far as we are aware, this is the first systematic review comparing the clinical effectiveness of multiple and single health risk behaviour interventions among people with SMI using NMAs. This is also, to our knowledge, the first systematic review to examine the effectiveness of BCTs using component NMA in people with SMI.

In addition, as far as we are aware, this is the first systematic review of qualitative studies on experiences of a broad range of multiple risk behaviour interventions in people with SMI. This is also the first systematic review, to our knowledge, to have integrated quantitative and qualitative studies on this range of health risk behaviours in people with SMI.

Limitations

As noted previously, there were very limited data for most behavioural outcomes [diet, physical activity, alcohol use and drug use (e.g. cannabis use)]. This is surprising, given that these interventions are designed to change behaviour. Even if the primary outcomes of most trials were weight, BMI or clinically related outcomes (e.g. blood pressure, cholesterol), the mechanism by which interventions aimed to affect these outcomes was mainly through behaviour.

Most studies targeted diet and physical activity; therefore, we have limited data on studies targeting a single risk behaviour (e.g. unhealthy diet, physical inactivity, excessive alcohol consumption or drug use). Similarly, we have limited data on studies investigating the effects of interventions targeting a more extensive combination of risk behaviours. This limits our ability to draw conclusions on the comparative benefits of targeting risk behaviours in isolation or in combination.

There were sufficient data to compare any risk behaviour intervention with TAU for quality-of-life outcomes. However, the more complex models, with separate nodes for interventions targeting different BCTs, lacked data.

Similarly, there was limited overlap in the BCTs targeted between studies. This limited our conclusions on what BCTs were more effective and the extent to which their effects on outcomes interact.

No studies specifically focused on interventions for people from minority ethnic groups or assessed the impact of ethnicity on outcomes. Therefore, it is unclear whether or not ethnicity has an impact on the effectiveness of interventions.

There was a lack of overlap between quantitative and qualitative evidence. Therefore, it was difficult to assess the relationship between these sources of data.

A further limitation is that we did not search specifically for grey literature (other than conference abstracts indexed in electronic databases), and we were only able to assess studies in languages understood by the project team (i.e. English, French, German, Dutch, Spanish, Portuguese, Russian and Japanese).

Comparison with previous systematic reviews

One way to compare our findings is with systematic reviews of multiple risk behaviour interventions in the general population. A 2017 systematic review[10] in the general population found a more developed literature on behavioural outcomes. Multiple risk behaviour interventions were associated with improvements in fruit and vegetable intake, fat intake, total physical activity and moderate/vigorous physical activity. However, the current review found very limited reporting of behavioural outcomes.

In both reviews, comparable data were available on weight and BMI. However, the method of analysing multiple risk behaviour interventions differed a little. The general population review combined all interventions targeting weight (−0.59 kg, 95% CI −1.02 to −0.16 kg) and BMI (−0.27 kg/m^2, 95% CI −0.46 to −0.07 kg/m^2). In this current review, among people with SMI, we assessed the effectiveness of interventions targeting diet and physical activity for weight (−2.12 kg, 95% CrI −2.94 to −1.34 kg) and BMI (−0.53 kg/m^2, 95% CrI −1.07 to 0.04 kg/m^2), which suggested a slightly larger improvement in both than was observed by combining all interventions targeting these outcomes in the general population. We also assessed the effectiveness of interventions targeting diet, physical activity, alcohol misuse and smoking concurrently. This review found that these sorts of interventions resulted in a smaller reduction in weight (1.27 kg, 95% CrI −1.46 to 3.42 kg) and BMI (−0.02 kg/m^2, 95% CrI −1.05 to 0.98 kg/m^2) than was observed in the general population. Taken together, interventions among people with SMI appear at least as effective on weight loss and reducing their BMI as those among the general population.

It is also important to compare our findings with systematic reviews specifically on trials of people with SMI. A 2019 review[158] focusing on weight management in people with SMI found similar results to our current study. As above, methods of pooling data were a little different. Speyer et al.[158] conducted an analysis combining all interventions with all controls. They also found similar modest benefits on weight (−2.25 kg, 95% CI −3.01 to −1.42 kg) and BMI (−0.63 kg/m^2, 95% CI −1.02 to −0.23 kg/m^2).

There is a much wider literature on pharmacological interventions for promoting smoking cessation among people with SMI.[28] Although many of these trials provide additional behaviour change interventions (along with pharmacological interventions), the content is usually the same for both intervention and control groups; therefore, it is not possible to draw conclusions about the effectiveness of behaviour change interventions in this context. However, our findings are consistent with broader reviews of pharmacological and/or behavioural interventions[28] of smoking cessation, which also found that smoking cessation interventions were of similar effectiveness to those found in general population samples.

Systematic reviews of qualitative studies in this area on people with SMI have mainly focused on smoking cessation.[159] Despite the wider range of risk behaviours included in our review, there were many overlapping themes such as the importance of tailoring interventions, addressing the common perception that smoking helps manage mental health symptoms (when the relief experienced is likely attributable to relieving symptoms of nicotine withdrawal: the 'misattribution hypothesis') and the importance of social support.

Chapter 9 Conclusions

Implications for practice

This review found preliminary support for focusing on smoking alone rather than targeting smoking in combination with other behaviours. For weight loss and reduction in BMI, there did not appear to be evidence of synergies when targeting more than one health behaviour at a time, although targeting multiple health risk behaviours appeared to be more beneficial in reducing blood pressure. These findings are consistent with group discussions in our webinar on the importance of setting realistic targets for behaviour change. Targeting multiple risk behaviours may have the potential to make some feel overwhelmed.

This systematic review found no evidence that interventions promoting health behaviours were associated with deterioration in mental health symptoms or mental health-related quality of life. Group discussions and polls from our webinar suggested that this was a key finding. This was rated as the key implication for practice and was a common theme across our discussion groups. Many webinar participants noted that this evidence challenged the tendency towards a risk-averse approach that had low expectations of people with SMI making positive changes to health risk behaviours.

Another key implication from the systematic review was the need for communication between staff and people with SMI on the goals of health risk behaviour interventions. Qualitative data found that people with SMI favoured holistic approaches to well-being that integrated the promotion of physical and mental health, whereas the quantitative data, mainly led by researchers and health-care professionals, consisted of trials focused on smoking cessation and weight loss. This may reflect important differences in the aims of such interventions between people with SMI and professionals delivering interventions. Our webinar group discussion also provided important context to these challenges. Several webinar participants pointed out potential barriers to a more holistic approach. Mental and physical health care in many services are often provided separately, which makes it difficult to deliver holistic approaches, because of a lack of multidisciplinary teams. In addition, some staff spoke of the training needs of delivering integrated interventions that aimed to promote both mental and physical health.

Providing choice and adapting interventions for the needs of the individual were key implications from the qualitative data. These included taking into account the preferences and capabilities of each individual and taking into account the challenges of managing a mental health condition. Webinar group discussions emphasised the importance that 'one size does not fit all' and the importance of adapting interventions to best reflect the person.

Suggestions for further research

Identifying how best to adapt interventions for the needs of people with SMI was the key research recommendation identified in our webinar poll. Although qualitative data showed that people with SMI valued the adaptation of interventions, the trial data rarely investigated how best to tailor interventions (particularly in trials aiming to promote weight loss). A recent trial has shown the benefits of adapting smoking cessation interventions for people with SMI.[69] The many gaps between findings from the qualitative literature and the quantitative literature suggests the importance of future research being co-produced by people with SMI.

Future quantitative research should take advantage of qualitative evidence to inform future trials, as well as how to develop these. Elements of co-production were missing from the evidence base, and discussion with our PPI group highlighted the importance of stakeholder engagement from the beginning.

Another important suggestion for further research that emerged from group discussions and interactions during the webinar was the need for trials specifically targeting people with SMI who have recently received a diagnosis. Epidemiological evidence shows that weight gain increases exponentially in the first year after diagnosis. However, few trials in this review targeted participants at this stage in their lives. Future trials are needed to assess the clinical effectiveness of health risk behaviour interventions among people with SMI who have recently received a mental health diagnosis.

We also identified a lack of studies with follow-up data of at least 12 months post intervention, although current data suggests that, at ≤ 6 months' follow-up, BMI and weight loss are maintained. These findings need to be confirmed in future research to assess the long-term benefits of health risk behaviour interventions, as well as potential barriers such as the impact of episodic depression and anxiety or periods spent as an inpatient in a psychiatric facility.

We found few trials that directly compared interventions targeting multiple health risk behaviours with interventions targeting single health risk behaviours. As seen previously, targeting smoking alone may be more effective than targeting smoking in combination with other behaviours. Future research is needed to clarify which combinations of behaviours to target for interventions.

Acknowledgements

Publications

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Data-sharing statement

All data requests should be submitted to the corresponding author for consideration. Access to available anonymised data may be granted following review.

Patient data

This work uses data provided by patients and collected by the NHS as part of their care and support. Using patient data is vital to improve health and care for everyone. There is huge potential to make better use of information from people's patient records, to understand more about disease, develop new treatments, monitor safety, and plan NHS services. Patient data should be kept safe and secure, to protect everyone's privacy, and it's important that there are safeguards to make sure that it is stored and used responsibly. Everyone should be able to find out about how patient data are used. #datasaveslives You can find out more about the background to this citation here: https://understandingpatientdata.org.uk/data-citation.

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Appendix 1 Search strategies

Serious mental illness and multiple risk behaviours: literature searching 4 March 2020

The original searches were carried out in October 2018 using CENTRAL, EMBASE, MEDLINE, PsycInfo and the Science Citation Index. The searches identified 27,795 records, reduced to 18,513 records after deduplication using EndNote bibliographic software.

Updated searches were carried out in March 2020 using EMBASE, MEDLINE, PsycInfo and the Science Citation Index; these identified a further 2822 records, reducing to 1433 after deduplication. It was not possible to download records from CENTRAL because of issues with the database at the time of the updated searches (28 March 2020).

The strategies used for both the original and updated searches are reproduced here.

Cochrane Central Register of Controlled Trials via the Cochrane Library
Date range searched: from inception to 24 October 2018.

Date searched: 24 October 2018.

Records identified: 3370.

Search strategy
#1   MeSH descriptor: [Schizophrenia] explode all trees

#2   MeSH descriptor: [Bipolar Disorder] explode all trees

#3   MeSH descriptor: [Psychotic Disorders] explode all trees

#4   MeSH descriptor: [Affective Disorders, Psychotic] explode all trees

#5   ((acute or chronic* or persistent* or serious* or severe*) NEAR/2 (mental* or psych*) NEAR/2 (disease* or disorder* or disturbanc* or ill*)):ti,ab,kw (Word variations have been searched)

#6   (SMI NEAR/3 (individual* or inpatient* or in-patient* or outpatient* or out-patient* or patient* or people or person* or population*)):ti,ab,kw (Word variations have been searched)

#7   ((mental health or psychiatric) NEAR/2 (inpatient* or in-patient*)):ti,ab,kw (Word variations have been searched)

#8   (schizophren*):ti,ab,kw (Word variations have been searched)

#9   (psychotic or psychosis or psychoses):ti,ab,kw (Word variations have been searched)

#10   (bipolar):ti,ab,kw (Word variations have been searched)

#11   #1 OR #2 OR #3 OR #4 OR #5 OR #6 OR #7 OR #8 OR #9 OR #10

#12   (healthy NEAR/2 (diet* or eating)):ti,ab,kw OR (fruit* NEAR/2 (intake or consum* or increase or portion* or serving* or frequenc* or number* or preference* or choice*)):ti,ab,kw OR (vegetablet* NEAR/2 (intake or consum* or increase or portion* or serving* or frequenc* or number* or preference* or choice*)):ti,ab,kw OR ("5 a day"):ti,ab,kw OR ("five a day"):ti,ab,kw (Word variations have been searched)

#13   MeSH descriptor: [Feeding Behavior] explode all trees

#14   MeSH descriptor: [Food Preferences] explode all trees

#15   MeSH descriptor: [Nutrition Therapy] explode all trees

#16   MeSH descriptor: [Diet Therapy] explode all trees

#17   MeSH descriptor: [Diet] explode all trees

#18   MeSH descriptor: [Obesity] explode all trees

#19   MeSH descriptor: [Overweight] explode all trees

#20   #12 or #13 or #14 or #15 or #16 or #17 or #18 or #19

#21   #11 and #20

#22   (physical NEAR/3 (fit* or train* or activ* or endur*)):ti,ab,kw OR (exercis* NEAR/3 (fit* or train* or activ* or endur*)):ti,ab,kw OR ((promot* or uptak* or encourag* or increas* or start* or adher*) NEAR/3 (exercis* or gym* or sport* or fitness)):ti,ab,kw OR ((decreas* or reduc* or discourag*) NEAR/3 (sedentary or deskbound)):ti,ab,kw OR (sport* or walk* or running or jogging or bicycling or biking or swimming):ti,ab,kw (Word variations have been searched)

#23   (active NEAR/1 (travel* or transport* or commut*)):ti,ab,kw (Word variations have been searched)

#24   MeSH descriptor: [Physical Fitness] explode all trees

#25   MeSH descriptor: [Recreation] explode all trees

#26   MeSH descriptor: [Exercise Therapy] explode all trees

#27   MeSH descriptor: [Exercise] explode all trees

#28   MeSH descriptor: [Running] explode all trees

#29   MeSH descriptor: [Jogging] explode all trees

#30   MeSH descriptor: [Swimming] explode all trees

#31   MeSH descriptor: [Walking] explode all trees

#32   #22 or #23 or #24 or #25 or #26 or #27 or #28 or #29 or #30 or #31

#33   #11 and #32

#34   MeSH descriptor: [Smoke] explode all trees

#35   MeSH descriptor: [Smoking Cessation] explode all trees

#36   MeSH descriptor: [Smoking Reduction] explode all trees

#37   MeSH descriptor: [Nicotine] explode all trees

#38   MeSH descriptor: [Tobacco] explode all trees

#39   MeSH descriptor: [Tobacco Smoking] explode all trees

#40   MeSH descriptor: [Tobacco Use Disorder] explode all trees

#41   MeSH descriptor: [Tobacco Use Cessation] explode all trees

#42   MeSH descriptor: [Tobacco, Smokeless] explode all trees

#43   MeSH descriptor: [Tobacco Smoke Pollution] explode all trees

#44   MeSH descriptor: [Electronic Nicotine Delivery Systems] explode all trees

#45   (smoking or antismoking or anti-smoking):ti,ab,kw OR (smoker or smokers):ti,ab,kw OR ("electronic cigarette*" or e-cigarette* or e-cig or e-cigs):ti,ab,kw OR (vape or vapes or vaper or vapers or vaping):ti,ab,kw (Word variations have been searched)

#46   #34 or #35 or #36 or #37 or #38 or #39 or #40 or #41 or #42 or #43 or #44 or #45

#47   #11 and #46

#48   MeSH descriptor: [Alcohol Drinking] explode all trees

#49   MeSH descriptor: [Alcoholic Intoxication] explode all trees

#50   MeSH descriptor: [Alcoholic Beverages] explode all trees

#51   MeSH descriptor: [Drinking Behavior] explode all trees

#52   (beer* or wine* or cider* or alcopop* or spirit or spirits):ti,ab,kw OR (alcohol*):ti,ab,kw OR (drink* NEAR/2 (binge or excessive* or harm* or heavily or heavy or misus* or abus* or consum*)):ti,ab,kw OR (intoxicat* or inebriat* or drunk*):ti,ab,kw (Word variations have been searched)

#53   #48 or #49 or #50 or #51 or #52

#54   #11 and #53

#55   MeSH descriptor: [Substance-Related Disorders] explode all trees

#56   MeSH descriptor: [Inhalant Abuse] explode all trees

#57   MeSH descriptor: [Marijuana Abuse] explode all trees

#58   MeSH descriptor: [Substance Abuse, Intravenous] explode all trees

#59   MeSH descriptor: [Drug Users] explode all trees

#60   ((drug* or substance*) NEAR/2 (use* or using or abuse* or abusing or misuse* or misusing)):ti,ab, kw OR ((heroin or opiate* or cocaine or crack) NEAR/2 (use* or using or abuse* or abusing or misuse* or misusing)):ti,ab,kw OR ((cannabis or marijuana) NEAR/2 (use* or using or abuse* or abusing or misuse* or misusing)):ti,ab,kw OR ((benzodiazepine* or amphetamine* or methamphetamine* or MDMA or ecstasy) NEAR/2 (use* or using or abuse* or abusing or misuse* or misusing)):ti,ab,kw OR (solvent* NEAR/2 (use* or using or abuse* or abusing or misuse* or misusing)):ti,ab,kw (Word variations have been searched)

#61   ("street drug*" or "recreational drug*" or "illicit drug*"):ti,ab,kw OR (("prescri* drug*") NEAR/2 (use* or using or abuse* or abusing or misuse* or misusing)):ti,ab,kw OR ("polydrug use*"):ti,ab,kw OR ("inject* drug use*"):ti,ab,kw OR ((needle* OR syringe*) NEAR/3 shar*):ti,ab,kw (Word variations have been searched)

#62   #55 or #56 or #57 or #58 or #59 or #60 or #61

#63   #11 and #62

#64   #21 or #33 or #47 or #54 or #63

#65   (lifestyle NEAR/2 (intervention* or program*)):ti,ab,kw OR ("life style" NEAR/2 (intervention* or program*)):ti,ab,kw OR ("behavior* change" NEAR/1 (intervention* or program*)):ti,ab,kw OR ("behaviour* change" NEAR/1 (intervention* or program*)):ti,ab,kw OR ("risk factor*" NEAR/2 (program* or intervention*)):ti,ab,kw (Word variations have been searched)

#66   ("multifactorial lifestyle" NEAR/1 (intervention* or program*)):ti,ab,kw OR ("health behavior*" NEAR/1 (program* or intervention*)):ti,ab,kw OR ("health behaviour*" NEAR/1 (program* or intervention*)):ti,ab,kw OR ("health risk behavior*" NEAR/1 (program* or intervention*)):ti,ab,kw OR ("health risk behaviour*" NEAR/1 (program* or intervention*)):ti,ab,kw (Word variations have been searched)

#67   ("risk behavior*" NEAR/1 (program* or intervention*)):ti,ab,kw OR ("risk behaviour*" NEAR/1 (program* or intervention*)):ti,ab,kw OR ("health behavior* change intervention*"):ti,ab,kw OR ("health behaviour* change intervention*"):ti,ab,kw OR ("behavior* risk factor* intervention*"):ti,ab,kw (Word variations have been searched)

#68   ("risk behavior*" NEAR/1 (program* or intervention*)):ti,ab,kw OR ("risk behaviour*" NEAR/1 (program* or intervention*)):ti,ab,kw OR ("health behavior* change intervention*"):ti,ab,kw OR ("health behaviour* change intervention*"):ti,ab,kw OR ("behavior* risk factor* intervention*"):ti,ab,kw (Word variations have been searched)

#69   ("behaviour* risk factor* intervention*"):ti,ab,kw OR ("behavior* risk factor* program*"):ti,ab,kw OR ("behaviour* risk factor* program*"):ti,ab,kw OR ("risk behaviour* intervention*"):ti,ab,kw OR ("risk behavior* intervention*"):ti,ab,kw (Word variations have been searched)

#70   ("risk behaviour* program*"):ti,ab,kw OR ("risk behavior* program*"):ti,ab,kw (Word variations have been searched)

#71   #65 or #66 or #67 or #68 or #69 or #70

#72   #11 AND #71

#73   #64 OR #72.

EMBASE via Ovid® (Wolters Kluwer, Alphen aan den Rijn, the Netherlands)
Date range searched: 1974 to 19 October 2018.

Date searched: 22 October 2020.

Records identified: 6199.

Search strategy

1. exp schizophrenia/ (165,050)
2. exp bipolar disorder/ (55,219)
3. exp psychosis/ (253,831)
4. ((acute or chronic$ or persistent$ or serious$ or severe$) adj2 (mental$ or psych$) adj2 (disease$ or disorder$ or disturbanc$ or ill$)).ti,ab,kw. (18,709)
5. (SMI adj3 (individual$ or inpatient$ or in-patient$ or outpatient$ or out-patient$ or patient$ or people or person$ or population$)).ti,ab,kw. (1481)
6. ((mental health or psychiatric) adj2 (inpatient$ or in-patient$)).ti,ab,kw. (12,391)
7. schizophren$.ti,ab,kw. (151,316)
8. (psychotic or psychosis or psychoses).ti,ab,kw. (86,293)
9. bipolar.ti,ab,kw. (82,270)
10. 1 or 2 or 3 or 4 or 5 or 6 or 7 or 8 or 9 (373,041)
11. (healthy adj2 (diet$ or eating)).ti,ab,kw. (15,028)
12. (fruit$ adj2 (intake or consum$ or increase or portion$ or serving$ or frequenc$ or number$ or preference$ or choice$)).ti,ab,kw. (10,978)
13. (vegetable$ adj2 (intake or consum$ or increase or portion$ or serving$ or frequenc$ or number$ or preference$ or choice$)).ti,ab,kw. (11,216)
14. "5 a day".ti,ab,kw. (220)
15. "five a day".ti,ab,kw. (61)
16. ((food or diet$) adj (choice$ or frequenc$ or intake)).ti,ab,kw. (96,918)
17. Feeding behavior/ (74,811)
18. Food preferences/ (10,664)
19. exp diet/ (282,043)
20. obesity/ (370,339)
21. 11 or 12 or 13 or 14 or 15 or 16 or 17 or 18 or 19 or 20 (728,864)
22. (editorial or letter).pt. (1,616,116)
23. 21 not 22 (698,752)
24. (physical adj3 (fit$ or train$ or activ$ or endur$)).ti,ab,kw. (153,242)
25. (exercis$ adj3 (fit$ or train$ or activ$ or endur$)).ti,ab,kw. (47,156)
26. ((promot$ or uptak$ or encourag$ or increas$ or start$ or adher$) adj3 (exercis$ or gym$ or sport$ or fitness)).ti,ab,kw. (39,955)
27. ((decreas$ or reduc$ or discourag$) adj3 (sedentary or deskbound)).ti,ab,kw. (1664)
28. (sport$ or walk$ or running or jogging or bicycling or biking or swimming).ti,ab,kw. (311,717)
29. (active adj (travel$ or transport$ or commut$)).ti,ab,kw. (9344)
30. exp fitness/ (34,746)
31. exp recreation/ (61,858)
32. running/ (24,432)
33. jogging/ (1834)
34. swimming/ (19,775)
35. exp walking/ (101,072)
36. 24 or 25 or 26 or 27 or 28 or 29 or 30 or 31 or 32 or 33 or 34 or 35 (597,469)
37. (editorial or letter).pt. (1,616,116)
38. 36 not 37 (585,776)
39. exp smoking/ (343,129)
40. smoking cessation/ (52,639)
41. smoking reduction/ (65)
42. (smoking or antismoking or anti-smoking).ti,ab,kw. (283,613)
43. (smoker or smokers).ti,ab,kw. (116,016)
44. nicotine/ (41,696)
45. tobacco/ (41,521)
46. "tobacco use"/ (7462)

47. tobacco smoke/ (12,136)
48. electronic cigarette/ (3860)
49. (electronic cigarette$ or e-cigarette$ or e-cig or e-cigs).ti,ab,kw. (3825)
50. (vape or vapes or vaper or vapers or vaping).ti,ab,kw. (625)
51. 39 or 40 or 41 or 42 or 43 or 44 or 45 or 46 or 47 or 48 or 49 or 50 (486,274)
52. (editorial or letter).pt. (1,616,116)
53. 51 not 52 (462,985)
54. drinking behavior/ (44,511)
55. alcohol intoxication/ (11,353)
56. exp alcoholic beverage/ (25,943)
57. drinking behavior/ (44,511)
58. (beer$ or wine$ or cider$ or alcopop$ or spirit or spirits).ti,ab,kw. (42,083)
59. (alcohol$ adj2 (binge or excessive$ or harm$ or heavily or heavy or misus$ or abus$ or consum $)).ti,ab,kw. (90,980)
60. (drink$ adj2 (binge or excessive$ or harm$ or heavily or heavy or misus$ or abus$ or consum $)).ti,ab,kw. (23,956)
61. (intoxicat$ or inebriat$ or drunk$).ti,ab,kw. (60,002)
62. 54 or 55 or 56 or 57 or 58 or 59 or 60 or 61 (229,090)
63. (editorial or letter).pt. (1,616,116)
64. 62 not 63 (223,747)
65. exp drug dependence/ (210,017)
66. inhalant abuse/ (504)
67. cannabis addiction/ (8769)
68. ((drug$ or substance$) adj2 (use$ or using or abuse$ or abusing or misuse$ or misusing)).ti,ab,kw. (264,725)
69. ((heroin or opiate$ or cocaine or crack) adj2 (use$ or using or abuse$ or abusing or misuse$ or misusing)).ti,ab,kw. (21,470)
70. ((cannabis or marijuana) adj2 (use$ or using or abuse$ or abusing or misuse$ or misusing)).ti,ab,kw. (15,565)
71. ((benzodiazepine$ or amphetamine$ or methamphetamine$ or MDMA or ecstasy) adj2 (use$ or using or abuse$ or abusing or misuse$ or misuising)).ti,ab,kw. (11,819)
72. (solvent$ adj2 (use$ or using or abuse$ or abusing or misuse$ or misusing)).ti,ab,kw. (12,664)
73. (street drug$ or recreational drug$ or illicit drug$).ti,ab,kw. (17,283)
74. (prescri$ drug$ adj2 (use$ or using or abuse$ or abusing or misuse$ or misusing)).ti,ab,kw. (3309)
75. polydrug use$.ti,ab,kw. (1032)
76. inject$ drug use$.ti,ab,kw. (12,111)
77. (needle adj3 shar$).ti,ab,kw. (1633)
78. (syringe$ adj3 shar$).ti,ab,kw. (877)
79. 65 or 66 or 67 or 68 or 69 or 70 or 71 or 72 or 73 or 74 or 75 or 76 or 77 or 78 (464,270)
80. (editorial or letter).pt. (1,616,116)
81. 79 not 80 (449,328)
82. 23 or 38 or 53 or 64 or 81 (2,132,733)
83. 10 and 82 (49,143)
84. clinical trial/ (950,305)
85. randomized controlled trial/ (517,116)
86. randomization/ (79,616)
87. single blind procedure/ (32,661)
88. double blind procedure/ (153,895)
89. crossover procedure/ (56,850)
90. placebo/ (324,536)
91. randomi?ed controlled trial$.tw. (187,656)
92. rct.tw. (29,684)
93. random allocation.tw. (1857)

94. randomly allocated.tw. (30,836)
95. allocated randomly.tw. (2373)
96. (allocated adj2 random).tw. (875)
97. single blind$.tw. (21,697)
98. double blind$.tw. (191,182)
99. ((treble or triple) adj blind$).tw. (846)
100. placebo$.tw. (278,797)
101. prospective study/ (475,629)
102. or/84-101 (1,953,083)
103. case study/ (56,829)
104. case report.tw. (364,419)
105. abstract report/or letter/ (1,074,387)
106. or/103-105 (1,486,683)
107. 102 not 106 (1,903,347)
108. 83 and 107 (6687)
109. (animal/or animal experiment/or animal model/or animal tissue/or nonhuman/) not exp human/ (5,563,208)
110. (rat or rats or mouse or mice or swine or porcine or murine or sheep or lambs or pigs or piglets or rabbit or rabbits or cat or cats or dog or dogs or cattle or bovine or monkey or monkeys).ti. (1,984,529)
111. editorial.pt. or case report.ti. (838,717)
112. 109 or 110 or 111 (6,771,530)
113. 108 not 112 (6650)
114. (lifestyle adj2 (intervention$ or program$)).ti,ab,kw. (10,866)
115. (life style adj2 (intervention$ or program$)).ti,ab,kw. (523)
116. (behavior$ change adj (intervention$ or program$)).ti,ab,kw. (931)
117. (behaviour$ change adj (intervention$ or program$)).ti,ab,kw. (727)
118. (risk factor adj2 (program$ or intervention$)).ti,ab,kw. (1267)
119. (single risk factor adj2 (program$ or intervention$)).ti,ab,kw. (13)
120. (multifactorial lifestyle adj (intervention$ or program$)).ti,ab,kw. (22)
121. (health behavior$ adj (program$ or intervention$)).ti,ab,kw. (239)
122. (health behaviour$ adj (program$ or intervention$)).ti,ab,kw. (87)
123. (health risk behavior$ adj (program$ or intervention$)).ti,ab,kw. (5)
124. (health risk behaviour$ adj (program$ or intervention$)).ti,ab,kw. (0)
125. (risk behavior$ adj (program$ or intervention$)).ti,ab,kw. (70)
126. (risk behaviour$ adj (program$ or intervention$)).ti,ab,kw. (11)
127. health behavior$ change intervention$.ti,ab,kw. (108)
128. health behaviour$ change intervention$.ti,ab,kw. (52)
129. behavior$ risk factor$ intervention$.ti,ab,kw. (4)
130. behaviour$ risk factor$ intervention$.ti,ab,kw. (0)
131. behavior$ risk factor$ program$.ti,ab,kw. (0)
132. behaviour$ risk factor$ program$.ti,ab,kw. (0)
133. risk behaviour$ intervention$.ti,ab,kw. (9)
134. risk behavior$ intervention$.ti,ab,kw. (60)
135. risk behaviour$ program$.ti,ab,kw. (2)
136. risk behavior$ program$.ti,ab,kw. (10)
137. 114 or 115 or 116 or 117 or 118 or 119 or 120 or 121 or 122 or 123 or 124 or 125 or 126 or 127 or 128 or 129 or 130 or 131 or 132 or 133 or 134 or 135 or 136 (14,472)
138. 83 and 137 (222)
139. (animal/or animal experiment/or animal model/or animal tissue/or nonhuman/) not exp human/ (5,563,208)
140. (rat or rats or mouse or mice or swine or porcine or murine or sheep or lambs or pigs or piglets or rabbit or rabbits or cat or cats or dog or dogs or cattle or bovine or monkey or monkeys).ti. (1,984,529)

141. editorial.pt. or case report.ti. (838,717)
142. 139 or 140 or 141 (6,771,530)
143. 138 not 142 (222)
144. qualitative research/ (56,931)
145. qualitative.ti,ab. (231,093)
146. patient attitude/ (61,649)
147. feasibility study/ (98,850)
148. (accept$ or attitude$ or barrier$ or belief$ or believ$ or consider$ or experienc$ or facilitat$ or feasib$ or implement$ or option$ or preference$ or promot$ or view or views or viewpoint$).ti. (949,167)
149. 144 or 145 or 146 or 147 or 148 (1,269,494)
150. 83 and 149 (2676)
151. (animal/or animal experiment/or animal model/or animal tissue/or nonhuman/) not exp human/ (5,563,208)
152. (rat or rats or mouse or mice or swine or porcine or murine or sheep or lambs or pigs or piglets or rabbit or rabbits or cat or cats or dog or dogs or cattle or bovine or monkey or monkeys).ti. (1,984,529)
153. editorial.pt. or case report.ti. (838,717)
154. 151 or 152 or 153 (6,771,530)
155. 150 not 154 (2590)
156. 113 or 143 or 155 (8976)
157. limit 156 to yr="1990 -Current" (8722)
158. limit 157 to embase (6199).

MEDLINE via Ovid

Ovid MEDLINE® and Epub Ahead of Print, In-Process & Other Non-Indexed Citations and Daily.

Date range searched: 1946 to 18 October 2018.

Date searched: 19 October 2018.

Records identified: 3450.

Search strategy

1. exp Schizophrenia/ (98,539)
2. Bipolar Disorder/ (37,622)
3. exp Psychotic Disorders/ (48,550)
4. exp Affective Disorders, Psychotic/ (2210)
5. ((acute or chronic$ or persistent$ or serious$ or severe$) adj2 (mental$ or psych$) adj2 (disease$ or disorder$ or disturbanc$ or ill$)).ti,ab,kw. (13,950)
6. (SMI adj3 (individual$ or inpatient$ or in-patient$ or outpatient$ or out-patient$ or patient$ or people or person$ or population$)).ti,ab,kw. (1040)
7. ((mental health or psychiatric) adj2 (inpatient$ or in-patient$)).ti,ab,kw. (9545)
8. schizophren$.ti,ab,kw. (117,306)
9. (psychotic or psychosis or psychoses).ti,ab,kw. (61,647)
10. bipolar.ti,ab,kw. (56,740)
11. 1 or 2 or 3 or 4 or 5 or 6 or 7 or 8 or 9 or 10 (259,622)
12. (healthy adj2 (diet$ or eating)).ti,ab,kw. (10,696)
13. (fruit$ adj2 (intake or consum$ or increase or portion$ or serving$ or frequenc$ or number$ or preference$ or choice$)).ti,ab,kw. (8756)
14. (vegetable$ adj2 (intake or consum$ or increase or portion$ or serving$ or frequenc$ or number$ or preference$ or choice$)).ti,ab,kw. (8962)

15. "5 a day".ti,ab,kw. (167)
16. "five a day".ti,ab,kw. (44)
17. ((food or diet$) adj (choice$ or frequenc$ or intake)).ti,ab,kw. (73,165)
18. Feeding Behavior/ (75,218)
19. Food preferences/ (13,009)
20. nutrition therapy/or exp diet therapy/or exp diet/ (264,431)
21. obesity/or overweight/ (172,728)
22. 12 or 13 or 14 or 15 or 16 or 17 or 18 or 19 or 20 or 21 (506,530)
23. (comment or editorial or letter).pt. (1,663,957)
24. 22 not 23 (485,772)
25. (physical adj3 (fit$ or train$ or activ$ or endur$)).ti,ab,kw. (110,746)
26. (exercis$ adj3 (fit$ or train$ or activ$ or endur$)).ti,ab,kw. (34,892)
27. ((promot$ or uptak$ or encourag$ or increas$ or start$ or adher$) adj3 (exercis$ or gym$ or sport$ or fitness)).ti,ab,kw. (31,395)
28. ((decreas$ or reduc$ or discourag$) adj3 (sedentary or deskbound)).ti,ab,kw. (1308)
29. (sport$ or walk$ or running or jogging or bicycling or biking or swimming).ti,ab,kw. (239,832)
30. (active adj (travel$ or transport$ or commut$)).ti,ab,kw. (8634)
31. physical fitness/ (25,838)
32. exp Recreation/ (189,425)
33. exp Exercise Therapy/or exp exercise/ (199,415)
34. running/or jogging/or swimming/or walking/ (61,927)
35. 25 or 26 or 27 or 28 or 29 or 30 or 31 or 32 or 33 or 34 (540,109)
36. (letter or editorial or comment).pt. (1,663,957)
37. 35 not 36 (521,636)
38. exp smoking/ (137,824)
39. Smoking Cessation/or Smoking Reduction/ (26,021)
40. (smoking or antismoking or anti-smoking).ti,ab,kw. (201,198)
41. (smoker or smokers).ti,ab,kw. (78,963)
42. exp Nicotine/ (24,185)
43. exp Tobacco/ (28,846)
44. exp Tobacco Smoking/ (878)
45. "Tobacco Use Disorder"/ (10,429)
46. "Tobacco Use Cessation"/ (1034)
47. Tobacco, Smokeless/ (3414)
48. Tobacco Smoke Pollution/ (12,348)
49. Electronic Nicotine Delivery Systems/ (2007)
50. (electronic cigarette$ or e-cigarette$ or e-cig or e-cigs).ti,ab,kw. (3440)
51. (vape or vapes or vaper or vapers or vaping).ti,ab,kw. (594)
52. 38 or 39 or 40 or 41 or 42 or 43 or 44 or 45 or 46 or 47 or 48 or 49 or 50 or 51 (314,465)
53. (letter or editorial or comment).pt. (1,663,957)
54. 52 not 53 (301,222)
55. exp Alcohol Drinking/ (63,656)
56. exp Alcoholic Intoxication/ (12,115)
57. exp Alcoholic Beverages/ (18,386)
58. exp Drinking Behavior/ (69,908)
59. (beer$ or wine$ or cider$ or alcopop$ or spirit or spirits).ti,ab,kw. (33,610)
60. alcohol$.ti,ab,kw. (305,539)
61. (drink$ adj2 (binge or excessive$ or harm$ or heavily or heavy or misus$ or abus$ or consum$)).ti,ab,kw. (17,180)
62. (intoxicat$ or inebriat$ or drunk$).ti,ab,kw. (47,727)
63. 55 or 56 or 57 or 58 or 59 or 60 or 61 or 62 (395,310)
64. (comment or editorial or letter).pt. (1,663,957)
65. 63 not 64 (384,701)

66. substance-related disorders/or inhalant abuse/or marijuana abuse/or substance abuse, intravenous/ (107,638)
67. Drug Users/ (2555)
68. ((drug$ or substance$) adj2 (use$ or using or abuse$ or abusing or misuse$ or misusing)).ti,ab,kw. (191,716)
69. ((heroin or opiate$ or cocaine or crack) adj2 (use$ or using or abuse$ or abusing or misuse$ or misusing)).ti,ab,kw. (16,274)
70. ((cannabis or marijuana) adj2 (use$ or using or abuse$ or abusing or misuse$ or misusing)).ti,ab,kw. (11,836)
71. ((benzodiazepine$ or amphetamine$ or methamphetamine$ or MDMA or ecstasy) adj2 (use$ or using or abuse$ or abusing or misuse$ or misusing)).ti,ab,kw. (8864)
72. (solvent$ adj2 (use$ or using or abuse$ or abusing or misuse$ or misusing)).ti,ab,kw. (9608)
73. (street drug$ or recreational drug$ or illicit drug$).ti,ab,kw. (12,452)
74. (prescri$ drug$ adj2 (use$ or using or abuse$ or abusing or misuse$ or misusing)).ti,ab,kw. (2241)
75. polydrug use$.ti,ab,kw. (849)
76. inject$ drug use$.ti,ab,kw. (9504)
77. (needle adj3 shar$).ti,ab,kw. (1311)
78. (syringe$ adj3 shar$).ti,ab,kw. (726)
79. or/66-78 (272,714)
80. (letter or editorial or comment).pt. (1,663,957)
81. 79 not 80 (262,481)
82. 24 or 37 or 54 or 65 or 81 (1,748,549)
83. 11 and 82 (27,989)
84. randomized controlled trial.pt. (469,898)
85. controlled clinical trial.pt. (92,702)
86. randomized.ab. (424,124)
87. placebo.ab. (192,498)
88. clinical trials as topic.sh. (185,008)
89. randomly.ab. (298,839)
90. trial.ti. (188,739)
91. 84 or 85 or 86 or 87 or 88 or 89 or 90 (1,177,116)
92. exp animals/not humans.sh. (4,506,067)
93. 91 not 92 (1,083,038)
94. 83 and 93 (2417)
95. (lifestyle adj2 (intervention$ or program$)).ti,ab,kw. (7301)
96. (life style adj2 (intervention$ or program$)).ti,ab,kw. (266)
97. (behavior$ change adj (intervention$ or program$)).ti,ab,kw. (897)
98. (behaviour$ change adj (intervention$ or program$)).ti,ab,kw. (629)
99. (risk factor adj2 (program$ or intervention$)).ti,ab,kw. (1029)
100. (single risk factor adj2 (program$ or intervention$)).ti,ab,kw. (12)
101. (multifactorial lifestyle adj (intervention$ or program$)).ti,ab,kw. (14)
102. (health behavior$ adj (program$ or intervention$)).ti,ab,kw. (278)
103. (health behaviour$ adj (program$ or intervention$)).ti,ab,kw. (87)
104. (health risk behavior$ adj (program$ or intervention$)).ti,ab,kw. (6)
105. (health risk behaviour$ adj (program$ or intervention$)).ti,ab,kw. (0)
106. (risk behavior$ adj (program$ or intervention$)).ti,ab,kw. (98)
107. (risk behaviour$ adj (program$ or intervention$)).ti,ab,kw. (15)
108. health behavior$ change intervention$.ti,ab,kw. (105)
109. health behaviour$ change intervention$.ti,ab,kw. (45)
110. behavior$ risk factor$ intervention$.ti,ab,kw. (2)
111. behaviour$ risk factor$ intervention$.ti,ab,kw. (0)
112. behavior$ risk factor$ program$.ti,ab,kw. (0)
113. behaviour$ risk factor$ program$.ti,ab,kw. (0)

114. risk behaviour$ intervention$.ti,ab,kw. (11)
115. risk behavior$ intervention$.ti,ab,kw. (47)
116. risk behaviour$ program$.ti,ab,kw. (2)
117. risk behavior$ program$.ti,ab,kw. (9)
118. 95 or 96 or 97 or 98 or 99 or 100 or 101 or 102 or 103 or 104 or 105 or 106 or 107 or 108 or 109 or 110 or 111 or 112 or 113 or 114 or 115 or 116 or 117 (10,433)
119. 11 and 82 and 118 (137)
120. 94 or 119 (2513)
121. limit 120 to yr="1990 -Current" (2312)
122. qualitative research/ (41,870)
123. qualitative.ti,ab. (190,253)
124. "Patient Acceptance of Health Care"/ (40,335)
125. Feasibility Studies/ (59,810)
126. (accept$ or attitude$ or barrier$ or belief$ or believ$ or consider$ or experienc$ or facilitat$ or feasib$ or implement$ or option$ or preference$ or promot$ or view or views or viewpoint$).ti. (817,156)
127. 122 or 123 or 124 or 125 or 126 (1,056,514)
128. 83 and 127 (1538)
129. exp animals/not humans.sh. (4,506,067)
130. 128 not 129 (1491)
131. limit 130 to yr="1990 -Current" (1331)
132. 121 or 131 (3450).

PsycInfo via Ovid
Date range searched: 1806 to week 4 October 2018.

Date searched: 25 October 2020.

Records identified: 10,354.

Search strategy

1. exp Schizophrenia/ (85,600)
2. Bipolar Disorder/ (25,219)
3. exp Psychosis/ (109,658)
4. ((acute or chronic$ or persistent$ or serious$ or severe$) adj2 (mental$ or psych$) adj2 (disease$ or disorder$ or disturbanc$ or ill$)).ti,ab,kw. (16,838)
5. (SMI adj3 (individual$ or inpatient$ or in-patient$ or outpatient$ or out-patient$ or patient$ or people or person$ or population$)).ti,ab,kw. (931)
6. ((mental health or psychiatric) adj2 (inpatient$ or in-patient$)).ti,ab,kw. (11,386)
7. schizophren$.ti,ab,kw. (113,900)
8. (psychotic or psychosis or psychoses).ti,ab,kw. (68,011)
9. bipolar.ti,ab,kw. (36,173)
10. 1 or 2 or 3 or 4 or 5 or 6 or 7 or 8 or 9 (209,491)
11. (healthy adj2 (diet$ or eating)).ti,ab,kw. (3697)
12. (fruit$ adj2 (intake or consum$ or increase or portion$ or serving$ or frequenc$ or number$ or preference$ or choice$)).ti,ab,kw. (1871)
13. (vegetable$ adj2 (intake or consum$ or increase or portion$ or serving$ or frequenc$ or number$ or preference$ or choice$)).ti,ab,kw. (2298)
14. "5 a day".ti,ab,kw. (82)
15. "five a day".ti,ab,kw. (12)
16. ((food or diet$) adj (choice$ or frequenc$ or intake)).ti,ab,kw. (14,493)
17. Eating Attitudes/ (1530)

18. Food preferences/ (4452)
19. Diets/or Food Intake/ (24,024)
20. obesity/or overweight/ (23,672)
21. 11 or 12 or 13 or 14 or 15 or 16 or 17 or 18 or 19 or 20 (56,824)
22. 10 and 21 (1093)
23. (physical adj3 (fit$ or train$ or activ$ or endur$)).ti,ab,kw. (34,827)
24. (exercis$ adj3 (fit$ or train$ or activ$ or endur$)).ti,ab,kw. (5926)
25. ((promot$ or uptak$ or encourag$ or increas$ or start$ or adher$) adj3 (exercis$ or gym$ or sport$ or fitness)).ti,ab,kw. (5944)
26. ((decreas$ or reduc$ or discourag$) adj3 (sedentary or deskbound)).ti,ab,kw. (438)
27. (sport$ or walk$ or running or jogging or bicycling or biking or swimming).ti,ab,kw. (72,925)
28. (active adj (travel$ or transport$ or commut$)).ti,ab,kw. (646)
29. physical fitness/ (4026)
30. exp Recreation/ (33,080)
31. exp Exercise Therapy/or exp exercise/ (24,104)
32. Physical Activity/ (17,162)
33. 23 or 24 or 25 or 26 or 27 or 28 or 29 or 30 or 31 or 32 (144,672)
34. 10 and 33 (2237)
35. exp Tobacco Smoking/ (29,372)
36. Smoking Cessation/ (12,191)
37. (smoking or antismoking or anti-smoking).ti,ab,kw. (44,133)
38. (smoker or smokers).ti,ab,kw. (20,066)
39. Nicotine/ (10,413)
40. Smokeless Tobacco/ (773)
41. Passive Smoking/ (776)
42. Electronic Cigarettes/ (730)
43. Tobacco, Smokeless/ (773)
44. (electronic cigarette$ or e-cigarette$ or e-cig or e-cigs).ti,ab,kw. (1138)
45. (vape or vapes or vaper or vapers or vaping).ti,ab,kw. (175)
46. 35 or 36 or 37 or 38 or 39 or 40 or 41 or 42 or 43 or 44 or 45 (55,798)
47. 10 and 46 (2676)
48. exp Alcohol Abuse/ (46,611)
49. exp Alcohol Drinking Patterns/ (63,984)
50. exp Alcohol Intoxication/ (3029)
51. (beer$ or wine$ or cider$ or alcopop$ or spirit or spirits).ti,ab,kw. (16,133)
52. (alcohol$ adj2 (binge or excessive$ or harm$ or heavily or heavy or misus$ or abus$ or consum$)).ti,ab,kw. (34,787)
53. (drink$ adj2 (binge or excessive$ or harm$ or heavily or heavy or misus$ or abus$ or consum$)).ti,ab,kw. (12,209)
54. (intoxicat$ or inebriat$ or drunk$).ti,ab,kw. (11,855)
55. 48 or 49 or 50 or 51 or 52 or 53 or 54 (99,930)
56. 10 and 55 (5834)
57. exp Drug Abuse/ (105,866)
58. exp Drug Addiction/ (13,397)
59. Heroin Addiction/ (2508)
60. ((drug$ or substance$) adj2 (use$ or using or abuse$ or abusing or misuse$ or misusing)).ti,ab,kw. (108,973)
61. ((heroin or opiate$ or cocaine or crack) adj2 (use$ or using or abuse$ or abusing or misuse$ or misusing)).ti,ab,kw. (10,568)
62. ((cannabis or marijuana) adj2 (use$ or using or abuse$ or abusing or misuse$ or misusing)).ti,ab,kw. (10,161)
63. ((benzodiazepine$ or amphetamine$ or methamphetamine$ or MDMA or ecstasy) adj2 (use$ or using or abuse$ or abusing or misuse$ or misuising)).ti,ab,kw. (5549)

64. (solvent$ adj2 (use$ or using or abuse$ or abusing or misuse$ or misusing)).ti,ab,kw. (270)
65. (street drug$ or recreational drug$ or illicit drug$).ti,ab,kw. (7932)
66. (prescri$ drug$ adj2 (use$ or using or abuse$ or abusing or misuse$ or misusing)).ti,ab,kw. (1169)
67. polydrug use$.ti,ab,kw. (834)
68. inject$ drug use$.ti,ab,kw. (4229)
69. (needle adj3 shar$).ti,ab,kw. (584)
70. (syringe$ adj3 shar$).ti,ab,kw. (387)
71. 57 or 58 or 59 or 60 or 61 or 62 or 63 or 64 or 65 or 66 or 67 or 68 or 69 or 70 (175,902)
72. 10 and 71 (16,517)
73. 22 or 34 or 47 or 56 or 72 (22,832)
74. clinical trials/ (11,117)
75. clinical trial.md. (21,833)
76. placebo/ (5150)
77. control$.ti,ab. (635,515)
78. random$.ti,ab. (181,628)
79. exp treatment/ (720,498)
80. 74 or 75 or 76 or 77 or 78 or 79 (1,330,498)
81. 73 and 80 (11,362)
82. (lifestyle adj2 (intervention$ or program$)).ti,ab,kw. (1742)
83. (life style adj2 (intervention$ or program$)).ti,ab,kw. (40)
84. (behavior$ change adj (intervention$ or program$)).ti,ab,kw. (702)
85. (behaviour$ change adj (intervention$ or program$)).ti,ab,kw. (217)
86. (risk factor adj2 (program$ or intervention$)).ti,ab,kw. (126)
87. (single risk factor adj2 (program$ or intervention$)).ti,ab,kw. (3)
88. (multifactorial lifestyle adj (intervention$ or program$)).ti,ab,kw. (3)
89. (health behavior$ adj (program$ or intervention$)).ti,ab,kw. (182)
90. (health behaviour$ adj (program$ or intervention$)).ti,ab,kw. (26)
91. (health risk behavior$ adj (program$ or intervention$)).ti,ab,kw. (2)
92. (health risk behaviour$ adj (program$ or intervention$)).ti,ab,kw. (0)
93. (risk behavior$ adj (program$ or intervention$)).ti,ab,kw. (47)
94. (risk behaviour$ adj (program$ or intervention$)).ti,ab,kw. (4)
95. health behavior$ change intervention$.ti,ab,kw. (101)
96. health behaviour$ change intervention$.ti,ab,kw. (25)
97. behavior$ risk factor$ intervention$.ti,ab,kw. (2)
98. behaviour$ risk factor$ intervention$.ti,ab,kw. (0)
99. behavior$ risk factor$ program$.ti,ab,kw. (0)
100. behaviour$ risk factor$ program$.ti,ab,kw. (0)
101. risk behaviour$ intervention$.ti,ab,kw. (3)
102. risk behavior$ intervention$.ti,ab,kw. (43)
103. risk behaviour$ program$.ti,ab,kw. (1)
104. risk behavior$ program$.ti,ab,kw. (4)
105. 82 or 83 or 84 or 85 or 86 or 87 or 88 or 89 or 90 or 91 or 92 or 93 or 94 or 95 or 96 or 97 or 98 or 99 or 100 or 101 or 102 or 103 or 104 (3008)
106. 10 and 105 (179)
107. 81 or 106 (11,482)
108. qualitative research/ (7974)
109. qualitative.ti,ab. (143,449)
110. (accept$ or attitude$ or barrier$ or belief$ or believ$ or consider$ or experienc$ or facilitat$ or feasib$ or implement$ or option$ or preference$ or promot$ or view or views or viewpoint$).ti. (298,416)
111. 108 or 109 or 110 (416,644)
112. 73 and 111 (1132)
113. 107 or 112 (12,057)

114. animal models/ (30,681)
115. (animal not (animal and human)).po. (346,436)
116. (rat or rats or mouse or mice or swine or porcine or murine or sheep or lambs or pigs or piglets or
     rabbit or rabbits or cat or cats or dog or dogs or cattle or bovine or monkey or monkeys).ti. (143,111)
117. 114 or 115 or 116 (366,257)
118. 113 not 117 (11,736)
119. limit 118 to yr="1990 -Current" (10,354).

Science Citation Index via Web of Science
Date range searched: 1990 to 25 October 2018.

Date searched: 25 October 2018.

Indexes = SCI-EXPANDED.

A series of five separate searches were carried out to identify specific risk factors in relation to low
levels of physical activity, alcohol use, drug use, poor diet and smoking. Each of these is reproduced here.

Records identified for each search:

- search 1, physical activity – 506
- search 2, alcohol use – 283
- search 3, drug use – 2154
- search 4, diet – 603
- search 5, smoking – 732.

Search strategies

Search 1: physical activity search history
1   TS=(schizophren*) (142,689).

2   TOPIC: ("psychotic disorder*") (7659)

3   TOPIC: ("bipolar disorder*") (39,462)

4   TOPIC: ((acute or chronic* or persistent* or serious* or severe*) NEAR/2 (mental* or psych*)
NEAR/2 (disease* or disorder* or disturbanc* or ill*)) (12,675)

5   TOPIC: (SMI NEAR/3 (individual* or inpatient* or in-patient* or outpatient* or out-patient* or
patient* or people or person* or population*)) (697)

6   TOPIC: (("mental health" or psychiatric) NEAR/2 (inpatient* or in-patient*)) (7262)

7   TOPIC: (psychotic or psychosis or psychoses) (57,961)

8   #7 OR #6 OR #5 OR #4 OR #3 OR #2 OR #1 (204,357)

9   TOPIC: ("clinical trial") (160,171)

10   TOPIC: (randomized NEAR/2 trial) (491,946)

11   TOPIC: (randomised NEAR/2 trial) (491,946)

12   TOPIC: (randomisation or randomization or randomly) (317,197)

13   TOPIC: ("single blind*" or "double blind*") (228,207)

14   TOPIC: (placebo) (223,067)

15   TOPIC: (RCT) (15,997)

16   #15 OR #14 OR #13 OR #12 OR #11 OR #10 OR #9 (1,044,182)

17   #16 AND #8 (21,145)

18   TOPIC: (physical NEAR/3 (fit* or train* or activ* or endur*)) OR TOPIC: (exercis* NEAR/3 (fit* or train* or activ* or endur*)) (165,537)

19   TOPIC: ((promot* or uptak* or encourag* or increas* or start* or adher*) NEAR/3 (exercis* or gym* or sport* or fitness)) (32,224)

20   TOPIC: ((decreas* or reduc* or discourag*) NEAR/3 (sedentary or deskbound)) (1231)

21   TOPIC: (recreation or sport* or walk* or running or jogging or bicycling or biking or swimming) (555,309)

22   TOPIC: (active NEAR/1 (travel* or transport* or commut*)) (9768)

23   #22 OR #21 OR #20 OR #19 OR #18 (709,486)

24   #23 AND #17 (506)

Search 2: alcohol search history
1   TS=(schizophren*) (142,689).

2   TOPIC: ("psychotic disorder*") (7659)

3   TOPIC: ("bipolar disorder*") (39,462)

4   TOPIC: ((acute or chronic* or persistent* or serious* or severe*) NEAR/2 (mental* or psych*) NEAR/2 (disease* or disorder* or disturbanc* or ill*)) (12,675)

5   TOPIC: (SMI NEAR/3 (individual* or inpatient* or in-patient* or outpatient* or out-patient* or patient* or people or person* or population*)) (697)

6   TOPIC: (("mental health" or psychiatric) NEAR/2 (inpatient* or in-patient*)) (7262)

7   TOPIC: (psychotic or psychosis or psychoses) (57,961)

8   #7 OR #6 OR #5 OR #4 OR #3 OR #2 OR #1 (204,357)

9   TS=("clinical trial") (160,171)

10   TOPIC: (randomized NEAR/2 trial) (491,946)

11   TOPIC: (randomised NEAR/2 trial) (491,946)

12   TS=(randomisation or randomization or randomly) (317,197)

13   TOPIC: ("single blind*" or "double blind*") (228,207)

14   TOPIC: (placebo) (223,067)

15   TOPIC: (RCT) (15,997)

16   #15 OR #14 OR #13 OR #12 OR #11 OR #10 OR #9 (1,044,182)

17   #16 AND #8 (21,145)

18   TOPIC: (drink* NEAR/2 (binge or excessive* or harm* or heavily or heavy or misus* or abus* or consum*)) OR TOPIC: (alcohol* NEAR/2 (binge or excessive* or harm* or heavily or heavy or misus* or abus* or consum*)) OR TOPIC: (alcohol* NEAR/2 (intoxicat* or inebriat* or drink* or drunk*)) OR TOPIC: ("drinking behaviour" or "drinking behavior") (76,396)

19   #18 AND #17 (283)

Search 3: drug use search history
1   TS=(schizophren*) (142,689).

2   TOPIC: ("psychotic disorder*") (7659)

3   TOPIC: ("bipolar disorder*") (39,462)

4   TOPIC: ((acute or chronic* or persistent* or serious* or severe*) NEAR/2 (mental* or psych*) NEAR/2 (disease* or disorder* or disturbanc* or ill*)) (12,675)

5   TOPIC: (SMI NEAR/3 (individual* or inpatient* or in-patient* or outpatient* or out-patient* or patient* or people or person* or population*)) (697)

6   TOPIC: (("mental health" or psychiatric) NEAR/2 (inpatient* or in-patient*)) (7262)

7   TOPIC: (psychotic or psychosis or psychoses) (57,961)

8   #7 OR #6 OR #5 OR #4 OR #3 OR #2 OR #1 (204,357)

9   TS=("clinical trial") (160,171)

10   TOPIC: (randomized NEAR/2 trial) (491,946)

11   TOPIC: (randomised NEAR/2 trial) (491,946)

12   TS=(randomisation or randomly) (317,197)

13   TOPIC: ("single blind*" or "double blind*") (228,207)

14   TOPIC: (placebo) (223,067)

15   TOPIC: (RCT) (15,997)

16   #15 OR #14 OR #13 OR #12 OR #11 OR #10 OR #9 (1,044,182)

17   #16 AND #8 (21,145)

18   TS=(drug* NEAR/2 (use* or using or abuse* or abusing or dependen* or misuse* or misusing)) (164,816)

19   TS=(substance* NEAR/2 (use* or using or abuse* or abusing or dependen* or misuse* or misusing)) (56,008)

20   TS=((heroin or opiate* or cocaine or crack) NEAR/2 (use* or using or abuse* or abusing or dependen* or misuse* or misusing)) (26,814)

21   TS=((cannabis or marijuana) NEAR/2 (use* or using or abuse* or abusing or dependen* or misuse* or misusing)) (11,144)

22   TS=((benzodiazepine* or amphetamine* or methamphetamine* or MDMA or ecstasy) NEAR/2 (use* or using or abuse* or abusing or dependen* or misuse* or misusing)) (9994)

23   TS=(solvent* NEAR/2 (use* or using or abuse* or abusing or dependen* or misuse* or misusing)) (44,507)

24   TS=(("prescri* drug*") NEAR/2 (use* or using or abuse* or abusing or dependen* or misuse* or misusing)) (2120)

25   TOPIC: ("street drug*" or "recreational drug*" or "illicit drug*" or "polydrug use") OR TOPIC: ("inject* drug use*") OR TOPIC: ((needle* or syringe*) NEAR/3 shar*) (21,063)

26   #25 OR #24 OR #23 OR #22 OR #21 OR #20 OR #19 OR #18 (279,350)

27   #26 AND #17 (2154)

Search 4: diet search history
1   TS=(schizophren*) (142,689).

2   TOPIC: ("psychotic disorder*") (7659)

3   TOPIC: ("bipolar disorder*") (39,462)

#4   TOPIC: ((acute or chronic* or persistent* or serious* or severe*) NEAR/2 (mental* or psych*) NEAR/2 (disease* or disorder* or disturbanc* or ill*)) (12,675)

5   TOPIC: (SMI NEAR/3 (individual* or inpatient* or in-patient* or outpatient* or out-patient* or patient* or people or person* or population*)) (697)

6   TOPIC: (("mental health" or psychiatric) NEAR/2 (inpatient* or in-patient*)) (7262)

7   TOPIC: (psychotic or psychosis or psychoses) (57,961)

8   #7 OR #6 OR #5 OR #4 OR #3 OR #2 OR #1 (204,357)

9   TOPIC: (healthy NEAR/2 (diet* or eating)) (11,006)

10   TOPIC: (fruit* NEAR/2 (intake or consum* or increase or portion* or serving* or frequenc* or number* or preference* or choice*)) (21,834)

11   TOPIC: (vegetable* NEAR/2 (intake or consum* or increase or portion* or serving* or frequenc* or number* or preference* or choice*)) (13,776)

12   TOPIC: ("5 a day") (211)

13   TOPIC: ("five a day") (42)

14   TOPIC: ((food or diet*) NEAR/1 (choice* or frequenc* or habit* or intake or preference*)) (123,099)

15   TOPIC: (obesity) (255,034)

16   TOPIC: (overweight) (68,056)

17   #16 OR #15 OR #14 OR #13 OR #12 OR #11 OR #10 OR #9 (397,907)

18   #17 AND #8 (2955)

19   TS=("clinical trial") (160,171)

20   TOPIC: (randomized NEAR/2 trial) (491,946)

21   TOPIC: (randomised NEAR/2 trial) (491,946)

22   TS=(randomisation or randomly) (317,197)

23   TOPIC: ("single blind*" or "double blind*") (228,207)

24   TOPIC: (placebo) (223,067)

25   TOPIC: (RCT) (15,997)

26   #25 OR #24 OR #23 OR #22 OR #21 OR #20 OR #19 (1,044,182)

27   #26 AND #18 (603)

Search 5: smoking search history
1   TS=(schizophren*) (142,689).

2   TOPIC: ("psychotic disorder*") (7659)

3   TOPIC: ("bipolar disorder*") (39,462)

4   TOPIC: ((acute or chronic* or persistent* or serious* or severe*) NEAR/2 (mental* or psych*) NEAR/2 (disease* or disorder* or disturbanc* or ill*)) (12,675)

5   TOPIC: (SMI NEAR/3 (individual* or inpatient* or in-patient* or outpatient* or out-patient* or patient* or people or person* or population*)) (697)

6   TOPIC: (("mental health" or psychiatric) NEAR/2 (inpatient* or in-patient*)) (7262)

7   TOPIC: (psychotic or psychosis or psychoses) (57,961)

8   #7 OR #6 OR #5 OR #4 OR #3 OR #2 OR #1 (204,357)

9   TS=("clinical trial") (160,171)

10   TOPIC: (randomized NEAR/2 trial) (491,946)

11   TOPIC: (randomised NEAR/2 trial) (491,946)

12   TS=(randomisation or randomly) (317,197)

13   TOPIC: ("single blind*" or "double blind*") (228,207)

14   TOPIC: (placebo) (223,067)

15   TOPIC: (RCT) (15,997)

16   #15 OR #14 OR #13 OR #12 OR #11 OR #10 OR #9 (1,044,182)

17   #16 AND #8 (21,145)

18   TOPIC: (smoking) OR TOPIC: ("smoking cessation") OR TOPIC: ("smoking reduction") OR TOPIC: (smoker or smokers) OR TOPIC: ((stop* or ceas* or give or gave or prevent*) NEAR/2 smok*) (241,392)

19   TOPIC: ((stop* or ceas* or give or gave or prevent*) NEAR/2 tobacco*) OR TOPIC: ("tobacco use") (13,340)

20   TOPIC: ("passive smoking") OR TOPIC: ("tobbaco smok*") (4960)

21   TOPIC: ("electronic cigarette*" or e-cigarette* or e-cig or e-cigs) (3312)

22   TOPIC: (vape or vapes or vaper or vapers or vaping) (511)

23   #22 OR #21 OR #20 OR #19 OR #18 (246,692)

24   #23 AND #17 (732)

Applied Social Sciences Index and Abstracts via ProQuest® (ProQuest LLC, Ann Arbor, MI, USA)
Date searched: 2 September 2020.

Six separate searches were conducted.

Serious mental illness and risk behaviours and poor diet
Records identified: 48.

Search strategy
(((((MAINSUBJECT.EXACT("Schizophrenia") OR MAINSUBJECT.EXACT("Bipolar affective disorder") OR MAINSUBJECT.EXACT("Psychotic mood disorders") OR MAINSUBJECT.EXACT("Affective disorders")) OR noft(((acute OR chronic* OR persistent* OR serious* OR severe*) NEAR/2 (mental* OR psych*) NEAR/2 (disease* OR disorder* OR disturbanc* OR ill*))) OR noft((SMI NEAR/3 (individual* OR inpatient* OR in-patient* OR outpatient* OR out-patient* OR patient* OR people OR person* OR population*))) OR noft((psychiatric) NEAR/2 (inpatient* OR in-patient*)) OR noft((mental) NEAR/3 (inpatient* OR in-patient*)) OR (noft(schizophren* OR bipolar) OR noft(psychotic OR psychosis OR psychoses))) AND ((noft(healthy NEAR/2 (diet* OR eating)) OR noft(fruit* NEAR/2 (intake OR consum* OR increase OR portion* OR serving* OR frequenc* OR number* OR preference* OR choice*)) OR noft((vegetable* NEAR/2 (intake OR consum* OR increase OR portion* OR serving* OR frequenc* OR

number* OR preference* OR choice*)))) OR noft("five a day" OR "five a day") OR noft((food OR diet*) NEAR/1 (choice* OR frequenc* OR intake)) OR (MAINSUBJECT.EXACT("Diet") OR (MAINSUBJECT.EXACT ("Healthy food") OR MAINSUBJECT.EXACT("Food") OR MAINSUBJECT.EXACT("Food consumption") OR MAINSUBJECT.EXACT("Food habits") OR MAINSUBJECT.EXACT("Takeaway food")) OR (MAINSUBJECT.EXACT("Nutritional therapy") OR MAINSUBJECT.EXACT("Nutrition programmes") OR MAINSUBJECT.EXACT("Nutrition")) OR MAINSUBJECT.EXACT("obesity")))) AND MAINSUBJECT.EXACT("randomized controlled trials")) OR ((((MAINSUBJECT.EXACT("Schizophrenia") OR MAINSUBJECT.EXACT("Bipolar affective disorder") OR MAINSUBJECT.EXACT("Psychotic mood disorders") OR MAINSUBJECT.EXACT("Affective disorders")) OR noft(((acute OR chronic* OR persistent* OR serious* OR severe*) NEAR/2 (mental* OR psych*) NEAR/2 (disease* OR disorder* OR disturbanc* OR ill*))) OR noft((SMI NEAR/3 (individual* OR inpatient* OR in-patient* OR outpatient* OR out-patient* OR patient* OR people OR person* OR population*))) OR noft((psychiatric) NEAR/2 (inpatient* OR in-patient*)) OR noft((mental) NEAR/3 (inpatient* OR in-patient*)) OR (noft(schizophren* OR bipolar) OR noft(psychotic OR psychosis OR psychoses))) AND ((noft(healthy NEAR/2 (diet* OR eating)) OR noft(fruit* NEAR/2 (intake OR consum* OR increase OR portion* OR serving* OR frequenc* OR number* OR preference* OR choice*)) OR noft((vegetable* NEAR/2 (intake OR consum* OR increase OR portion* OR serving* OR frequenc* OR number* OR preference* OR choice*)))) OR noft ("five a day" OR "five a day") OR noft((food OR diet*) NEAR/1 (choice* OR frequenc* OR intake)) OR (MAINSUBJECT.EXACT("Diet") OR (MAINSUBJECT.EXACT("Healthy food") OR MAINSUBJECT.EXACT ("Food") OR MAINSUBJECT.EXACT("Food consumption") OR MAINSUBJECT.EXACT("Food habits") OR MAINSUBJECT.EXACT("Takeaway food")) OR (MAINSUBJECT.EXACT("Nutritional therapy") OR MAINSUBJECT.EXACT("Nutrition programmes") OR MAINSUBJECT.EXACT("Nutrition")) OR MAINSUBJECT.EXACT("obesity")))) AND (MAINSUBJECT.EXACT("Qualitative research") OR noft (qualitative*) OR ti((accept* OR attitude* OR barrier* OR belief* OR believ* OR consider* OR experienc* OR facilitat* OR feasib* OR implement* OR option* OR preference* OR promot* OR view OR views OR viewpoint*)))).

Serious mental illness and risk behaviours and lack of physical activity
Records identified: 127.

Search strategy
(((noft((physical OR exercise*) NEAR/3 (fit* OR train* OR activ* OR endur*)) OR noft((promot* OR uptak* OR encourag* OR increas* OR start* OR adher*) NEAR/3 (exercis* OR gym* OR sport* OR fitness)) OR noft((decreas* OR reduc* OR discourag*) NEAR/3 (sedentary OR deskbound)) OR noft (sport* OR walk* OR running OR jogging OR bicycling OR biking OR swimming) OR noft(active NEAR/1 (travel* OR transport* OR commut*))) OR (MAINSUBJECT.EXACT("Physical fitness") OR (MAINSUBJECT.EXACT("Aerobic fitness") OR MAINSUBJECT.EXACT("Fitness"))) OR MAINSUBJECT.EXACT.EXPLODE("Sports")) AND ((MAINSUBJECT.EXACT("Schizophrenia") OR MAINSUBJECT.EXACT("Bipolar affective disorder") OR MAINSUBJECT.EXACT("Psychotic mood disorders") OR MAINSUBJECT.EXACT("Affective disorders")) OR noft(((acute OR chronic* OR persistent* OR serious* OR severe*) NEAR/2 (mental* OR psych*) NEAR/2 (disease* OR disorder* OR disturbanc* OR ill*))) OR noft((SMI NEAR/3 (individual* OR inpatient* OR in-patient* OR outpatient* OR out-patient* OR patient* OR people OR person* OR population*))) OR noft((psychiatric) NEAR/2 (inpatient* OR in-patient*)) OR noft((mental) NEAR/3 (inpatient* OR in-patient*)) OR (noft(schizophren* OR bipolar) OR noft(psychotic OR psychosis OR psychoses)))) AND (MAINSUBJECT.EXACT ("randomized controlled trials") OR (MAINSUBJECT.EXACT("Qualitative research") OR noft (qualitative*) OR ti((accept* OR attitude* OR barrier* OR belief* OR believ* OR consider* OR experienc* OR facilitat* OR feasib* OR implement* OR option* OR preference* OR promot* OR view OR views OR viewpoint*)))).

Serious mental illness and risk behaviours and smoking
Records identified: 68.

Search strategy

MAINSUBJECT.EXACT("randomized controlled trials") OR (MAINSUBJECT.EXACT("Qualitative research") OR noft(qualitative*) OR ti((accept* OR attitude* OR barrier* OR belief* OR believ* OR consider* OR experienc* OR facilitat* OR feasib* OR implement* OR option* OR preference* OR promot* OR view OR views OR viewpoint*)))) AND (((MAINSUBJECT.EXACT("Schizophrenia") OR MAINSUBJECT.EXACT("Bipolar affective disorder") OR MAINSUBJECT.EXACT("Psychotic mood disorders") OR MAINSUBJECT.EXACT("Affective disorders")) OR noft(((acute OR chronic* OR persistent* OR serious* OR severe*) NEAR/2 (mental* OR psych*) NEAR/2 (disease* OR disorder* OR disturbanc* OR ill*))) OR noft((SMI NEAR/3 (individual* OR inpatient* OR in-patient* OR outpatient* OR out-patient* OR patient* OR people OR person* OR population*))) OR noft((psychiatric) NEAR/2 (inpatient* OR in-patient*)) OR noft((mental) NEAR/3 (inpatient* OR in-patient*)) OR (noft(schizophren* OR bipolar) OR noft(psychotic OR psychosis OR psychoses))) AND ((noft(smoking OR antismoking OR anti-smoking) OR noft(smoker OR smokers) OR noft(electronic cigarette* OR e-cigarette* OR e-cig OR e-cigs) OR noft(vape OR vapes OR vaper OR vapers OR vaping) OR noft(tobacco)) OR (MAINSUBJECT.EXACT.EXPLODE("Smoking") OR MAINSUBJECT.EXACT.EXPLODE("Tobacco") OR MAINSUBJECT.EXACT.EXPLODE("Nicotine")))).

Serious mental illness and risk behaviours and alcohol use

Records identified: 141.

Search strategy

(MAINSUBJECT.EXACT("randomized controlled trials") OR (MAINSUBJECT.EXACT("Qualitative research") OR noft(qualitative*) OR ti((accept* OR attitude* OR barrier* OR belief* OR believ* OR consider* OR experienc* OR facilitat* OR feasib* OR implement* OR option* OR preference* OR promot* OR view OR views OR viewpoint*)))) AND (((MAINSUBJECT.EXACT("Schizophrenia") OR MAINSUBJECT.EXACT("Bipolar affective disorder") OR MAINSUBJECT.EXACT("Psychotic mood disorders") OR MAINSUBJECT.EXACT("Affective disorders")) OR noft(((acute OR chronic* OR persistent* OR serious* OR severe*) NEAR/2 (mental* OR psych*) NEAR/2 (disease* OR disorder* OR disturbanc* OR ill*))) OR noft((SMI NEAR/3 (individual* OR inpatient* OR in-patient* OR outpatient* OR out-patient* OR patient* OR people OR person* OR population*))) OR noft((psychiatric) NEAR/2 (inpatient* OR in-patient*)) OR noft((mental) NEAR/3 (inpatient* OR in-patient*)) OR (noft(schizophren* OR bipolar) OR noft(psychotic OR psychosis OR psychoses))) AND ((noft(beer* OR wine* OR cider* OR alcopop* OR spirit OR spirits) OR noft(alcohol*) OR noft(drink* NEAR/2 (binge OR excessive* OR harm* OR heavily OR heavy OR misus* OR abus* OR consum*)) OR noft(intoxicat* OR inebriat* OR drunk*)) OR (MAINSUBJECT.EXACT.EXPLODE("Alcohol abuse") OR MAINSUBJECT.EXACT.EXPLODE ("Alcohol intoxication") OR MAINSUBJECT.EXACT("Alcohol consumption") OR MAINSUBJECT.EXACT. EXPLODE("Alcoholic beverages") OR MAINSUBJECT.EXACT("Alcoholics") OR MAINSUBJECT.EXACT ("Alcohol related problems") OR MAINSUBJECT.EXACT.EXPLODE("Alcoholism") OR MAINSUBJECT.EXACT.EXPLODE("Alcohol dependence")))).

Serious mental illness and risk behaviours and drug misuse

Records identified: 257.

Search strategy

((MAINSUBJECT.EXACT("Qualitative research") OR noft(qualitative*) OR ti((accept* OR attitude* OR barrier* OR belief* OR believ* OR consider* OR experienc* OR facilitat* OR feasib* OR implement* OR option* OR preference* OR promot* OR view OR views OR viewpoint*))) OR MAINSUBJECT. EXACT("randomized controlled trials")) AND (((MAINSUBJECT.EXACT("Schizophrenia") OR MAINSUBJECT.EXACT("Bipolar affective disorder") OR MAINSUBJECT.EXACT("Psychotic mood disorders") OR MAINSUBJECT.EXACT("Affective disorders")) OR noft(((acute OR chronic* OR persistent* OR serious* OR severe*) NEAR/2 (mental* OR psych*) NEAR/2 (disease* OR disorder* OR disturbanc* OR ill*))) OR noft((SMI NEAR/3 (individual* OR inpatient* OR in-patient* OR outpatient* OR out-patient* OR patient* OR people OR person* OR population*))) OR noft((psychiatric) NEAR/2

(inpatient* OR in-patient*)) OR noft((mental) NEAR/3 (inpatient* OR in-patient*)) OR (noft(schizophren* OR bipolar) OR noft(psychotic OR psychosis OR psychoses))) AND ((noft((drug* OR substance*) NEAR/2 (use* OR using OR abuse* OR abusing OR misuse* OR misusing)) OR noft((heroin OR opiate* OR cocaine OR crack) NEAR/2 (use* OR using OR abuse* OR abusing OR misuse* OR misusing)) OR noft ((cannabis OR marijuana) NEAR/2 (use* OR using OR abuse* OR abusing OR misuse* OR misusing)) OR noft((benzodiazepine* OR amphetamine* OR methamphetamine* OR MDMA OR ecstasy) NEAR/2 (use* OR using OR abuse* OR abusing OR misuse* OR misusing)) OR noft(solvent* NEAR/2 (use* OR using OR abuse* OR abusing OR misuse* OR misusing)) OR noft("street drug*" OR "recreational drug*" OR "illicit drug*") OR noft("polydrug use*") OR noft("inject* drug use*") OR noft(needle NEAR/3 shar*) OR noft (syringe* NEAR/3 shar)) OR ((MAINSUBJECT.EXACT("Drug abuse") OR MAINSUBJECT.EXACT("Drug abusers")) OR MAINSUBJECT.EXACT.EXPLODE("Heroin") OR MAINSUBJECT.EXACT("Cocaine") OR MAINSUBJECT.EXACT.EXPLODE("Cannabis")))).

Serious mental illness and lifestyle interventions
Records identified: 17.

Search strategy
(((noft(lifestyle NEAR/2 (intervention* OR program*)) OR noft("life style" NEAR/2 (intervention* OR program*)) OR noft("behavior* change" NEAR/1 (intervention* OR program*)) OR noft("risk factor" NEAR/2 (program* OR intervention*)) OR noft("multifactorial lifestyle" NEAR/1 (intervention* OR program*)) OR noft("health behavior*" NEAR/1 (program* OR intervention*)) OR noft("health behaviour*" NEAR/1 (program* OR intervention*)) OR noft("health risk behavior*" NEAR/1 (program* OR intervention*)) OR noft("health risk behaviour*" NEAR/1 (program* OR intervention*)) OR noft("risk behavior*" NEAR/1 (program* OR intervention*))) OR (noft("risk behaviour*" NEAR/1 (program* OR intervention*)) OR noft("health behavior* change intervention* ") OR noft("health behaviour* change intervention*") OR noft("behavior* risk factor* intervention* ") OR noft("behaviour* risk factor* intervention*") OR noft("behavior* risk factor* program*") OR noft("behaviour* risk factor* program* ") OR noft("risk behaviour* intervention* ") OR noft("risk behavior* intervention* ") OR noft("risk behavio* program*"))) AND (MAINSUBJECT.EXACT("randomized controlled trials") OR (MAINSUBJECT.EXACT ("Qualitative research") OR noft(qualitative*) OR ti((accept* OR attitude* OR barrier* OR belief* OR believ* OR consider* OR experienc* OR facilitat* OR feasib* OR implement* OR option* OR preference* OR promot* OR view OR views OR viewpoint*))))) AND (((MAINSUBJECT.EXACT ("Schizophrenia") OR MAINSUBJECT.EXACT("Bipolar affective disorder") OR MAINSUBJECT.EXACT ("Psychotic mood disorders") OR MAINSUBJECT.EXACT("Affective disorders")) OR noft(((acute OR chronic* OR persistent* OR serious* OR severe*) NEAR/2 (mental* OR psych*) NEAR/2 (disease* OR disorder* OR disturbanc* OR ill*))) OR noft((SMI NEAR/3 (individual* OR inpatient* OR in-patient* OR outpatient* OR out-patient* OR patient* OR people OR person* OR population*))) OR noft((psychiatric) NEAR/2 (inpatient* OR in-patient*)) OR noft((mental) NEAR/3 (inpatient* OR in-patient*)) OR (noft (schizophren* OR bipolar) OR noft(psychotic OR psychosis OR psychoses))

Appendix 2 Excluded studies with reasons for exclusion

TABLE 6 Excluded studies with reasons for exclusion

Full reference	Reason for exclusion
Abed H. What factors affect the lifestyle choices of people with schizophrenia? *Ment Health Rev J* 2010;**15**:21–7	Intervention did not meet criteria
Acil AA, Dogan S, Dogan O. The effects of physical exercises to mental state and quality of life in patients with schizophrenia. *J Psychiatr Ment Health Nurs* 2008;**15**:808–15	Study design did not meet criteria
Aguiar-Bloemer AC, Agliussi RG, Pinho TMP, Furtado EF, Diez-Garcia RW. Eating behavior of schizophrenic patients. *Rev de Nutr* 2018;**31**:13–24	Study design did not meet criteria
Alvarez-Jiménez M, González-Blanch C, Vázquez-Barquero JL, Pérez-Iglesias R, Martínez-García O, Pérez-Pardal T, *et al.* Attenuation of antipsychotic-induced weight gain with early behavioral intervention in drug-naive first-episode psychosis patients: a randomized controlled trial. *J Clin Psychiatry* 2006;**67**:1253–60	Population did not meet criteria
Alvidrez J, Kaiser D, Havassy BE. Severely mentally ill consumers' perspectives on drug use. *J Psychoactive Drugs* 2004;**36**:347–55	Intervention did not meet criteria
Arbour-Nicitopoulos KP, Faulkner GE, Hsin A, Selby P. A pilot study examining the acute effects of exercise on cigarette cravings and affect among individuals with serious mental illness. *Ment Health Phys Act* 2011;**4**:89–94	Outcomes did not meet criteria
Archie S, Wilson JH, Osborne S, Hobbs H, McNiven J. Pilot study: access to fitness facility and exercise levels in olanzapine-treated patients. *Can J Psychiatry* 2003;**48**:628–32	Study design did not meet criteria
Aschbrenner KA, Pepin R, Mueser KT, Naslund JA, Rolin SA, Faber MJ, Bartels SJ. A mixed methods exploration of family involvement in medical care for older adults with serious mental illness. *Int J Psychiatry Med* 2014;**48**:121–33	Intervention did not meet criteria
Aschbrenner K, Mueser K, Bartels S, Carpenter-Song E, Pratt S, Barre L, *et al.* The other 23 hours: a qualitative study of fitness provider perspectives on social support for health promotion for adults with mental illness. *Health Soc Work* 2015;**40**:91–9	Population did not meet criteria
Aschbrenner KA, Naslund JA, Barre LK, Mueser KT, Kinney A, Bartels SJ. Peer health coaching for overweight and obese individuals with serious mental illness: intervention development and initial feasibility study. *Transl Behav Med* 2015;**5**:277–84	Outcomes did not meet criteria
Aschbrenner KA, Naslund JA, Bartels SJ. A mixed methods study of peer-to-peer support in a group-based lifestyle intervention for adults with serious mental illness. *Psychiatr Rehabil J* 2016;**39**:328–34	Population did not meet criteria
Aschbrenner KA, Naslund JA, Gill L, Hughes T, O'Malley AJ, Bartels SJ, Brunette MF. Qualitative analysis of social network influences on quitting smoking among individuals with serious mental illness. *J Ment Health* 2019;**28**:475–81	Population did not meet criteria
Aschbrenner KA, Naslund JA, Gill L, Bartels SJ, O'Malley AJ, Brunette MF. Preferences for smoking cessation support from family and friends among adults with serious mental illness. *Psychiatr Q* 2017;**88**:701–10	Population did not meet criteria

TABLE 6 Excluded studies with reasons for exclusion (*continued*)

Full reference	Reason for exclusion
Aschbrenner KA, Naslund JA, Gorin AA, Mueser KT, Scherer EA, Viron M, *et al.* Peer support and mobile health technology targeting obesity-related cardiovascular risk in young adults with serious mental illness: protocol for a randomized controlled trial. *Contemp Clin Trials* 2018;**74**:97–106	Record was a protocol or registry entry
Asher CJ, Gask L. Reasons for illicit drug use in people with schizophrenia: qualitative study. *BMC Psychiatry* 2010;**10**:94	Intervention did not meet criteria
Bagøien G, Bjørngaard JH, Østensen C, Reitan SK, Romundstad P, Morken G. The effects of motivational interviewing on patients with comorbid substance use admitted to a psychiatric emergency unit – a randomised controlled trial with two year follow-up. *BMC Psychiatry* 2013;**13**:93	Population did not meet criteria
Bailey JM, Hansen V, Wye PM, Wiggers JH, Bartlem KM, Bowman JA. Supporting change in chronic disease risk behaviours for people with a mental illness: a qualitative study of the experiences of family carers. *BMC Public Health* 2018;**18**:416	Population did not meet criteria
Baker A, Lewin T, Reichler H, Clancy R, Carr V, Garrett R, *et al.* Evaluation of a motivational interview for substance use within psychiatric in-patient services. *Addiction* 2002;**97**:1329–37	Population did not meet criteria
Baker A, Lewin T, Reichler H, Clancy R, Carr V, Garrett R, *et al.* Motivational interviewing among psychiatric in-patients with substance use disorders. *Acta Psychiatr Scand* 2002;**106**:233–40	Population did not meet criteria
Baker A, Borland R, Bonevski B, Castle DJ, Williams J, Segan C, *et al.* Quitlink: accessible smoking cessation support for people living with severe and enduring mental illness. *Schizophr Bull* 2018;**44**(Suppl. 1):S151	Record was a protocol or registry entry
Barre LK, Ferron JC, Davis KE, Whitley R. Healthy eating in persons with serious mental illnesses: understanding and barriers. *Psychiatr Rehabil J* 2011;**34**:304–10	Population did not meet criteria
Barrowclough C, Haddock G, Tarrier N, Lewis SW, Moring J, O'Brien R, *et al.* Randomized controlled trial of motivational interviewing, cognitive behavior therapy, and family intervention for patients with comorbid schizophrenia and substance use disorders. *Am J Psychiatry* 2001;**158**:1706–13	Intervention did not meet criteria
Barrowclough C, Lobbanl F, Warburton J, Choudhry I, Gregg L, Wood H, *et al.* HELPER ReCAP: Rethinking Choices after Psychosis – a phase-specific psychological therapy for people with problematic cannabis use following a first episode of psychosis. *Early Interv Psychiatry* 2010;**4**:161	Population did not meet criteria
Barrowclough C, Haddock G, Wykes T, Beardmore R, Conrod P, Craig T, *et al.* Integrated motivational interviewing and cognitive behavioural therapy for people with psychosis and comorbid substance misuse: randomised controlled trial. *BMJ* 2010;**341**:c6325	Population did not meet criteria
Barrowclough C, Marshall M, Gregg L, Fitzsimmons M, Tomenson B, Warburton J, Lobban F. A phase-specific psychological therapy for people with problematic cannabis use following a first episode of psychosis: a randomized controlled trial. *Psychol Med* 2014;**44**:2749–61	Population did not meet criteria
Bartels SJ, Pratt SI, Aschbrenner KA, Barre LK, Jue K, Wolfe RS, *et al.* Clinically significant improved fitness and weight loss among overweight persons with serious mental illness. *Psychiatr Serv* 2013;**64**:729–36	Population did not meet criteria
Bartels SJ, Aschbrenner KA, Pratt SI, Naslund JA, Scherer EA, Zubkoff L, *et al.* Implementation of a lifestyle intervention for people with serious mental illness in state-funded mental health centers. *Psychiatr Serv* 2018;**69**:664–70	Study design did not meet criteria
Battersby M, Kidd MR, Licinio J, Aylward P, Baker A, Ratcliffe J, *et al.* Improving cardiovascular health and quality of life in people with severe mental illness: study protocol for a randomised controlled trial. *Trials* 2018;**19**:366	Record was a protocol or registry entry

TABLE 6 Excluded studies with reasons for exclusion (*continued*)

Full reference	Reason for exclusion
Beebe LH, Smith KD, Roman MW, Burk RC, McIntyre K, Dessieux OL, *et al.* A pilot study describing physical activity in persons with schizophrenia spectrum disorders (SSDS) after an exercise program. *Issues Ment Health Nurs* 2013;**34**:214–19	Study design did not meet criteria
Bellack AS, Bennett ME, Gearon JS, Brown CH, Yang Y. A randomized clinical trial of a new behavioral treatment for drug abuse in people with severe and persistent mental illness. *Arch Gen Psychiatry* 2006;**63**:426–32	Population did not meet criteria
Bennett ME, Bellack AS, Gearon JS. Treating substance abuse in schizophrenia: preliminary analysis of data from a randomized treatment trial. *Schizophr Res* 2003;**60**:319	Trial was incomplete
Bennett ME, Brown CH, Li L, Himelhoch S, Bellack A, Dixon L. Smoking cessation in individuals with serious mental illness: a randomized controlled trial of two psychosocial interventions. *J Dual Diagn* 2015;**11**:161–73	Population did not meet criteria
Bergqvist A, Karlsson M, Foldemo A, Wärdig R, Hultsjö S. Preventing the development of metabolic syndrome in people with psychotic disorders – difficult, but possible: experiences of staff working in psychosis outpatient care in Sweden. *Issues Ment Health Nurs* 2013;**34**:350–8	Population did not meet criteria
Bersani FS, Biondi M, Coviello M, Fagiolini A, Majorana M, Minichino A, *et al.* Psychoeducational intervention focused on healthy living improves psychopathological severity and lifestyle quality in psychiatric patients: preliminary findings from a controlled study. *J Ment Health* 2017;**26**:271–5	Population did not meet criteria
Beyraghi N, Mazaheri Meybodi A, Jafarian Bahri RS. Smoking ban in psychiatric inpatient unit: an Iranian study on the views and attitudes of the mental health staff and psychiatric patients. *Psychiatry J* 2018;**2018**:2450939	Population did not meet criteria
Biseul I, Icick R, Seguin P, Bellivier F, Scott J. Feasibility and acceptability of the 'HABIT' group programme for comorbid bipolar and alcohol and substance use disorders. *Clin Psychol Psychother* 2017;**24**:887–98	Study design did not meet criteria
Blanner Kristiansen C, Juel A, Vinther Hansen M, Hansen AM, Kilian R, Hjorth P. Promoting physical health in severe mental illness: patient and staff perspective. *Acta Psychiatr Scand* 2015;**132**:470–8	Population did not meet criteria
Bogenschutz MP, Rice SL, Tonigan JS, Vogel HS, Nowinski J, Hume D, Arenella PB. 12-step facilitation for the dually diagnosed: a randomized clinical trial. *J Subst Abuse Treat* 2014;**46**:403–11	Population did not meet criteria
Bogomolova S, Zarnowiecki D, Wilson A, Fielder A, Procter N, Itsiopoulos C, *et al.* Dietary intervention for people with mental illness in South Australia. *Health Promot Int* 2018;**33**:71–83	Population did not meet criteria
Bradizza CM, Stasiewicz PR. Qualitative analysis of high-risk drug and alcohol use situations among severely mentally ill substance abusers. *Addict Behav* 2003;**28**:157–69	Intervention did not meet criteria
Bradshaw T, Lovell K, Bee P, Campbell M. The development and evaluation of a complex health education intervention for adults with a diagnosis of schizophrenia. *J Psychiatr Ment Health Nurs* 2010;**17**:473–86	Study design did not meet criteria
Bradshaw T, Wearden A, Marshall M, Warburton J, Husain N, Pedley R, *et al.* Developing a healthy living intervention for people with early psychosis using the Medical Research Council's guidelines on complex interventions: phase 1 of the HELPER – InterACT programme. *Int J Nurs Stud* 2012;**49**:398–406	Outcomes did not meet criteria
Broderick J, Knowles A, Chadwick J, Vancampfort D. Yoga vs. standard care for schizophrenia. *Schizophr Bull* 2016;**42**:15–17	Study design did not meet criteria

TABLE 6 Excluded studies with reasons for exclusion (*continued*)

Full reference	Reason for exclusion
Brooke L, Gucciardi D, Lin A, Ntoumanis N. A qualitative investigation of perceived barriers to and enablers of sport participation for young people with first episode psychosis. *Early Interv Psychiatry* 2018;**12**:56	Population did not meet criteria
Brunette MF, Asher D, Whitley R, Lutz WJ, Wieder BL, Jones AM, McHugo GJ. Implementation of integrated dual disorders treatment: a qualitative analysis of facilitators and barriers. *Psychiatr Serv* 2008;**59**:989–95	Outcomes did not meet criteria
Brunette MF, Ferron JC, Drake RE, Devitt TS, Geiger PT, McHugo GJ, *et al.* Carbon monoxide feedback in a motivational decision support system for nicotine dependence among smokers with severe mental illnesses. *J Subst Abuse Treat* 2013;**45**:319–24	Outcomes did not meet criteria
Brunette MF, Ferron JC, Robinson D, Coletti D, Geiger P, Devitt T, *et al.* Brief web-based interventions for young adult smokers with severe mental illnesses: a randomized, controlled pilot study. *Nicotine Tob Res* 2018;**20**:1206–14	Population did not meet criteria
Cabassa LJ, Siantz E, Nicasio A, Guarnaccia P, Lewis-Fernández R. contextual factors in the health of people with serious mental illness. *Qual Health Res* 2014;**24**:1126–37	Intervention did not meet criteria
Cabassa LJ, Stefancic A, O'Hara K, El-Bassel N, Lewis-Fernández R, Luchsinger JA, *et al.* Peer-led healthy lifestyle program in supportive housing: study protocol for a randomized controlled trial. *Trials* 2015;**16**:388	Record was a protocol or registry entry
Carson NE. Influences on the food choice behavior of adults with severe mental illness. *Diss Abstr Int B Sci Eng* 2012;**72**:6678	Intervention did not meet criteria
Castle H, Prestwich A, Gupta A. Effects of a control theory based dietary intervention to promote fruit and vegetable consumption in young people experiencing a first episode of psychosis. *Early Interv Psychiatry* 2012;**6**:71	Population did not meet criteria
Chen MD, Yeh YC, Tsai YJ, Chang YC, Yu JW, Hsu CH. Efficacy of baduanjin exercise and feasibility of mobile text reminders on follow-up participation in people with severe mental illness: an exploratory study. *J Psychiatr Pract* 2016;**22**:241–9	Study design did not meet criteria
Chen MD, Chang JJ, Kuo CC, Yu JW, Huang MF, Marks B, *et al.* A pilot comparative study of one-way versus two-way text message program to promote physical activity among people with severe mental illness. *Ment Health Phys Act* 2017;**13**:143–51	Study design did not meet criteria
Chen MD, I JH, Pellegrini CA, Tang TC, Kuo CC. A qualitative exploration of facilitators and barriers to physical activity participation in people with severe mental illness in Taiwan. *Ment Health Phys Act* 2017;**13**:100–7	Intervention did not meet criteria
Chengappa KN, Perkins KA, Brar JS, Schlicht PJ, Turkin SR, Hetrick ML, *et al.* Varenicline for smoking cessation in bipolar disorder: a randomized, double-blind, placebo-controlled study. *J Clin Psychiatry* 2014;**75**:765–72	Intervention did not meet criteria
Childs HE, McCarthy-Jones S, Rowse G, Turpin G. The journey through cannabis use: a qualitative study of the experiences of young adults with psychosis. *J Nerv Ment Dis* 2011;**199**:703–8	Population did not meet criteria
Cole J. *The Effects of an Exercise Program on Chronically Mentally Ill Outpatients; A Study of Symptom Reduction, Physical Fitness, and Stress.* PhD thesis. Chicago, IL: Illinois Institute of Technology; 1997	Outcomes did not meet criteria
Connolly M, Floyd S, Forrest R, Marshall B. Mental health nurses' beliefs about smoking by mental health facility inpatients. *Int J Ment Health Nurs* 2013;**22**:288–93	Study design did not meet criteria
Curcic D, Stojmenovic T, Djukic-Dejanovic S, Dikic N, Vesic-Vukasinovic M, Radivojevic N, *et al.* Positive impact of prescribed physical activity on symptoms of schizophrenia: randomized clinical trial. *Psychiatr Danub* 2017;**29**:459–65	Outcomes did not meet criteria

TABLE 6 Excluded studies with reasons for exclusion (*continued*)

Full reference	Reason for exclusion
Daumit G, Appel L, Leatherman E, Latkin C, Dalcin A, Goggins B, *et al.* Randomized trial of peer-supported physical activity for persons with severe mental illness in community psychiatry. *J Gen Intern Med* 2010;**25**:S378–S9	Population did not meet criteria
Davis KE, O'Neill SJ. A focus group analysis of relapse prevention strategies for persons with substance use and mental disorders. *Psychiatr Serv* 2005;**56**:1288–91	Population did not meet criteria
Davis K, Brunette M, Vorhies V, Ferron J, Whitley R. A qualitative study of how individuals with severe mental illness assess smoking risks. *Ment Health Subst Use* 2010;**3**:110–23	Intervention did not meet criteria
Dickerson F, Bennett M, Dixon L, Burke E, Vaughan C, Delahanty J, Diclemente C. Smoking cessation in persons with serious mental illnesses: the experience of successful quitters. *Psychiatr Rehabil J* 2011;**34**:311–16	Study design did not meet criteria
Dixon LB, Potts W. *Smoking Cessation for Veterans with Severe and Persistent Mental Illness*. URL: www.clinicaltrials.gov/ct2/show/nct00960375 (accessed 30 April 2021)	Record was a protocol or registry entry
Dlack GW, Meador-Woodruff JH. Nicotine replacement and smoking reduction in smokers with schizophrenia conference abstract. *Schizophr Res* 1999;**36**:1–382	Conference abstract only
Druss BG, Zhao L, von Esenwein SA, Bona JR, Fricks L, Jenkins-Tucker S, *et al.* The Health and Recovery Peer (HARP) program: a peer-led intervention to improve medical self-management for persons with serious mental illness. *Schizophr Res* 2010;**118**:264–70	Population did not meet criteria
Duraiswamy G, Thirthalli J, Nagendra HR, Gangadhar BN. Yoga therapy as an add-on treatment in the management of patients with schizophrenia – a randomized controlled trial. *Acta Psychiatr Scand* 2007;**116**:226–32	Outcomes did not meet criteria
Edwards J, Elkins KS, Hinton MF, Harrigan SM, Donovan KD, Athanasopoulos O. Randomized controlled trial of a cannabis-focused intervention versus psychoeducation for young people continuing to use cannabis in the 12 months following entry to treatment for first-episode psychosis. *Schizophr Res* 2004;**70**:61	Population did not meet criteria
Edwards J, Elkins K, Hinton M, Harrigan SM, Donovan K, Athanasopoulos O, McGorry PD. Randomized controlled trial of a cannabis-focused intervention for young people with first-episode psychosis. *Acta Psychiatr Scand* 2006;**114**:109–17	Population did not meet criteria
Engh JA, Andersen E, Holmen TL, Martinsen EW, Mordal J, Morken G, Egeland J. Effects of high-intensity aerobic exercise on psychotic symptoms and neurocognition in outpatients with schizophrenia: study protocol for a randomized controlled trial. *Trials* 2015;**16**:557	Record was a protocol or registry entry
Esterberg ML, Compton MT. Smoking behavior in persons with a schizophrenia-spectrum disorder: a qualitative investigation of the transtheoretical model. *Soc Sci Med* 2005;**61**:293–303	Intervention did not meet criteria
Evins AE. *Smoking Relapse Prevention in Schizophrenia*. URL: https://clinicaltrials.gov/ct2/show/NCT00320697 (accessed 30 April 2021)	Record was a protocol or registry entry
Evins AE, Cather C, Rigotti NA, Freudenreich O, Henderson DC, Olm-Shipman CM, Goff DC. Two-year follow-up of a smoking cessation trial in patients with schizophrenia: increased rates of smoking cessation and reduction. *J Clin Psychiatry* 2004;**65**:307–11	Intervention did not meet criteria
Evins AE, Cather C, Deckersbach T, Freudenreich O, Culhane MA, Olm-Shipman CM, *et al.* A double-blind placebo-controlled trial of bupropion sustained-release for smoking cessation in schizophrenia. *J Clin Psychopharmacol* 2005;**25**:218–25	Intervention did not meet criteria

TABLE 6 Excluded studies with reasons for exclusion (*continued*)

Full reference	Reason for exclusion
Evins AE, Cather C, Culhane MA, Birnbaum A, Horowitz J, Hsieh E, *et al.* A 12-week double-blind, placebo-controlled study of bupropion SR added to high-dose dual nicotine replacement therapy for smoking cessation or reduction in schizophrenia. *J Clin Psychopharmacol* 2007;**27**:380–6	Intervention did not meet criteria
Faber G, Smid HG, Van Gool AR, Wunderink L, van den Bosch RJ, Wiersma D. Continued cannabis use and outcome in first-episode psychosis: data from a randomized, open-label, controlled trial. *J Clin Psychiatry* 2012;**73**:632–8	Outcomes did not meet criteria
Fatemi SH, Yousefi MK, Kneeland RE, Liesch SB, Folsom TD, Thuras PD. Antismoking and potential antipsychotic effects of varenicline in subjects with schizophrenia or schizoaffective disorder: a double-blind placebo and bupropion-controlled study. *Schizophr Res* 2013;**146**:376–8	Intervention did not meet criteria
Faurholt-Jepsen M. The effect of smartphone-based treatment interventions in bipolar disorder. *Eur Psychiatry* 2018;**48**:S42–3	Outcomes did not meet criteria
Firth J, Carney R, Elliott R, French P, Parker S, McIntyre R, *et al.* Exercise as an intervention for first-episode psychosis: a feasibility study. *Early Interv Psychiatry* 2018;**12**:307–15	Study design did not meet criteria
Forchuk C, Norman R, Malla A, Martin ML, McLean T, Cheng S, *et al.* Schizophrenia and the motivation for smoking. *Perspect Psychiatr Care* 2002;**38**:41–9	Study design did not meet criteria
Forsell Y, Hallgren M, Mattson M, Ekblom O, Lavebratt C. FitForLife: study protocol for a randomized controlled trial. *Trials* 2015;**16**:553	Record was a protocol or registry entry
Furness T, Hewavasam J, Barnfield J, McKenna B, Joseph C. Adding an accredited exercise physiologist role to a new model of care at a secure extended care mental health service: a qualitative study. *J Ment Health* 2018;**27**:120–6	Intervention did not meet criteria
Ganguli R, Jenkins T, McKinnon K. Weight loss in individuals with diabetes and psychosis: an intervention for community residential settings. *Biol Psychiatry* 2013;**73**:319S	Study design did not meet criteria
Garcia-Portilla MP, Garcia-Alvarez L, Saiz PA, Diaz-Mesa E, Galvan G, Sarramea F, *et al.* Effectiveness of a multi-component Smoking Cessation Support Programme (McSCSP) for patients with severe mental disorders: study design. *Int J Environ Res Public Health* 2013;**11**:373–89	Record was a protocol or registry entry
George TP, Vessicchio JC, Sacco KA, Weinberger AH, Dudas MM, Allen TM, *et al.* A placebo-controlled trial of bupropion combined with nicotine patch for smoking cessation in schizophrenia. *Biol Psychiatry* 2008;**63**:1092–6	Intervention did not meet criteria
George TP, Vessicchio JC, Termine A, Bregartner TA, Feingold A, Rounsaville BJ, Kosten TR. A placebo controlled trial of bupropion for smoking cessation in schizophrenia. *Biol Psychiatry* 2002;**52**:53–61	Intervention did not meet criteria
Glover CM, Ferron JC, Whitley R. Barriers to exercise among people with severe mental illnesses. *Psychiatr Rehabil J* 2013;**36**:45–7	Population did not meet criteria
Goldberg RW, Reeves G, Tapscott S, Medoff D, Dickerson F, Goldberg AP, *et al.* 'MOVE!' Outcomes of a weight loss program modified for veterans with serious mental illness. *Psychiatr Serv* 2013;**64**:737–44	Population did not meet criteria
Goldberg RW, Dickerson F, Lucksted A, Brown CH, Weber E, Tenhula WN, *et al.* Living well: an intervention to improve self-management of medical illness for individuals with serious mental illness. *Psychiatr Serv* 2013;**64**:51–7	Outcomes did not meet criteria
Gomes E, Bastos T, Probst M, Ribeiro JC, Silva G, Corredeira R. Effects of a group physical activity program on physical fitness and quality of life in individuals with schizophrenia. *Ment Health Phys Act* 2014;**7**:155–62	Study design did not meet criteria

TABLE 6 Excluded studies with reasons for exclusion (*continued*)

Full reference	Reason for exclusion
Goodrich DE, Kilbourne AM, Lai Z, Post EP, Bowersox NW, Mezuk B, *et al.* Design and rationale of a randomized controlled trial to reduce cardiovascular disease risk for patients with bipolar disorder. *Contemp Clin Trials* 2012;**33**:666–78	Record was a protocol or registry entry
Graeber DA, Moyers TB, Griffith G, Guajardo E, Tonigan S. A pilot study comparing motivational interviewing and an educational intervention in patients with schizophrenia and alcohol use disorders. *Community Ment Health J* 2003;**39**:189–202	Study design did not meet criteria
Graham C, Rollings C, de Leeuw S, Anderson L, Griffiths B, Long N. A qualitative study exploring facilitators for improved health behaviors and health behavior programs: mental health service users' perspectives. *Sci World J* 2014;**2014**:870497	Population did not meet criteria
Graham CR, Larstone R, Griffiths B, de Leeuw S, Anderson L, Powell-Hellyer S, Long N. Development and evaluation of innovative peer-led physical activity programs for mental health service users. *J Nerv Ment Dis* 2017;**205**:840–7	Population did not meet criteria
Gray R, Brown E. What does mental health nursing contribute to improving the physical health of service users with severe mental illness? A thematic analysis. *Int J Ment Health Nurs* 2017;**26**:32–40	Intervention did not meet criteria
Gyllensten AL, Forsberg KA. Computerized physical activity training for persons with severe mental illness – experiences from a communal supported housing project. *Disabil Rehabil Assist Technol* 2017;**12**:780–8	Population did not meet criteria
Haddock G, Barrowclough C, Tarrier N, Moring J, O'Brien R, Schofield N, *et al.* Cognitive-behavioural therapy and motivational intervention for schizophrenia and substance misuse. 18-month outcomes of a randomised controlled trial. *Br J Psychiatry* 2003;**183**:418–26	Intervention did not meet criteria
Happell B, Scott D, Platania-Phung C, Nankivell J. Nurses' views on physical activity for people with serious mental illness. *Ment Health Phys Act* 2012;**5**:4–12	Population did not meet criteria
Happell B, Stanton R, Hoey W, Scott D. Cardiometabolic health nursing to improve health and primary care access in community mental health consumers: baseline physical health outcomes from a randomised controlled trial. *Issues Ment Health Nurs* 2014;**35**:114–21	Intervention did not meet criteria
Happell B, Stanton R, Hoey W, Scott D. Cardiometabolic health nursing to improve health and primary care access in community mental health consumers: protocol for a randomised controlled trial. *Int J Nurs Stud* 2014;**51**:236–42	Intervention did not meet criteria
Hargreaves J, Lucock M, Rodriguez A. From inactivity to becoming physically active: the experiences of behaviour change in people with serious mental illness. *Ment Health Phys Act* 2017;**13**:83–93	Intervention did not meet criteria
Hasson-Ohayon I, Kravetz S, Roe D, Rozencwaig S, Weiser M. Qualitative assessment of verbal and non-verbal psychosocial interventions for people with severe mental illness. *J Ment Health* 2006;**15**:343–53	Outcomes did not meet criteria
Healey C, Peters S, Kinderman P, McCracken C, Morriss R. Reasons for substance use in dual diagnosis bipolar disorder and substance use disorders: a qualitative study. *J Affect Disord* 2009;**113**:118–26	Intervention did not meet criteria
Hearon BA, Beard C, Kopeski LM, Smits JAJ, Otto MW, Björgvinsson T. Attending to timely contingencies: promoting physical activity uptake among adults with serious mental illness with an exercise-for-mood vs. an exercise-for-fitness prescription. *Behav Med* 2018;**44**:108–15	Population did not meet criteria

TABLE 6 Excluded studies with reasons for exclusion (*continued*)

Full reference	Reason for exclusion
Heffner JL, Kelly MM, Waxmonsky J, Mattocks K, Serfozo E, Bricker JB, et al. Pilot randomized controlled trial of web-delivered acceptance and commitment therapy versus smokefree.gov for smokers with bipolar disorder. *Nicotine Tob Res* 2019;**26**:26	Study design did not meet criteria
Heggelund J, Nilsberg GE, Hoff J, Morken G, Helgerud J. Effects of high aerobic intensity training in patients with schizophrenia: a controlled trial. *Nord J Psychiatry* 2011;**65**:269–75	Study design did not meet criteria
Hickman NJ, Delucchi KL, Prochaska JJ. Treating Tobacco dependence at the intersection of diversity, poverty, and mental illness: a randomized feasibility and replication trial. *Nicotine Tob Res* 2015;**17**:1012–21	Population did not meet criteria
Ho RT, Fong TC, Wan AH, Au-Yeung FS, Wong CP, Ng WY, *et al.* A randomized controlled trial on the psychophysiological effects of physical exercise and Tai-chi in patients with chronic schizophrenia. *Schizophr Res* 2016;**171**:42–9	Outcomes did not meet criteria
Hulse GK, Tait RJ. Six-month outcomes associated with a brief alcohol intervention for adult in-patients with psychiatric disorders. *Drug Alcohol Rev* 2002;**21**:105–12	Population did not meet criteria
Hultsjo S. Mental healthcare staff's knowledge and experiences of diabetes care for persons with psychosis – a qualitative interview study. *Prim Health Care Res Dev* 2013;**14**:281–92	Population did not meet criteria
Hultsjo S, Hjelm K. Community health-care staff's experiences of support to prevent type 2 diabetes among people with psychosis: an interview study with health staff. *Int J Ment Health Nurs* 2012;**21**:480–9	Population did not meet criteria
Ikai S, Uchida H, Mizuno Y, Tani H, Nagaoka M, Tsunoda K, *et al.* Effects of chair yoga therapy on physical fitness in patients with psychiatric disorders: a 12-week single-blind randomized controlled trial. *J Psychiatr Res* 2017;**94**:194–201	Outcomes did not meet criteria
James W, Preston NJ, Koh G, Spencer C, Kisely SR, Castle DJ. A group intervention which assists patients with dual diagnosis reduce their drug use: a randomized controlled trial. *Psychol Med* 2004;**34**:983–90	Study design did not meet criteria
Jerome GJ, Dalcin AT, Young DR, Stewart KJ, Crum RM, Latkin C, *et al.* Rationale, design and baseline data for the Activating Consumers to Exercise through Peer Support (ACE trial): a randomized controlled trial to increase fitness among adults with mental illness. *Ment Health Phys Act* 2012;**5**:166–74	Record was a protocol or registry entry
Jerome GJ, Young DR, Dalcin AT, Gennusa JV, Oefinger M, Yu A, *et al.* Association between weight loss program attendance and weight loss among adults with serious mental illness. *Circulation* 2014;**129**	Population did not meet criteria
Johnson JL, Malchy LA, Ratner PA, Hossain S, Procyshyn RM, Bottorff JL, *et al.* Community mental healthcare providers' attitudes and practices related to smoking cessation interventions for people living with severe mental illness. *Patient Educ Couns* 2009;**77**:289–95	Study design did not meet criteria
Johnstone R, Nicol K, Donaghy M, Lawrie S. Barriers to uptake of physical activity in community-based patients with schizophrenia. *J Ment Health* 2009;**18**:523–32	Intervention did not meet criteria
Kavanagh DJ, Young R, White A, Saunders JB, Wallis J, Shockley N, *et al.* A brief motivational intervention for substance misuse in recent-onset psychosis. *Drug Alcohol Rev* 2004;**23**:151–5	Population did not meet criteria
Kikkert M, Goudriaan A, de Waal M, Peen J, Dekker J. Effectiveness of Integrated Dual Diagnosis Treatment (IDDT) in severe mental illness outpatients with a co-occurring substance use disorder. *J Subst Abuse Treat* 2018;**95**:35–42	Intervention did not meet criteria

TABLE 6 Excluded studies with reasons for exclusion (*continued*)

Full reference	Reason for exclusion
Kilbourne AM, Bramlet M, Barbaresso MM, Nord KM, Goodrich DE, Lai Z, *et al.* SMI life goals: description of a randomized trial of a collaborative care model to improve outcomes for persons with serious mental illness. *Contemp Clin Trials* 2014;**39**:74–85	Population did not meet criteria
Kilbourne AM, Barbaresso MM, Lai Z, Nord KM, Bramlet M, Goodrich DE, *et al.* Improving physical health in patients with chronic mental disorders: twelve-month results from a randomized controlled collaborative care trial. *J Clin Psychiatry* 2017;**78**:129–37	Population did not meet criteria
Kinnafick FE, Papathomas A, Regoczi D. Promoting exercise behaviour in a secure mental health setting: healthcare assistant perspectives. *Int J Ment Health Nurs* 2018;**27**:1776–83	Population did not meet criteria
Lamont E, Harris J, McDonald G, Kerin T, Dickens GL. Qualitative investigation of the role of collaborative football and walking football groups in mental health recovery. *Ment Health Phys Act* 2017;**12**:116–23	Population did not meet criteria
Landi S, Palumbo D, Margolies P, Salerno AJ, Cleek A, Castaldo E, *et al.* Implementation trial of a wellness self-management program for individuals with severe mental illness in an Italian day hospital setting: a pilot study. *J Psychopathol* 2018;**24**:3–9	Outcomes did not meet criteria
Lawn SJ, Pols RG, Barber JG. Smoking and quitting: a qualitative study with community-living psychiatric clients. *Soc Sci Med* 2002;**54**:93–104	Population did not meet criteria
Lawn S, Van Agteren J, Zabeen S, Bertossa S, Barton C, Stewart J. Adapting, pilot testing and evaluating the Kick.it app to support smoking cessation for smokers with severe mental illness: a study protocol. *Int J Environ Res Public Health* 2018;**15**:E254	Record was a protocol or registry entry
Lee JG, Ranney LM, Goldstein AO, McCullough A, Fulton-Smith SM, Collins NO. Successful implementation of a wellness and tobacco cessation curriculum in psychosocial rehabilitation clubhouses. *BMC Public Health* 2011;**11**:702	Population did not meet criteria
Leutwyler H, Hubbard EM, Jeste DV, Vinogradov S. 'We're not just sitting on the periphery': a staff perspective of physical activity in older adults with schizophrenia. *Gerontologist* 2013;**53**:474–83	Population did not meet criteria
Leutwyler H, Hubbard EM, Slater M, Jeste DV. 'It's good for me': physical activity in older adults with schizophrenia. *Community Ment Health J* 2014;**50**:75–80	Intervention did not meet criteria
Leutwyler H, Hubbard E, Cooper BA, Dowling G. Impact of a pilot videogame-based physical activity program on walking speed in adults with schizophrenia. *Community Ment Health J* 2018;**54**:735–9	Outcomes did not meet criteria
Leyland SD, Currie A, Anderson SD, Bradley E, Ling J. Offering physical activity advice to people with serious mental illness: the beliefs of mental health professionals. *Ment Health Phys Act* 2018;**15**:1–6	Population did not meet criteria
Lin JJ, Lee HM, Chan KW, Chang WC, Su W, Honer WG, *et al.* The impacts of aerobic exercise and mind–body exercise (yoga) on neuro-cognition and clinical symptoms in early psychosis a single-blind radomized controlled clinical trial. *Schizophr Res* 2014;**153**:S260	Outcomes did not meet criteria
Lin SS, Sheu SJ, Lee YC, Chiang HH. [The physical activity and life healing in psychiatric patients: taijiguan as an example.] *Hu Li Za Zhi* 2014;**61**:46–55	Intervention did not meet criteria
Lin JJX, Lee EHM, Chang WC, Chan SKW, Tse M, Phong PL, *et al.* Aerobic exercise and yoga hold promises for improving neuro-cognition and symptom in early psychosis. *Schizophr Bull* 2015;**41**:S320	Outcomes did not meet criteria
Linhardt A, Krger C, Pogarell O, Weltzer V, Wenig J, Rther T. Implementation and evaluation of the smoking cessation programme 'the smokers' group' in psychiatric inpatients. *Eur Psychiatry* 2014;**29**	Study design did not meet criteria

TABLE 6 Excluded studies with reasons for exclusion (*continued*)

Full reference	Reason for exclusion
Liu NH, Spaulding WD. Pilot study of a health-focused day program on improving health behaviors, clinical functioning, and perceived wellness in individuals with severe mental illness. *Psychol Serv* 2010;**7**:233–41	Study design did not meet criteria
Loh SY, Abdullah A, Abu Bakar AK, Thambu M, Nik Jaafar NR. Structured walking and chronic institutionalized schizophrenia inmates: a pilot RCT study on quality of life. *Glob J Health Sci* 2015;**8**:238–48	Outcomes did not meet criteria
Looijmans A, Stiekema A, Bruggeman R, Van DML, Stolk RP, Schoevers RA, *et al.* Improving cardiometabolic health by adjusting the obesogenic environment in severe mentally ill residential patients: a randomised controlled trial. *Eur J Epidemiol* 2015;**30**:796	Study design did not meet criteria
Looijmans A, Stiekema A, Bruggeman R, Van DML, Stolk R, Schoevers R, *et al.* Improving cardiometabolic health by adjusting the obesogenic environment in severe mentally ill inpatients: a randomised controlled trial. *Obes Facts* 2016;**9**:74–5	Study design did not meet criteria
Looijmans A, Stiekema APM, Bruggeman R, van der Meer L, Stolk RP, Schoevers RA, *et al.* Changing the obesogenic environment to improve cardiometabolic health in residential patients with a severe mental illness: cluster randomised controlled trial. *Br J Psychiatry* 2017;**211**:296–303	Population did not meet criteria
Looijmans A, Jörg F, Bruggeman R, Schoevers R, Corpeleijn E. Design of the Lifestyle Interventions for severe mentally ill Outpatients in the Netherlands (LION) trial; a cluster randomised controlled study of a multidimensional web tool intervention to improve cardiometabolic health in patients with severe mental illness. *BMC Psychiatry* 2017;**17**:107	Record was a protocol or registry entry
Looijmans A, Jörg F, Bruggeman R, Schoevers RA, Corpeleijn E. Multimodal lifestyle intervention using a web-based tool to improve cardiometabolic health in patients with serious mental illness: results of a cluster randomized controlled trial (LION). *BMC Psychiatry* 2019;**19**:339	Population did not meet criteria
Lopez-Jaramillo C, Palacio JD, Vargas C. Effects of a multimodal intervention program in patients with bipolar disorder and schizophrenia. *Bipolar Disord* 2015;**17**:130	Outcomes did not meet criteria
Lovell K, Wearden A, Bradshaw T, Tomenson B, Pedley R, Davies LM, *et al.* An exploratory randomized controlled study of a healthy living intervention in early intervention services for psychosis: the INTERvention to encourage ACTivity, improve diet, and reduce weight gain (INTERACT) study. *J Clin Psychiatry* 2014;**75**:498–505	Population did not meet criteria
Lutgens D, Iyer S, Joober R, Brown TG, Norman R, Latimer E, *et al.* A five-year randomized parallel and blinded clinical trial of an extended specialized early intervention vs. regular care in the early phase of psychotic disorders: study protocol. *BMC Psychiatry* 2015;**15**:22	Intervention did not meet criteria
Madigan K, Lawlor E, Brennan D, Turner N, Kinsella A, O'Connor J, *et al.* A multi-centre, randomised controlled trial of a group psychological intervention for psychosiswith comorbid cannabis dependence over the early course of illness. *Schizophr Res* 2012;**136**:S371	Insufficient data to assess eligibility
Madigan K, Brennan D, Lawlor E, Turner N, Kinsella A, O'Connor JJ, *et al.* A multi-center, randomized controlled trial of a group psychological intervention for psychosis with comorbid cannabis dependence over the early course of illness. *Schizophr Res* 2013;**143**:138–42	Population did not meet criteria
Maggouritsa G, Kokaridas D, Theodorakis I, Patsiaouras A, Mouzas O, Dimitrakopoulos S, *et al.* The effect of a physical activity programme on improving mood profile of patients with schizophrenia. *Int J Sport Exerc Psychol* 2014;**12**:273–84	Outcomes did not meet criteria
Magni LR, Ferrari C, Rossi G, Staffieri E, Uberti A, Lamonaca D, *et al.* Superwellness Program: a cognitive–behavioral therapy-based group intervention to reduce weight gain in patients treated with antipsychotic drugs. *Braz J Psychiatry* 2017;**39**:244–51	Study design did not meet criteria

TABLE 6 Excluded studies with reasons for exclusion (*continued*)

Full reference	Reason for exclusion
Mahony G, Haracz K, Williams LT. How mental health occupational therapists address issues of diet with their clients: a qualitative study. *Aust Occup Ther J* 2012;**59**:294–301	Population did not meet criteria
Mangrum LF, Spence RT, Lopez M. Integrated versus parallel treatment of co-occurring psychiatric and substance use disorders. *J Subst Abuse Treat* 2006;**30**:79–84	Outcomes did not meet criteria
Martino S, Carroll KM, Nich C, Rounsaville BJ. A randomized controlled pilot study of motivational interviewing for patients with psychotic and drug use disorders. *Addiction* 2006;**101**:1479–92	Intervention did not meet criteria
McDevitt J, Snyder M, Miller A, Wilbur J. Perceptions of barriers and benefits to physical activity among outpatients in psychiatric rehabilitation. *J Nurs Scholarsh* 2006;**38**:50–5	Population did not meet criteria
McCann TV, Renzaho A, Mugavin J, Lubman DI. Stigma of mental illness and substance misuse in sub-Saharan African migrants: a qualitative study. *Int J Ment Health Nurs* 2018;**27**:956–65	Population did not meet criteria
McDonell MG, Srebnik D, Angelo F, McPherson S, Lowe JM, Sugar A, *et al.* Randomized controlled trial of contingency management for stimulant use in community mental health patients with serious mental illness. *Am J Psychiatry* 2013;**170**:94–101	Population did not meet criteria
McDonell MG, Leickly E, McPherson S, Skalisky J, Nepom JR, Srebnik D, *et al.* Ethylglucuronide based continency management for alcohol in seriously mentally ill outpatients. *Alcohol Clin Exp Res* 2016;**40**(Suppl. 1):188A.	Population did not meet criteria
McDonell MG, Leickly E, McPherson S, Srebnik D, Roll JM, Ries R, *et al.* Treatment for alcohol use disorders in seriously mentally ill adults using the ethyl glucuronide biomarker. *Drug Alcohol Depend* 2017;**171**:e137–8	Population did not meet criteria
McDonell MG, Leickly E, McPherson S, Skalisky J, Srebnik D, Angelo F, *et al.* A randomized controlled trial of ethyl glucuronide-based contingency management for outpatients with co-occurring alcohol use disorders and serious mental illness. *Am J Psychiatry* 2017;**174**:370–7	Population did not meet criteria
McKibbin CL, Kitchen KA, Wykes TL, Lee AA. Barriers and facilitators of a healthy lifestyle among persons with serious and persistent mental illness: perspectives of community mental health providers. *Community Ment Health J* 2014;**50**:566–76	Population did not meet criteria
Melau M, Jeppesen P, Thorup A, Bertelsen M, Petersen L, Gluud C, *et al.* The effect of five years versus two years of specialised assertive intervention for first episode psychosis – OPUS II: study protocol for a randomized controlled trial. *Trials* 2011;**12**:72	Intervention did not meet criteria
Mericle AA, Alvidrez J, Havassy BE. Mental health provider perspectives on co-occurring substance use among severely mentally ill clients. *J Psychoactive Drugs* 2007;**39**:173–81	Population did not meet criteria
Metse AP, Bowman JA, Wye P, Stockings E, Adams M, Clancy R, *et al.* Evaluating the efficacy of an integrated smoking cessation intervention for mental health patients: study protocol for a randomised controlled trial. *Trials* 2014;**15**:266	Population did not meet criteria
Metse AP, Wiggers J, Wye P, Wolfenden L, Freund M, Clancy R, *et al.* Efficacy of a universal smoking cessation intervention initiated in inpatient psychiatry and continued post-discharge: a randomised controlled trial. *Aust N Z J Psychiatry* 2017;**51**:366–81	Population did not meet criteria
Morrens M, Dewilde B, Sabbe B, Dom G, De Cuyper R, Moggi F. Treatment outcomes of an integrated residential programme for patients with schizophrenia and substance use disorder. *Eur Addict Res* 2011;**17**:154–63	Study design did not meet criteria

TABLE 6 Excluded studies with reasons for exclusion (*continued*)

Full reference	Reason for exclusion
Mueser KT, Glynn SM, Cather C, Xie H, Zarate R, Smith LF, *et al.* A randomized controlled trial of family intervention for co-occurring substance use and severe psychiatric disorders. *Schizophr Bull* 2013;**39**:658–72	Intervention did not meet criteria
Muralidharan A, Niv N, Brown CH, Olmos-Ochoa TT, Fang LJ, Cohen AN, *et al.* Impact of online weight management with peer coaching on physical activity levels of adults with serious mental illness. *Psychiatr Serv* 2018;**69**:1062–8	Study design did not meet criteria
Naeem F, Kingdon D, Turkington D. Cognitive behavior therapy for schizophrenia in patients with mild to moderate substance misuse problems. *Cogn Behav Ther* 2005;**34**:207–15	Study design did not meet criteria
Naslund JA. Digital technology for health promotion among individuals with serious mental illness. *Diss Abstr Int B Sci Eng* 2018;**79**	Study design did not meet criteria
Naslund JA, Aschbrenner KA, Barre LK, Bartels SJ. Feasibility of popular m-health technologies for activity tracking among individuals with serious mental illness. *Telemed J E Health* 2015;**21**:213–16	Population did not meet criteria
Naslund JA, Aschbrenner KA, Bartels SJ. Wearable devices and smartphones for activity tracking among people with serious mental illness. *Ment Health Phys Act* 2016;**10**:10–17	Population did not meet criteria
Naslund JA, Aschbrenner KA, Scherer EA, Pratt SI, Wolfe RS, Bartels SJ. Lifestyle intervention for people with severe obesity and serious mental illness. *Am J Prev Med* 2016;**50**:145–53	Population did not meet criteria
Naslund JA, Aschbrenner KA, Scherer EA, Pratt SI, Bartels SJ. Health promotion for young adults with serious mental illness. *Psychiatr Serv* 2017;**68**:137–43	Population did not meet criteria
Nawaz S, Frounfelker R, Ferron JC, Carpenter-Song EA, Davis K, Brunette MF. Smoking and quitting beliefs, attitudes, and behaviors among smokers with severe mental illness from three race/ethnicity groups. *J Dual Diagn* 2012;**8**:180–7	Population did not meet criteria
Nehlin C, Fredriksson A, Oster C. Young female psychiatric patients' reasons for excessive alcohol use: a qualitative interview study. *Ment Health Subst Use* 2013;**6**:315–24	Population did not meet criteria
Noordsy DL, Schwab B, Fox L, Drake RE. The role of self-help programs in the rehabilitation of persons with severe mental illness and substance use disorders. *Community Ment Health J* 1996;**32**:71–81	Study design did not meet criteria
O'Connell MJ, Sledge WH, Staeheli M, Sells D, Costa M, Wieland M, Davidson L. Outcomes of a peer mentor intervention for persons with recurrent psychiatric hospitalization. *Psychiatr Serv* 2018;**69**:760–7	Population did not meet criteria
Oertel-Knöchel V, Mehler P, Thiel C, Steinbrecher K, Malchow B, Tesky V, *et al.* Effects of aerobic exercise on cognitive performance and individual psychopathology in depressive and schizophrenia patients. *Eur Arch Psychiatry Clin Neurosci* 2014;**264**:589–604	Outcomes did not meet criteria
Oluwoye O, Leickly E, Skalisky J, McPherson S, Hirchak K, Srebnik D, *et al.* Serious mental illness in heavy drinkers is associated with poor treatment outcomes in outpatients with co-occurring disorders. *Int J Ment Health Addict* 2018;**16**:672–9	Population did not meet criteria
Oluwoye O, Skalisky J, Burduli E, Chaytor NS, McPherson S, Murphy SM, *et al.* Using a randomized controlled trial to test whether modifications to contingency management improve outcomes for heavy drinkers with serious mental illness. *Contemp Clin Trials* 2018;**69**:92–8	Record was a protocol or registry entry

TABLE 6 Excluded studies with reasons for exclusion (*continued*)

Full reference	Reason for exclusion
Owen RR, Drummond KL, Viverito KM, Marchant K, Pope SK, Smith JL, Landes RD. Monitoring and managing metabolic effects of antipsychotics: a cluster randomized trial of an intervention combining evidence-based quality improvement and external facilitation. *Implement Sci* 2013;**8**:120	Record was a protocol or registry entry
Peckham E, Bradshaw TJ, Brabyn S, Knowles S, Gilbody S. Exploring why people with SMI smoke and why they may want to quit: baseline data from the SCIMITAR RCT. *J Psychiatr Ment Health Nurs* 2016;**23**:282–9	Study design did not meet criteria
Pedley R, Lovell K, Bee P, Bradshaw T, Gellatly J, Ward K, *et al.* Collaborative, individualised lifestyle interventions are acceptable to people with first episode psychosis; a qualitative study. *BMC Psychiatry* 2018;**18**:111	Population did not meet criteria
Pelham TW, Campagna PD, Ritvo PG, Birnie WA. The effects of exercise therapy on clients in a psychiatric rehabilitation program. *Psychosoc Rehabil J* 1993;**16**:75–84	Outcomes did not meet criteria
Pelletier JR, Nguyen M, Bradley K, Johnsen M, McKay C. A study of a structured exercise program with members of an ICCD Certified Clubhouse: program design, benefits, and implications for feasibility. *Psychiatr Rehabil J* 2005;**29**:89–96	Study design did not meet criteria
Petersen L, Jeppesen P, Thorup A, Ohlenschlaeger J, Krarup G, Ostergård T, *et al.* Substance abuse and first-episode schizophrenia-spectrum disorders. The Danish OPUS trial. *Early Interv Psychiatry* 2007;**1**:88–96	Intervention did not meet criteria
Petry NM, Alessi SM, Rash CJ. A randomized study of contingency management in cocaine-dependent patients with severe and persistent mental health disorders. *Drug Alcohol Depend* 2013;**130**:234–7	Population did not meet criteria
Pettersen H, Ruud T, Ravndal E, Landheim A. Walking the fine line: self-reported reasons for substance use in persons with severe mental illness. *Int J Qual Stud Health Well-being* 2013;**8**:21968	Outcomes did not meet criteria
Pettersen H, Ruud T, Ravndal E, Havnes I, Landheim A. Engagement in assertive community treatment as experienced by recovering clients with severe mental illness and concurrent substance use. *Int J Ment Health Syst* 2014;**8**:40	Intervention did not meet criteria
Prochaska JJ, Hall SE, Delucchi K, Hall SM. Efficacy of initiating tobacco dependence treatment in inpatient psychiatry: a randomized controlled trial. *Am J Public Health* 2014;**104**:1557–65	Population did not meet criteria
Provencher MD, Bélanger MÈ, Shriqui C, Lachance I, Bonneville S. [Psychoeducation for overweight patients with psychiatric disorders: the Wellness program developed in Quebec.] *Encephale* 2016;**42**:201–7	Population did not meet criteria
Ragaisis KM. Psychiatric Inpatient Nurses' Perceptions of Using Motivational Interviewing. *Issues Ment Health Nurs* 2017;**38**:945–55	Population did not meet criteria
Ratschen E, Britton J, Doody GA, McNeill A. Smoke-free policy in acute mental health wards: avoiding the pitfalls. *Gen Hosp Psychiatry* 2009;**31**:131–6	Population did not meet criteria
Ratschen E, Britton J, Doody G, McNeill A. Smoking attitudes, behaviour and nicotine dependence among mental health acute inpatients: an exploratory study. *Int J Soc Psychiatry* 2010;**56**:107–18	Population did not meet criteria
Rebgetz S, Hides L, Kavanagh DJ, Choudhary A. Natural recovery from cannabis use in people with psychosis: a qualitative study. *J Dual Diagn* 2015;**11**:179–83	Intervention did not meet criteria
Rezaie L, Shafaroodi N, Philips D. The barriers to participation in leisure time physical activities among Iranian women with severe mental illness: a qualitative study. *Ment Health Phys Act* 2017;**13**:171–7	Intervention did not meet criteria

TABLE 6 Excluded studies with reasons for exclusion (*continued*)

Full reference	Reason for exclusion
Ridgely MS, Jerrell JM. Analysis of three interventions for substance abuse treatment of severely mentally ill people. *Community Ment Health J* 1996;**32**:561–72	Study design did not meet criteria
Roberts SH, Bailey JE. Incentives and barriers to lifestyle interventions for people with severe mental illness: a narrative synthesis of quantitative, qualitative and mixed methods studies. *J Adv Nurs* 2011;**67**:690–708	Study design did not meet criteria
Romain AJ, Longpre-Poirier C, Tannous M, Abdel-Baki A. Preferences of physical activity and perception of health behaviour in early psychosis individuals. *Early Interv Psychiatry* 2016;**10**:193	Study design did not meet criteria
Romain AJ, Fankam C, Karelis A, Letendre E, Mikolajacks G, Stip E, *et al.* Effect of interval training on metabolic risk factors in overweight individuals with psychosis: a randomized controlled trial. *Schizophr Bull* 2018;**44**(Suppl. 1):S17	Study design did not meet criteria
Rosen MI, Rounsaville BJ, Ablondi K, Black AC, Rosenheck RA. Advisor-Teller Money Manager (ATM) therapy for substance use disorders. *Psychiatr Serv* 2010;**61**:707–13	Population did not meet criteria
Rosenbaum S, Ward PB. 'At least 50% of young people experiencing a first episode psychosis should be engaged in age-appropriate physical activity'. Achieving a healthy active lives target for physical activity participation. *Early Interv Psychiatry* 2014;**8**:91	Study design did not meet criteria
Rowe M, Bellamy C, Baranoski M, Wieland M, O'Connell MJ, Benedict P, *et al.* A peer-support, group intervention to reduce substance use and criminality among persons with severe mental illness. *Psychiatr Serv* 2007;**58**:955–61	Population did not meet criteria
Sampogna G, Fiorillo A, Luciano M, Del Vecchio V, Steardo L, Pocai B, *et al.* A randomized controlled trial on the efficacy of a psychosocial behavioral intervention to improve the lifestyle of patients with severe mental disorders: study protocol. *Front Psychiatry* 2018;**9**:235	Record was a protocol or registry entry
Shiner B, Whitley R, Van Citters AD, Pratt SI, Bartels SJ. Learning what matters for patients: qualitative evaluation of a health promotion program for those with serious mental illness. *Health Promot Int* 2008;**23**:275–82	Population did not meet criteria
Shor R, Shalev A. Identifying barriers to improving the wellness of persons with severe mental illness in community residential mental health facilities. *Soc Work Ment Health* 2013;**11**:334–48	Intervention did not meet criteria
Shor R, Shalev A. Barriers to involvement in physical activities of persons with mental illness. *Health Promot Int* 2016;**31**:116–23	Study design did not meet criteria
Silva BA, Cassilhas RC, Attux C, Cordeiro Q, Gadelha AL, Telles BA, *et al.* A 20-week program of resistance or concurrent exercise improves symptoms of schizophrenia: results of a blind, randomized controlled trial. *Braz J Psychiatry* 2015;**37**:271–9	Intervention did not meet criteria
Skrinar GS, Huxley NA, Hutchinson DS, Menninger E, Glew P. The role of a fitness intervention on people with serious psychiatric disabilities. *Psychiatr Rehabil J* 2005;**29**:122–7	Intervention did not meet criteria
Smeerdijk M, Keet R, Dekker N, van Raaij B, Krikke M, Koeter M, *et al.* Motivational interviewing and interaction skills training for parents to change cannabis use in young adults with recent-onset schizophrenia: a randomized controlled trial. *Psychol Med* 2012;**42**:1627–36	Population did not meet criteria
Smeerdijk M, Keet R, van Raaij B, Koeter M, Linszen D, de Haan L, Schippers G. Motivational interviewing and interaction skills training for parents of young adults with recent-onset schizophrenia and co-occurring cannabis use: 15-month follow-up. *Psychol Med* 2015;**45**:2839–48	Population did not meet criteria
Smelson D, Kalman D, Losonczy MF, Kline A, Sambamoorthi U, Hill LS, *et al.* A brief treatment engagement intervention for individuals with co-occurring mental illness and substance use disorders: results of a randomized clinical trial. *Community Ment Health J* 2012;**48**:127–32	Intervention did not meet criteria

TABLE 6 Excluded studies with reasons for exclusion (*continued*)

Full reference	Reason for exclusion
Smith J, Williams B, Band M, Hickman D, Bradley E, Richardson J, *et al.* SHAPE (Supporting Health And Promoting Exercise) project for young people with psychosis. *Early Interv Psychiatry* 2014;**8**:122	Study design did not meet criteria
Smith RC, Amiaz R, Si TM, Maayan L, Jin H, Boules S, *et al.* Varenicline effects on smoking, cognition, and psychiatric symptoms in schizophrenia: a double-blind randomized trial. *PLOS ONE* 2016;**11**:e0143490	Intervention did not meet criteria
Snyder M, McDevitt J, Painter S. Smoking cessation and serious mental illness. *Arch Psychiatr Nurs* 2008;**22**:297–304	Intervention did not meet criteria
Stasiewicz PR, Bradizza CM, Maisto SA. Alcohol problem resolution in the severely mentally ill: a preliminary investigation. *J Subst Abuse* 1997;**9**:209–22	Population did not meet criteria
Steinberg ML, Ziedonis DM, Krejci JA, Brandon TH. Motivational interviewing with personalized feedback: a brief intervention for motivating smokers with schizophrenia to seek treatment for tobacco dependence. *J Consult Clin Psychol* 2004;**72**:723–8	Intervention did not meet criteria
Stiekema APM, Looijmans A, van der Meer L, Bruggeman R, Schoevers RA, Corpeleijn E, Jörg F. Effects of a lifestyle intervention on psychosocial well-being of severe mentally ill residential patients: ELIPS, a cluster randomized controlled pragmatic trial. *Schizophr Res* 2018;**199**:407–13	Outcomes did not meet criteria
Stockings EA, Bowman JA, Wiggers J, Baker AL, Terry M, Clancy R, *et al.* A randomised controlled trial linking mental health inpatients to community smoking cessation supports: a study protocol. *BMC Public Health* 2011;**11**:570	Population did not meet criteria
Stockings EA, Bowman JA, Baker AL, Terry M, Clancy R, Wye PM, *et al.* Impact of a postdischarge smoking cessation intervention for smokers admitted to an inpatient psychiatric facility: a randomized controlled trial. *Nicotine Tob Res* 2014;**16**:1417–28	Population did not meet criteria
Stockings EA, Bowman JA, Bartlem KM, McElwaine KM, Baker AL, Terry M, *et al.* Quality of implementation of a smoke-free policy in an inpatient psychiatric facility: association with patient acceptability. *Asia Pac J Clin Oncol* 2014;**10**:166–7	Study design did not meet criteria
Stockings EA, Bowman JA, Bartlem KM, McElwaine KM, Baker AL, Terry M, *et al.* Implementation of a smoke-free policy in an inpatient psychiatric facility: patient-reported adherence, support, and receipt of nicotine-dependence treatment. *Int J Ment Health Nurs* 2015;**24**:342–9	Study design did not meet criteria
Strong JR, Lemaire GS, Murphy LS. Assessment of a chronic disease self-management program to increase physical activity of adults with severe mental illness. *Arch Psychiatr Nurs* 2017;**31**:137–40	Study design did not meet criteria
Strong Kinnaman JE, Slade E, Bennett ME, Bellack AS. Examination of contingency payments to dually-diagnosed patients in a multi-faceted behavioral treatment. *Addict Behav* 2007;**32**:1480–5	Population did not meet criteria
Su CY, Wang PW, Lin YJ, Tang TC, Liu MF, Chen MD. The effects of aerobic exercise on cognition in schizophrenia: a 3-month follow-up study. *Psychiatry Res* 2016;**244**:394–402	Outcomes did not meet criteria
Sundgren E, Hallqvist J, Fredriksson L. Health for smokers with schizophrenia – a struggle to maintain a dignified life. *Disabil Rehabil* 2016;**38**:416–22	Intervention did not meet criteria
Svatkova A, Mandl RC, Scheewe TW, Cahn W, Kahn RS, Hulshoff Pol HE. Physical exercise keeps the brain connected: biking increases white matter integrity in patients with schizophrenia and healthy controls. *Schizophr Bull* 2015;**41**:869–78	Population did not meet criteria

TABLE 6 Excluded studies with reasons for exclusion (*continued*)

Full reference	Reason for exclusion
Swanson AJ, Pantalon MV, Cohen KR. Motivational interviewing and treatment adherence among psychiatric and dually diagnosed patients. *J Nerv Ment Dis* 1999;**187**:630–5	Population did not meet criteria
Teasdale S, Harris S, Rosenbaum S, Watkins A, Samaras K, Curtis J, Ward PB. Individual dietetic consultations in first episode psychosis: a novel intervention to reduce cardiometabolic risk. *Community Ment Health J* 2015;**51**:211–14	Study design did not meet criteria
Teasdale SB, Ward PB, Rosenbaum S, Watkins A, Curtis J, Kalucy M, Samaras K. A nutrition intervention is effective in improving dietary components linked to cardiometabolic risk in youth with first-episode psychosis. *Br J Nutr* 2016;**115**:1987–93	Study design did not meet criteria
Teferra S, Hanlon C, Alem A, Jacobsson L, Shibre T. Khat chewing in persons with severe mental illness in Ethiopia: a qualitative study exploring perspectives of patients and caregivers. *Transcult Psychiatry* 2011;**48**:455–72	Intervention did not meet criteria
Teferra S, Shibre T. Perceived causes of severe mental disturbance and preferred interventions by the Borana semi-nomadic population in southern Ethiopia: a qualitative study. *BMC Psychiatry* 2012;**12**:79	Population did not meet criteria
Tidey JW, O'Neill SC, Higgins ST. Contingent monetary reinforcement of smoking reductions, with and without transdermal nicotine, in outpatients with schizophrenia. *Exp Clin Psychopharmacol* 2002;**10**:241–7	Study design did not meet criteria
Trainor K, Leavey G. Barriers and facilitators to smoking cessation among people with severe mental illness: a critical appraisal of qualitative studies. *Nicotine Tob Res* 2017;**19**:14–23	Study design did not meet criteria
Ursuliak Z, Milliken H, Morgan N. Wellness program for people with early psychosis: promoting skills and attitudes for recovery. *Psychiatr Serv* 2015;**66**:105	Study design did not meet criteria
Ussher M, Stanbury L, Cheeseman V, Faulkner G. Physical activity preferences and perceived barriers to activity among persons with severe mental illness in the United Kingdom. *Psychiatr Serv* 2007;**58**:405–8	Study design did not meet criteria
Vandyk AD, Baker C. Qualitative descriptive study exploring schizophrenia and the everyday effect of medication-induced weight gain. *Int J Ment Health Nurs* 2012;**21**:349–57	Intervention did not meet criteria
Vaughan K, McConaghy N. Megavitamin and dietary treatment in schizophrenia: a randomised, controlled trial. *Aust N Z J Psychiatry* 1999;**33**:84–8	Outcomes did not meet criteria
Verhaeghe N, Clays E, Vereecken C, De Maeseneer J, Maes L, Van Heeringen C, *et al.* Health promotion in individuals with mental disorders: a cluster preference randomized controlled trial. *BMC Public Health* 2013;**13**:657	Population did not meet criteria
Vessichio JC, George TP. *Treating Nicotine Dependence in Schizophrenic Individuals: Effectiveness of Bupropion – 1.* URL: https://clinicaltrials.gov/ct2/show/NCT00124683 (accessed 30 April 2021)	Record was a protocol or registry entry
Vilardaga R, Rizo J, Palenski P, Mannelli P, Oliver JA, McClernon FJ. Pilot randomized controlled trial of a novel smoking cessation app designed for individuals with co-occurring tobacco dependence and serious mental illness. *Nicotine Tob Res* 2019;**31**:31	Population did not meet criteria
Ward TD. The lived experience of adults with bipolar disorder and comorbid substance use disorder. *Issues Ment Health Nurs* 2011;**32**:20–7	Intervention did not meet criteria
Wärdig RE, Bachrach-Lindström M, Foldemo A, Lindström T, Hultsjö S. Prerequisites for a healthy lifestyle-experiences of persons with psychosis. *Issues Ment Health Nurs* 2013;**34**:602–10	Intervention did not meet criteria

TABLE 6 Excluded studies with reasons for exclusion (*continued*)

Full reference	Reason for exclusion
Weinberger AH, Vessicchio JC, Sacco KA, Creeden CL, Chengappa KN, George TP. A preliminary study of sustained-release bupropion for smoking cessation in bipolar disorder. *J Clin Psychopharmacol* 2008;**28**:584–7	Intervention did not meet criteria
Weiner E, Buchholz A, Coffay A, Liu F, McMahon RP, Buchanan RW, Kelly DL. Varenicline for smoking cessation in people with schizophrenia: a double blind randomized pilot study. *Schizophr Res* 2011;**129**:94–5	Intervention did not meet criteria
Weiner E, Ball MP, Buchholz AS, Gold JM, Evins AE, McMahon RP, Buchanan RW. Bupropion sustained release added to group support for smoking cessation in schizophrenia: a new randomized trial and a meta-analysis. *J Clin Psychiatry* 2012;**73**:95–102	Intervention did not meet criteria
Weinstein LC. Beyond lifestyle factors: Exploring the role of the social determinants of health in weight loss attempts in people with serious mental illness living in supportive housings settings. *Diss Abstr Int B Sci Eng* 2018;**79**	Could not obtain dissertation
Weiss RD, Griffin ML, Greenfield SF, Najavits LM, Wyner D, Soto JA, Hennen JA. Group therapy for patients with bipolar disorder and substance dependence: results of a pilot study. *J Clin Psychiatry* 2000;**61**:361–7	Study design did not meet criteria
Weiss RD, Griffin ML, Kolodziej ME, Janis IB, Hennen J. A randomized controlled trial of integrated group therapy for patients with bipolar disorder & substance dependence. *Alcohol Clin Exp Res* 2005;**29**:158A	Intervention did not meet criteria
Weiss RD, Griffin ML, Kolodziej ME, Greenfield SF, Najavits LM, Daley DC, *et al.* A randomized trial of integrated group therapy versus group drug counseling for patients with bipolar disorder and substance dependence. *Am J Psychiatry* 2007;**164**:100–7	Intervention did not meet criteria
Weiss RD, Griffin ML, Jaffee WB, Bender RE, Graff FS, Gallop RJ, Fitzmaurice GM. A 'community-friendly' version of integrated group therapy for patients with bipolar disorder and substance dependence: a randomized controlled trial. *Drug Alcohol Depend* 2009;**104**:212–19	Intervention did not meet criteria
Weissman EM, Moot DM, Essock SM. What do people with schizophrenia think about weight management? *Psychiatr Serv* 2006;**57**:724–5	Study design did not meet criteria
Wells ME. Increasing motivation to stop smoking among persons with schizophrenia and other chronic mental illnesses. *Diss Abstr Int B Sci Eng* 2003;**63**:3946	Could not obtain dissertation
Westman J, Eberhard J, Gaughran FP, Lundin L, Stenmark R, Edman G, *et al.* Outcome of a psychosocial health promotion intervention aimed at improving physical health and reducing alcohol use in patients with schizophrenia and psychotic disorders (MINT). *Schizophr Res* 2019;**208**:138–44	Study design did not meet criteria
Williams JM, Steinberg ML, Zimmermann MH, Gandhi KK, Stipelman B, Budsock PD, Ziedonis DM. Comparison of two intensities of tobacco dependence counseling in schizophrenia and schizoaffective disorder. *J Subst Abuse Treat* 2010;**38**:384–93	Intervention did not meet criteria
Williams JM, Anthenelli RM, Morris CD, Treadow J, Thompson JR, Yunis C, George TP. A randomized, double-blind, placebo-controlled study evaluating the safety and efficacy of varenicline for smoking cessation in patients with schizophrenia or schizoaffective disorder. *J Clin Psychiatry* 2012;**73**:654–60	Intervention did not meet criteria
Williams J, Stubbs B, Gaughran F, Craig T. 'Walk This Way' - a pilot of a health coaching intervention to reduce sedentary behaviour and increase low intensity exercise in people with serious mental illness: study protocol for a randomised controlled trial. *Trials* 2016;**17**:594	Study design did not meet criteria
Wilson SM, Thompson AC, Currence ED, Thomas SP, Dedert EA, Kirby AC, *et al.* Patient-informed treatment development of behavioral smoking cessation for people with schizophrenia. *Behav Ther* 2019;**50**:395–409	Study design did not meet criteria

TABLE 6 Excluded studies with reasons for exclusion (*continued*)

Full reference	Reason for exclusion
Wright K, Armstrong T, Taylor A, Dean S. 'It's a double edged sword': a qualitative analysis of the experiences of exercise amongst people with bipolar disorder. *J Affect Disord* 2012;**136**:634–42	Intervention did not meet criteria
Wu BS, Weinberger AH, Mancuso E, Wing VC, Haji-Khamneh B, Levinson AJ, George TP. A Preliminary feasibility study of varenicline for smoking cessation in bipolar disorder. *J Dual Diagn* 2012;**8**:131–2	Intervention did not meet criteria
Wye P, Bowman J, Wiggers J, Baker A, Carr V, Terry M, *et al.* Providing nicotine dependence treatment to psychiatric inpatients: the views of Australian nurse managers. *J Psychiatr Ment Health Nurs* 2010;**17**:319–27	Population did not meet criteria
Xiao S, Baker C, Oyewumi LK. Psychosocial processes influencing weight management among persons newly prescribed atypical antipsychotic medications. *J Psychiatr Ment Health Nurs* 2012;**19**:241–7	Intervention did not meet criteria
Xiong G, Ziegahn L, Schuyler B, Rowlett A, Cassady D. Improving dietary and physical activity practices in group homes serving residents with severe mental illness. *Prog Community Health Partnersh* 2010;**4**:279–88	Intervention did not meet criteria
Yarborough BJ, Leo MC, Yarborough MT, Stumbo S, Janoff SL, Perrin NA, Green CA. Improvement in body image, perceived health, and health-related self-efficacy among people with serious mental illness: the STRIDE study. *Psychiatr Serv* 2016;**67**:296–301	Outcomes did not meet criteria
Zhu Y, Jiang H, Su H, Zhong N, Li R, Li X, *et al.* A newly designed mobile-based computerized cognitive addiction therapy app for the improvement of cognition impairments and risk decision making in methamphetamine use disorder: randomized controlled trial. *JMIR Mhealth Uhealth* 2018;**6**:e10292	Population did not meet criteria

Appendix 3 Population characteristics of included randomised controlled trials

TABLE 7 Population characteristics for included RCTs

Study (first author, year of publication, country)	Sample size (*n*)	Age (years) (range, or mean and SD)	Female (%)	Ethnicity	Antipsychotic use	Mental health diagnoses (%)
Attux 2013,[45] Brazil	Intervention, 60; control, 66	Intervention: 36.2 (9.9); control: 38.3 (10.7)	Intervention: 38; control: 42	• Intervention: white (74%), African American (14%), other (12%) • Control: white (73%), African American (19%), other (8%)	• Intervention: first generation (14%), second generation (70%), association (16%) • Control: first generation (9%), second generation (75%), association (14%)	• Intervention: schizophrenia (89%), other psychosis (9%) • Control: schizophrenia (87%), other psychosis (10%)
Baker 2006,[46] Australia	Intervention, 147; control, 151	37.24 (11.09)	48	NR, 84.9% Australian born	82.9% on antipsychotic medication	56.7% schizophrenia or schizoaffective disorder; 6.4% severe depression with psychosis; 9.1% bipolar disorder, mania; 27.95% other psychoses
Baker 2015,[47] Australia	Intervention, 122; control, 113	41.6 (11.1)	41	NR, 84% Australian born	NR	59% schizophrenia spectrum disorders, 22% bipolar disorder, 19% non-organic psychotic syndrome
Battaglia 2013,[48] Italy	Intervention, 10; control, 8	Intervention: 36.00 (5.00); control: 35.00 (4.00)	0	NR	100%	Schizophrenia or schizoaffective disorder (100%)
Bechdolf 2012,[49] Germany	Intervention, 30; control, 30	Intervention: 31.53 (8.9); control: 31.60 (10.2)	28	NR	Intervention: 83.3%; control: 93.3%	Schizophrenia or schizoaffective disorder (83.33%), substance-induced psychosis (16.67%)
Beebe 2005,[51] USA	Intervention, 4; control, 6	52 (range 40–63)	20	White (80%), African American (20%)	> 90%	Schizophrenia or any subtype (100%)
Beebe 2011,[50] USA	Intervention, 48; control, 49	46.9 (2)	47.40	White (54.6%), African American (44.4%), Asian (1%)	NR	Schizophrenia (28.9%), schizoaffective (71.1%)

Study (first author, year of publication, country)	Sample size (n)	Age (years) (range, or mean and SD)	Female (%)	Ethnicity	Antipsychotic use	Mental health diagnoses (%)
Bonfioli 2018,[52] Italy	Intervention, 169; control, 156	Intervention: 44.6 (10.3); control: 47.5 (10.8)	Intervention: 46.7; control: 46.8	NR	NR	Schizophrenia and functional psychoses (intervention, 69.8%; control, 66%), affective psychoses (intervention, 30.2%; control, 34%)
Bonsack 2011,[53] Switzerland	Intervention, 30; control, 32	25 (17)	13	NR	NR	100% psychoses (59.4% schizophrenia, 15.6% schizotypal disorder, 12.5% schizoaffective disorder, 4% other)
Brar 2005,[54] USA	Intervention, 34; control, 37	Intervention: 40.0 (10.1); control: 40.5 (10.6)	Intervention: 52.9; control: 64.9	White (intervention, 52.9%; control, 45.9%), Hispanic (intervention, 2.9%; control, 13.5%), black (intervention, 38.2%; control, 32.4%), Asian (intervention, 5.9%; control 5.4%), other (intervention, 0%; control, 2.7%)	100% risperidone	Schizophrenia (intervention, 61.8%; control, 45.9%), schizoaffective disorder (intervention, 38.2%; control, 54.1%)
Brody 2017,[55] USA	Intervention, 14; control, 14	Combination extended treatment: 56.3 (10.6); control: 57.5 (7.6)	0	• Combination extended treatment: Asian (10%), black (60%), white, (30%) • Control: Asian (7.7%), black (61.5%), white (30.8%)	100%; atypical, 79%	Schizophrenia (100%)
Brown 2006,[57] UK	Intervention, 15; control, 13	Intervention: 45.1; control: 41.7	Intervention: 100; control: 69	NR	NR	Psychosis/major affective illness/severe personality disorder (100%)
Brown 2011,[56] USA	Intervention, 47; control, 42	44.6 (10.9)	61 (completers, 39%)	Completers: 60% white, 34% African American, 6% other	100%	NR

TABLE 7 Population characteristics for included RCTs (*continued*)

Study (first author, year of publication, country)	Sample size (*n*)	Age (years) (range, or mean and SD)	Female (%)	Ethnicity	Antipsychotic use	Mental health diagnoses (%)
Brunette 2020,[58] USA	Smoking intervention, 78; computerised education, 84	45.91 (11.32)	33.30	53% black	NR	100% schizophrenia
Christiansen 2018,[59] USA	Intervention, 118; control, 104	Intervention: 43.8 (9.9); control: 43.6 (10.0)	Intervention: 49.0; control: 46.7	Black (intervention, 20.8%; control, 32.9%), Hispanic (intervention, 8.4%; control, 5.8%)	NR	Schizophrenia (intervention, 51.4%; control, 46.8%), bipolar disorder (intervention, 51.4%; control, 60.6%), major affective disorder (intervention, 50.5%; control, 48.9%), anxiety disorder (intervention, 39.4%; control, 50.0%), alcoholism (intervention, 12.8%; control, 11.7%), other drug abuse disorder (intervention, 9.2%; control, 8.5%)
Cordes 2011,[60] Germany	Intervention, 36; control, 38	Intervention: 38.2 (11.2); control: 35.8 (10.9)	Intervention: 58.3; control: 28.9	NR	100%	Schizophrenia or schizoaffective disorder (100%)
Daumit 2013,[61] USA	Intervention, 144; control, 147	Intervention: 46.6 (11.5); control: 44.1 (11.0)	Intervention: 48.6; control: 51.0	56% white, 38.1% black, 5.8% other	89.7% any antipsychotic; 82.8% atypicals, 22.3% clozapine or olanzapine	Schizophrenia (intervention, 30.6%; control, 27.9%), schizoaffective disorder (intervention, 28.5%; control, 29.3%), bipolar disorder (intervention, 19.4%; control, 24.5%), major depression (intervention, 12.5%; control, 11.6%), other (intervention, 9.0%; control, 6.8%)

Study (first author, year of publication, country)	Sample size (n)	Age (years) (range, or mean and SD)	Female (%)	Ethnicity	Antipsychotic use	Mental health diagnoses (%)
Evans 2005,[62] Australia	Intervention, 29; control, 22	Intervention: 34.6 (9.6); control: 33.6 (11.6)	Intervention: 62; control: 50	NR	100% olanzapine	Schizophrenia (intervention, 34%; control, 27%), schizoaffective (intervention, 32%; control, 14%), schizophreniform psychosis (intervention, 14%; control, 27%), bipolar (intervention, 14%; control, 18%), depression (intervention, 6%; control, 14%)
Fernández Guijarro 2019,[63] Spain	Intervention, 21; control, 20	46.98 (9.18)	32.80	NR	9.8% first-generation antipsychotics, 90.2% second-generation antipsychotics	67.2% schizophrenia, 16.4% schizoaffective disorder, 8.2% bipolar disorder, 4.9% delusional disorder, 3.3% major depression
Forsberg 2008,[64] Sweden	Intervention, 23; control, 14	41	39	NR	73%	Schizophrenia 56%, bipolar disorder 7%, other psychotic diseases 17%, other psychiatric diagnosis 20%
Frank 2015,[65] USA	Intervention, 61; control, 61	Intervention: 41.8 (9.5); control: 41.4 (9.7)	NR	NR	NR	Bipolar disorder I (100%)
Ganguli 2011,[66] India	260	NR	NR	NR	NR	100% schizophrenia
Gaughran 2017,[67] UK	Intervention, 213; control, 193	Intervention: 43.76 (10.09); control: 44.65 (10.17)	Intervention: 45.1; control: 39.4	55% white, 34% black, 7% mixed and other, 4% Asian	NR	100% with a diagnosis of a psychotic disorder (ICD-10 codes F20-F29, F31.2, F31.5)
George 2000,[68] USA	Intervention, 28; control, 17	Intervention: 41.6 (7.9); control: 36.6 (9.5)	Intervention: 35.7; control: 29.4	62% white, 29% black, 9% Hispanic	60% typical antipsychotics, 40% atypical antipsychotics	42% schizophrenia, 58% schizoaffective disorder
Gilbody 2019,[69] UK	Intervention, 265; control, 261	Intervention: 46.5 (12.5); control: 45.5 (11.7)	Intervention: 40; control: 43	NR	NR	Bipolar disorder (intervention, 22%; control, 21%), schizoaffective disorder (intervention, 10%; control, 16%), schizophrenia (intervention, 52%; control, 48%), other psychotic disorder (intervention, 16%; control, 15%)

TABLE 7 Population characteristics for included RCTs (continued)

Study (first author, year of publication, country)	Sample size (n)	Age (years) (range, or mean and SD)	Female (%)	Ethnicity	Antipsychotic use	Mental health diagnoses (%)
Gillhoff 2010,[70] Switzerland	Intervention, 26; control, 24	Intervention: 48.1 (11.5); control: 48.9 (12.0)	Intervention: 41.7; control: 50	NR	50% antipsychotics, 100% weight-increasing drugs	100% bipolar disorder
Graham 2016,[71] UK	Intervention, 18; control, 18	Intervention: 39.5 (11.12); control: 37.69 (11.11)	Intervention: 16.7; control: 13.8	47% white, 25% black, 10% mixed, 17% Asian	NR	61% schizophrenia, 8.5% schizoaffective disorder, 1.7% other psychosis, 28.8% bipolar disorder
Green 2015,[72] USA	Intervention, 104; control, 96	Intervention: 46.2 (11.4); control: 48.3 (9.7)	Intervention: 72.1; control: 71.9	88% white, 12% non-white	91% atypical antipsychotics	Schizophrenia spectrum disorder (intervention, 31%; control, 27%), bipolar disorder or affective psychosis (intervention, 71%; control, 67%), PTSD (intervention, 2%; control, 2%)
Hjorth 2014,[73] Denmark	Intervention, 77; control, 97	Intervention: • Male – 48 (13.6) • Female – 47.8 (11.1) Control: • Male – 41.5 (12.4) • Female – 45 (17.9)	Intervention: 41.2; control: 49.5	All but three were white (two Innuits and one Indian)	N/A	• Intervention: 72% schizophrenia, 28% other severe mental illnesses • Control: 73% schizophrenia, 27% other severe mental illnesses
Hjorthøj 2013,[74] Denmark	Intervention, 52; control, 51	Intervention: 26.6 (6.3); control: 27.1 (6.3)	Intervention: 26.9; control: 21.6	NR, intervention: 82.7% were born in Denmark; control: 78.4% were born in Denmark	N/A	• Intervention: 59.6% schizophrenia, 25% schizotypal disorder, 15.4% other/unclear diagnoses • Control: 43.1% schizophrenia, 37.3% schizotypal disorder, 19.6% other/unclear diagnosis

Study (first author, year of publication, country)	Sample size (n)	Age (years) (range, or mean and SD)	Female (%)	Ethnicity	Antipsychotic use	Mental health diagnoses (%)
Holt 2019,[75] UK	Intervention, 207; control, 205	Intervention: 40 (11.3); control: 40.1 (11.5)	Intervention: 44.4; control: 53.7	• Intervention: white European, 86.5%; Asian, 4.3%; black, 5.8%; mixed, 1.9%; other, 1.4% • Control: white European, 82.9%; Asian, 3.4%; black, 9.3%; mixed, 3.4%; other, 1%	• Intervention: haloperidol (oral), 3.4%; amisulpride (oral), 10.1%; aripiprazole (oral), 17.9%; aripiprazole (LA injection), 1.4%; clozapine (oral), 43%; olanzapine (oral), 15%; quetiapine (oral), 13.5%; risperidone (oral), 2.9%; risperidone (LA injection), 1.9%; flupentixol (injection), 3.9%; zuclopenthixol (oral), 1%; zuclopenthixol (LA injection), 3.9%; paliperidone (LA injection), 3.4%; other, 9.2% • Control: haloperidol (oral), 1.5%; amisulpride (oral), 7.8%; aripiprazole (oral), 13.7%; aripiprazole (LA injection), 2.9%; clozapine (oral), 39.5%; olanzapine (oral), 15.1%; quetiapine (oral), 11.7%; risperidone (oral), 7.8%; risperidone (LA injection), 2.4%; flupentixol (injection), 5.4%; zuclopenthixol (oral), 2.9%; zuclopenthixol (LA injection), 7.3%; paliperidone (LA injection), 3.9%; other, 4.4%	Intervention: schizophrenia – ICD-10 = F20, 70%; ICD-10 = F25, 14.5%; first-episode psychosis – 15.5% Control: schizophrenia – ICD-10 = F20, 67.3%; ICD-10 = F25, 17.6%; first-episode psychosis – 15.1%
Iglesias-García 2010,[76] UK	Intervention, 7; control, 7	39.9 (11.3)	21.4	N/A	Whole study: 28.6% clozapine, 21.4% olanzapine, 21.4% aripiprazole, 21.4% fluphenazine decanoate, 7.1% risperidone	Schizophrenia (100%)

TABLE 7 Population characteristics for included RCTs (*continued*)

Study (first author, year of publication, country)	Sample size (*n*)	Age (years) (range, or mean and SD)	Female (%)	Ethnicity	Antipsychotic use	Mental health diagnoses (%)
Jean-Baptiste 2007,[77] USA	Intervention, 9; control, 9	Intervention: 52.37; control: 40.73	Intervention: 77.8; control: 22.2	• Intervention: white, 55.6%; African American, 44.4% • Control: white, 66.7%; African American, 33.3% • Whole group: white, 61.1%; African American, 38.9%	Across whole study: clozapine, 38.9%; olanzapine, 38.9%; risperidone, 22.2%; haloperidol, 11.1%; perphenazine, 11.1%; thiothixene, 5.6%; fluphenazine, 5.6%; quetiapine, 5.6%; ziprasidone, 5.6%	• Intervention: schizophrenia, 44.4%; schizoaffective disorder, 55.6% • Control: schizophrenia, 66.7%; schizoaffective disorder, 33.3% • Whole group: schizophrenia, 55.6%; schizoaffective disorder, 44.4%
Jones 2019,[78] UK	Intervention, 24; control, 20	40	48	91% white	NR	100% bipolar disorder • 91% bipolar I disorder • 9% bipolar II disorder
Kaltsatou 2015,[79] Greece	Intervention, 16; control, 15	Intervention: 59.5 (19.6); control: 60.4 (8.6)	Intervention: 12.5; control: 26.7	N/A	Just says that medication included haloperidol, fluphenazine decanoate, risperidone, olanzapine, quetiapine	Schizophrenia (100%)
Khazaal 2007,[80] Switzerland	Intervention, 31; control, 30	Intervention: 43 (9.8); control: 38.3 (10.4)	Intervention: 58; control: 50	N/A	• Intervention: olanzapine, 45.2%; risperidone, 12.9%; clozapine, 19.4%; quetiapine, 6.5%; amisulpride, 3.2%; classical antipsychotic drugs, 12.9% • Control: olanzapine, 50%; risperidone, 13.3%; clozapine, 16.7%; quetiapine, 0%; amisulpride, 13.3%; classical antipsychotic drugs, 6.6% • Whole study: olanzapine, 47.5%; risperidone, 13.1%; clozapine, 18%; quetiapine, 3.3%; amisulpride, 8.2%; classical antipsychotic drugs, 9.8%	• Intervention: schizophrenia and schizoaffective disorders, 80.60%; bipolar disorder, 3.2%; schizotypal disorder, 6.5%; other, 9.7% • Control: schizophrenia and schizoaffective disorders, 66.7%; bipolar disorder, 13.3%; schizotypal disorder, 6.7%; other, 13.3% • Group total: schizophrenia and schizoaffective disorders, 73.8%; bipolar disorder, 8.2%; schizotypal disorder, 6.6%; other, 11.5%

Study (first author, year of publication, country)	Sample size (n)	Age (years) (range, or mean and SD)	Female (%)	Ethnicity	Antipsychotic use	Mental health diagnoses (%)
Kilbourne 2012,[81] USA	Intervention, 32; control, 33	Intervention: 47.2 (11.8); control: 43.4 (13.6)	Intervention: 56; control: 66	• Intervention: white, 78%; African American, 22%; other, 3% • Control: white, 79%; African American, 16%; other, 6%	• Intervention: 9% taking any second-generation antipsychotic medication (olanzapine, ziprasidone, aripiprazole, quetiapine or clozapine) • Control: 12% taking any second-generation antipsychotic medication (olanzapine, ziprasidone, aripiprazole, quetiapine, or clozapine)	Bipolar disorder (type 1 or 2 or not otherwise specified) (100%)
Kwon 2006,[82] the Republic of Korea	Intervention, 33; control, 15	Intervention: 32 (9.22); control: 29.8 (6.07)	Intervention: 23/33 (70%); control: 10/15 (67%)	N/A	Olanzapine (100%)	Schizophrenia or schizoaffective disorder (100%)
Lee 2014,[83] USA	Intervention, 8; control, 8	44.09 (7.6)	45.5	64% white	N/A	N/A
Littrell 2003,[84] USA	Intervention, 35; control, 35	Intervention: 33.66 (9.23); control: 34.51 (9.99)	Intervention: 37; control: 40	• Intervention: white, 74.3%; African American, 25.7% • Control: white, 74.3%; African American, 25.7%	• Most common: haloperidol – 27/70 (39%), decanoate formulations – 9/70 (13%) • Mean olanzapine dosage was 16.64 mg in the intervention group and 16.29 mg in the control group	• Intervention: schizophrenia, 80%; schizoaffective disorder, 20% • Control: schizophrenia, 74.3%; schizoaffective disorder, 25.7%
Marzolini 2009,[85] Canada	Intervention, 7; control, 6	Intervention: 43 (SEM = 3); control: 46.7 (SEM = 5)	Intervention: 43; control: 33	NR	• 85% of all participants were taking atypical antipsychotics • Intervention: 86% taking atypical antipsychotics, 71% taking typical antipsychotics • Control: 83% taking atypical antipsychotics, 50% taking typical antipsychotics	Schizophrenia or schizoaffective disorder (100%)

TABLE 7 Population characteristics for included RCTs (continued)

Study (first author, year of publication, country)	Sample size (n)	Age (years) (range, or mean and SD)	Female (%)	Ethnicity	Antipsychotic use	Mental health diagnoses (%)
Masa-Font 2015,[86] Spain	Intervention, 169; control, 163	Intervention: 46.3 (8.9); control: 47.1 (9.9)	Intervention: 45; control: 45.4	NR	NR	• Intervention: schizophrenia 65.6%, schizoaffective disorder 16.6%, bipolar disorder 17.8% • Control: schizophrenia 68.7%, schizoaffective disorder 17.8%, bipolar disorder 13.5%
Mauri 2008,[87] Italy	Intervention, 15; control, 18	38.9 (range 19–60)	Intervention: 53.3; control: 62.1	NR	100%	Bipolar I disorder (83.6%), bipolar II disorders (4.1%), schizoaffective disorders (10.2%), psychotic depression (2%)
McCreadie 2005,[88] Scotland	Fruit and vegetable with instruction, 32; fruit and vegetable, 37; control, 33	45 (13)	29	NR	NR	Schizophrenia (100%)
McKibbin 2006,[89] USA	Intervention, 28; control, 29	Control: 54.8 (8.2); intervention: 53.1 (10.4)	Control: 37.9; intervention: 32.1	• Control: white (72.4%), other (27.6%) • Intervention: white (50%), other (50%)	NR	• UCI group: 90% schizophrenia, 10% schizoaffective • DART group: 79% schizophrenia, 21% schizoaffective
Melamed 2008,[90] Israel	Intervention, 28; control, 31	46.18 (11.93)	27	NR	91.50%	Schizophrenia or schizoaffective disorder (100%)
Methapatara 2011,[91] Thailand	Intervention, 32; control, 32	Intervention: 43.16 (9.27); control: 37.59 (10.83)	Intervention: 28.12; control: 43.75	NR	Intervention: 43.8%; control: 43.8%	Schizophrenia (100%)
Milano 2007,[92] Italy	Intervention, 22; control, 14	Intervention: 46; control: 45	Intervention: 54.5; control: 57.1	NR	100%	Schizophrenia or maniacal episodes in bipolar disease (100%)

Study (first author, year of publication, country)	Sample size (n)	Age (years) (range, or mean and SD)	Female (%)	Ethnicity	Antipsychotic use	Mental health diagnoses (%)
Osborn 2018,[93] UK	Intervention, 155; control, 172	51 (10)	Intervention: 57; control: 49	• Intervention: white, 87%; black, 7%; Asian, 3%; other, 3% • Control: white, 91%; black, 3%; Asian, 3%; other, 4%	• Intervention: first generation, 14%; second generation, 54% • Control: first generation, 13%; second generation, 64%	• Intervention: schizophrenia or schizoaffective disorder (35%), bipolar affective disorder (46%), other psychoses (19%) • Control: schizophrenia or schizoaffective disorder (30%), bipolar affective disorder (51%), other psychoses (19%)
Peckham 2017,[94] UK	Intervention, 46; control, 51	Intervention: 47.8 (12.4); control: 45.9 (12.8)	Intervention: 30.4; control: 49.0	White British (intervention, 93.3%; control, 80.4%), white Irish (intervention, 0.0%; control, 2.0%), any other white background (intervention, 2.2%; control, 3.9%), mixed white and black Caribbean (intervention, 0.0%; control, 2.0%), any other mixed background (intervention, 0.0%; control, 2.0%), Asian or Asian British Pakistani (intervention, 0.0%; control, 2.0%), black or black British Caribbean (intervention, 2.2%; control, 7.8%), black or black British African (intervention, 2.2%; control, 0%)	NR	Schizophrenia or other psychotic illness (59%), schizoaffective disorder (10%), bipolar disorder (31%)
Penn 2000,[95] USA	112	34 (range 19–59)	42	White (70%), Hispanic (13%)	NR	NR

TABLE 7 Population characteristics for included RCTs (continued)

Study (first author, year of publication, country)	Sample size (n)	Age (years) (range, or mean and SD)	Female (%)	Ethnicity	Antipsychotic use	Mental health diagnoses (%)
Ratliff 2012,[96] USA	CM (weight), 10; CM (attendance), 10; control, 10	CM (weight): 50.1 (10.6), CM (attendance): 49.0 (8.1), control: 47.3 (8.0)	CM (weight): 60, CM (attendance): 70, control: 70	• CM (weight): white (60%), African American (30%), Hispanic (10%) • CM (attendance): white (60%), African American (40%), Hispanic (0%) • Control: white (30%), African American (40%), Hispanic (30%)	100%	60% schizophrenia or schizoaffective disorder, remainder NR
Romain 2019,[97] Canada	Intervention, 38; control, 28	30.73 (7.23)	37.90	White, 65.2%; black, 12.1%; other, 22.7%	Quetiapine 36.4%, risperidone 31.8%, paliperidone 22.7%, clozapine 22.7%, olanzapine 27.3%	Psychosis (100%)
Scheewe 2013,[98] the Netherlands	Intervention, 29; control, 25	Intervention: 29.2 (7.2); control: 30.1 (7.7)	Intervention: 25.8; control: 28.1	• Intervention: white (67.7%), other (32.3%) • Control: white (81.3%), other (18.7%)	100%	• Intervention: schizophrenia (77.4%), schizoaffective disorder (19.4%), schizophreniform disorder (3.2%) • Control: schizophrenia (65.6%), schizoaffective disorder (28.1%), schizophreniform disorder (6.3%)
Scocco 2006,[99] Italy	Intervention, 10; control, 10	Intervention: 51.7 (12.4); control: 39.2 (9.9)	Intervention: 70; control: 20	NR	100% medium-/long-term medication, 0% atypical antipsychotics	Schizophrenic disorder (intervention, 80%; control, 70%), schizoaffective disorder (intervention, 20%; control, 30%)

Study (first author, year of publication, country)	Sample size (n)	Age (years) (range, or mean and SD)	Female (%)	Ethnicity	Antipsychotic use	Mental health diagnoses (%)
Sheridan Rains 2019,[100] UK	Intervention, 278; control, 273	25 (4)	13	53% white, 23% black, 11% Asian, 14% other	NR	• Intervention: 31% schizophrenia or schizoaffective disorder, 10% bipolar disorder, 4% depression with psychotic features, 54% other psychoses • Control: 34% schizophrenia or schizoaffective disorder, 7% bipolar disorder, 2% depression with psychotic features, 57% other psychoses
Sorić 2019,[101] Croatia	Intervention, 38; control, 41	Intervention: 53.2 (8.9); control: 50.7 (8.0)	15	NR	Atypicals, 60.6%; typicals, 3%; both, 36.4%	100% schizophrenia
Speyer 2016,[102] Denmark	CHANGE, 138; care co-ordination, 142; TAU, 148	CHANGE: 37.8 (12.6); care co-ordinator: 39.5 (12.8); TAU: 38.5 (11.8)	CHANGE: 55.1; care co-ordinator: 57.7; TAU: 54.7	NR	NR	Schizophrenia (CHANGE, 90.6%; care co-ordinator, 91.5%; TAU, 83.1%) or schizoaffective disorder/persistent delusional disorder
Steinberg 2016,[103] USA	Intervention, 51; control, 50	Intervention: 42.61 (11.06); control: 43.49 (9.49)	Intervention: 44.90; control: 42.86	Black (intervention, 28.57%; control, 26.53%), white (intervention, 59.18%; control, 63.27%), Latino (intervention, 2.04%; control, 8.16%), Asian (intervention, 2.04%; control, 0%), Native American (intervention, 2.04%; control, 0%), other (intervention, 6.12%; control, 2.04%)	NR	Schizophrenia (intervention, 28.6%; control, 34.7%), schizoaffective (intervention, 30.6%; control, 18.4%), bipolar (intervention, 40.8%; control, 46.9%)
Sugawara 2018,[104] Japan	Advice alone, 67; education group, 61; standard care, 61	Advice alone (group B): 47.6 (9.6); education group (group C): 46.6 (10.9); standard care (group A): 44.0 (10.3)	Advice (group B): 53.7; education (group C): 47.5; standard care (group A): 42.6	NR	100%	Schizophrenia (100%)

TABLE 7 Population characteristics for included RCTs (continued)

Study (first author, year of publication, country)	Sample size (n)	Age (years) (range, or mean and SD)	Female (%)	Ethnicity	Antipsychotic use	Mental health diagnoses (%)
Sylvia 2019,[105] USA	Intervention, 19; control, 19	42 (12.3)	65.80	84.2% white, 2.6% black, 2.6% Asian	66%	100% bipolar disorder: • 84% bipolar I • 16% bipolar II
Tantirangsee 2015,[106] Thailand	BI, 53; BI-FS, 58; control, 55	BI: 35.52 (10.1); BI-FS: 34.98 (11.0); control: 35.49 (7.0)	BI: 3.7; BI-FS: 1.7; control: 0	NR	42%	Schizophrenia (control, 85%; BI, 83.3%; BI-FS, 72.4%), transient psychotic disorder (control, 7%; BI, 9.3%; BI-FS, 15.5%), unspecified non-organic psychosis (control, 7%; BI, 7.4%; BI-FS, 12.1%)
Usher 2013,[107] Australia	Intervention, 51; control, 50	NR	46.50	White Australian (71.3%), Aboriginal or Torres Strait Islander (13.9%), other (14.9%)	100%: [olanzapine, 36.6%; clozapine, 18.8%; risperidone, 23.8%; Seroquel® (quetiapine; AstraZeneca plc, Cambridge, UK), 14.9%; amisulpride, 2%; abilify, 3%; avanza, 1%]	Schizophrenia (84.2%), bipolar disorder (6.9%), depression or anxiety (15.8%)
Weber 2006,[108] USA	Intervention, 15; control, 15	NR	Intervention: 62.5; control: 77.8	African American (intervention, 62.5%; control, 44.4%), white (intervention, 25.0%; control, 33.3%), Hispanic (intervention, 12.5%; control, 22.2%)	NR	Schizophrenia or schizoaffective disorder (100%)
Williams 2019,[109] UK	Intervention, 20; control, 20	43 (range 20–56)	45	27.5% white, 50% black, 7.5% Asian, 12.5% mixed	NR	55% schizophrenia, 12.5% bipolar disorder, 7.5% psychosis, 25% other
Wu 2008,[110] China	Intervention, 32; control, 32	Intervention: 26.4 (24.8–28.1); control: 25.8 (24.1–27.6)	Intervention: 46.9; control: 50.0	NR	100%	Schizophrenia (100%)

Study (first author, year of publication, country)	Sample size (*n*)	Age (years) (range, or mean and SD)	Female (%)	Ethnicity	Antipsychotic use	Mental health diagnoses (%)
Young 2017,[111] USA	WebMOVE, 71; MOVE SMI, 78; TAU, 88	WebMOVE: 55.5 (9.2); MOVE SMI: 53.8 (10.1); TAU: 54.2 (9.9)	WebMOVE: 4.2; MOVE SMI: 7.7; TAU: 2.3	White (web, 43.7%; MOVE, 38.5%; TAU, 37.5%), African American (web, 42.3%; MOVE, 41.0%; TAU, 51.1%), American Indian (web, 5.6%; MOVE, 1.3%; TAU, 1.1%), Asian (web, 0%; MOVE, 6.8%; TAU, 2.3%), Pacific Islander (web, 0%; MOVE, 0%; TAU, 2.3%), multiple races (web, 4.2%; MOVE, 6.4%; TAU, 3.4%), Hispanic (web, 11.3%; MOVE, 18%; TAU, 10.2%), not given (web, 4.2%; MOVE, 9%; TAU, 2.3%)	100%	Schizophrenia, schizoaffective disorder, bipolar disorder, PTSD and major depressive disorder

BI, brief intervention; BI-FS, brief intervention with family support; CM, contingency management; DART, Diabetes Awareness and Rehabilitation Training; ICD-10, *International Statistical Classification of Diseases and Related Health Problems*, Tenth Revision; LA, long-acting; N/A, not applicable; NR, not reported; PTSD, post-traumatic stress disorder; SEM, standard error of the mean; UCI, Usual Care plus Information.

Appendix 4 Characteristics of interventions of included randomised controlled trials

TABLE 8 Intervention characteristics for included RCTs

Study (first author, year of publication)	BCTs (BCTT v1)	Targeted risk behaviour(s)	Intervention	Intensity (duration, frequency and length of sessions)	Delivery (method, setting and professional)	Control
Attux 2013[45]	• 11.2 Reduce negative emotions ++ • 4.1 Instruction on how to perform a behaviour ++ • 15.1 Verbal persuasion about capability+ • 5.1 Information about health consequences +	Diet, physical activity	Weight management intervention	• Duration: 12 weeks • Frequency: weekly • Length of sessions: 1 hour	• Delivery method: group, face to face • Setting: NR • Professional: nurses/ occupational therapists/ psychologists/dietitians	TAU
Baker 2015[47]	• 1.1 Goal-setting (behaviour) ++ • 1.2 Problem-solving + • 10.10 Reward (outcome) ++ • 11.1 Pharmacological support + • 14.4 Reward approximation ++ • 2.3 Self-monitoring of behaviour ++ • 3.1 Social support (unspecified) ++ • 8.2 Behaviour substitution + • 10.2 Material reward (behaviour) ++ • 2.2 Feedback on behaviour ++ • 2.7 Feedback on outcomes of behaviour ++ • 5.1 Information about health consequences ++	Diet, smoking, physical activity	Healthy Lifestyles intervention – motivational interviewing/ CBT + nicotine replacement therapy	• Duration: 30 weeks • Frequency: 7 weekly sessions, then 3 fortnightly sessions followed by 6 monthly booster sessions • Length of sessions: 1 hour	• Delivery method: individual, face to face • Setting: research centre or clinic • Professional: psychologists	TAU+

Study (first author, year of publication)	BCTs (BCTT v1)	Targeted risk behaviour(s)	Intervention	Intensity (duration, frequency and length of sessions)	Delivery (method, setting and professional)	Control
Baker 2006[46]	• 1.3 Goal-setting (outcome) + • 1.2 Problem-solving ++ • 1.4 Action-planning + • 3.1 Social support (unspecified) ++ • 5.1 Information about health consequences + • 8.2 Behaviour substitution + • 9.2 Pros and cons ++ • 11.1 Pharmacological support ++ • 11.2 Reduce negative emotions ++ • 13.2 Framing/reframing ++	Smoking	Motivational interviewing/ CBT + nicotine replacement therapy	• Duration: 10 weeks • Frequency: 6 weekly, booster weeks 8 and 10 • Length of sessions: 1 hour	• Delivery method: individual, face to face • Setting: research centre, clinic or home • Professional: trained therapists	TAU+
Battaglia 2013[48]	• 2.6 Biofeedback ++ • 3.1 Social support ++ • 4.1 Instruction on how to perform a behaviour ++ • 6.1 Demonstration of the behaviour ++ • 8.1 Behavioural practice/ rehearsal ++	Physical activity	Soccer therapy	• Duration: 12 weeks • Frequency: twice per week • Length of sessions: 100–120 minutes	• Delivery method: group • Setting: community • Professional: NR	TAU
Bechdolf 2012[49]	• 1.1 Goal-setting (behaviour) ++ • 1.2 Problem-solving ++ • 2.2 Feedback on behaviour + • 3.1 Social support (unspecified) ++ • 5.1 Information about health consequences ++ • 9.2 Pros and cons ++	Alcohol, other (cannabis)	Motivational interviewing	• Duration: NR • Frequency: once or twice per week • Length of sessions: 50 minutes	• Delivery method: individual • Setting: inpatient • Professional: qualified psychologists trained in motivational interviewing and behavioural psychotherapy	TAU+
Beebe 2005[51]	• 2.6 Biofeedback ++ • 4.1 Instruction on how to perform a behaviour ++ • 8.1 Behavioural practice/ rehearsal ++	Physical activity	Treadmill walking	• Duration: 16 weeks • Frequency: three times per week • Length of sessions: 25–50 minutes	• Delivery method: group • Setting: outpatient VA centre • Professional: NR	Wait list

TABLE 8 Intervention characteristics for included RCTs (*continued*)

Study (first author, year of publication)	BCTs (BCTT v1)	Targeted risk behaviour(s)	Intervention	Intensity (duration, frequency and length of sessions)	Delivery (method, setting and professional)	Control
Beebe 2011[50]	• 1.1 Goal-setting + • 1.3 Goal-setting (outcome) + • 1.4 Action-planning ++ • 4.1 Instruction on how to perform a behaviour ++ • 5.1 Information about health consequences ++ • 6.1 Demonstration of the behaviour ++ • 7.1 Prompts/cues ++ • 8.1 Behavioural practice/ rehearsal ++	Physical activity	Walking programme (WALC-S)	• Duration: 16 weeks • Frequency: 4 times per week • Length of sessions: 1 hour	• Delivery method: group and individual • Setting: unclear • Professional: NR	Attention control
Bonfioli 2018,[52] education intervention	• 5.1 Information about health consequences ++ • 7.1 Prompts/cues +	Diet, physical activity	Education	• Duration: 6 months • Frequency: health education – seven classes over 6 months, walking group – weekly • Length of sessions: NR	• Delivery method: group • Setting: unclear • Professional: physical trainers and dietitians, for appropriate behaviours	TAU
Bonfioli 2018,[52] health promotion	• 4.1 Instruction on how to perform a behaviour ++ • 6.1 Demonstration of the behaviour ++ • 8.1 Behavioural practice/ rehearsal ++	Diet, physical activity	Health promotion	• Duration: 6 months • Frequency: health education – seven classes over 6 months, walking group – weekly • Length of sessions: NR	• Delivery method: group • Setting: unclear • Professional: physical trainers and dietitians, for appropriate behaviours	TAU
Bonsack 2011[53]	• 1.1 Goal-setting (behaviour) ++ • 1.2 Problem-solving ++ • 13.3 Incompatible beliefs + • 2.2 Feedback on behaviour + • 3.1 Social support (unspecified) + • 5.1 Information about health consequences + • 9.1 Pros and cons ++	Drug use	Motivational interviewing	• Duration: 6 months • Frequency: 4–6 sessions • Length of sessions: NR	• Delivery method: individual (optional group sessions) • Setting: outpatient (option for hospital admission); • Professional: psychologists	TAU

Study (first author, year of publication)	BCTs (BCTT v1)	Targeted risk behaviour(s)	Intervention	Intensity (duration, frequency and length of sessions)	Delivery (method, setting and professional)	Control
Brar 2005[54]	• 1.2 Problem-solving + • 2.2 Feedback on behaviour ++ • 2.3 Self-monitoring of behaviour ++ • 2.4 Self-monitoring of outcomes of behaviour ++ • 4.1 Instruction on how to perform a behaviour + • 6.1 Demonstration of the behaviour ++ • 7.3 Reduce prompts/cues + • 8.1 Behavioural practice/ rehearsal ++	Diet, physical activity	Behaviour weight loss programme	• Duration: 14 weeks • Frequency: 20 sessions • Length of sessions: NR	• Delivery method: group • Setting: NR • Professional: NR	TAU
Brody 2017[55]	• 2.5 Monitoring of outcome of behaviour without feedback + • 3.1 Social support (unspecified) ++ • 4.1 Information on how to perform the behaviour + • 5.1 Information about health consequences ++	Smoking	Combination extended treatment	• Duration: 26 weeks • Frequency: NR • Length of sessions: NR	• Delivery method: group and individual • Setting: community, self-management • Professional: NR	TAU
Brown 2006[57]	• 2.3 Self-monitoring of behaviour ++ • 3.1 Social support (unspecified) ++	Diet, smoking, physical activity, alcohol use, drug use	Lilly 'Meaningful Day' manual	• Duration: 6 weeks • Frequency: weekly • Length of sessions: NR	• Delivery method: individual • Setting: community • Professional: member of research team	TAU
Brown 2011[56]	• 1.1 Goal-setting ++ • 3.1 Social support (unspecified) + • 8.1 Behavioural practice/ rehearsal +	Diet, physical activity	RENEW weight loss programme	• Duration: 12 months • Frequency: 12 sessions • Length of sessions: NR	• Delivery method: individual and group • Setting: community • Professional: graduate-trained nurse, occupational therapist, or dietitian	TAU
Brunette 2020[58]	• 2.2 Feedback on behaviour ++ • 9.2 Pros and cons	Smoking	Web-based motivational intervention	• Duration: 1 session • Frequency: once • Length of sessions: 30–90 minutes	• Delivery method: N/A • Setting: N/A • Professional: N/A	TAU

TABLE 8 Intervention characteristics for included RCTs (continued)

Study (first author, year of publication)	BCTs (BCTT v1)	Targeted risk behaviour(s)	Intervention	Intensity (duration, frequency and length of sessions)	Delivery (method, setting and professional)	Control
Christiansen 2018[59]	• 1.1 Goal-setting ++ • 1.4 Action-planning + • 11.1 Pharmacological support ++ • 15.2 Mental rehearsal of successful performance + • 15.3 Focus on past success ++ • 9.2 Pros and cons ++	Smoking	motivational intervention	• Duration: 4 weeks • Frequency: weekly • Length of sessions: NR	• Delivery method: individual • Setting: community • Professional: peer interventionist	TAU+
Cordes 2011[60]	• 1.2 Problem-solving ++ • 12.6 Body changes + • 2.3 Self-monitoring of behaviour ++ • 3.3 Social support (emotional) + • 4.1 Instruction on how to perform the behaviour +	Diet, physical activity	Weight management programme	• Duration: 24 weeks • Frequency: 12 sessions • Length of sessions: NR	• Delivery method: group • Setting: NR • Professional: dietitian experienced in counselling patients with schizophrenia	TAU
Daumit 2013[61]	• 10.3 Non-specific reward + • 12.1 Restructuring the physical environment + • 2.3 Self-monitoring of behaviour + • 2.5 Monitoring of outcome of behaviour without feedback + • 4.1 Instruction on how to perform the behaviour ++ • 6.1 Demonstration of the behaviour ++ • 7.1 Prompts/cues++ • 8.1 Behavioural practice/ rehearsal +	Diet, physical activity	Weight loss programme	• Duration: 18 months • Frequency: NR • Length of sessions: NR	• Delivery method: group and individual • Setting: community • Professional: NR	TAU

Study (first author, year of publication)	BCTs (BCTT v1)	Targeted risk behaviour(s)	Intervention	Intensity (duration, frequency and length of sessions)	Delivery (method, setting and professional)	Control
Evans 2005[62]	• 4.1 Information on how to perform the behaviour +	Diet, physical activity	Nutrition intervention	• Duration: 3 months • Frequency: 6 sessions • Length of sessions: NR	• Delivery method: individual • Setting: community • Professional: dietitian	TAU
Fernández Guijarro 2019[63]	• 4.1 Information on how to perform the behaviour ++ • 6.1 Demonstration of the behaviour +	Diet, physical activity	Nurse-led lifestyle intervention	• Duration: 24 weeks • Frequency: weekly • Length of sessions: 80 minutes	• Delivery method: group • Setting: community mental health centre • Professional: nurse and researcher	TAU
Forsberg 2008[64]	• 4.1 Instruction on how to perform the behaviour ++ • 6.1 Demonstration of the behaviour ++ • 8.1 Behavioural practice/ rehearsal ++	Diet, physical activity	Diet and physical activity intervention	• Duration: 12 months • Frequency: 70 sessions • Length of sessions: NR	• Delivery method: group • Setting: sheltered housing • Professional: fitness instructor	TAU+
Frank 2015[65]	• 1.1 Goal-setting (behaviour) ++ • 1.2 Relapse prevention ++ • 10.4 Social reward + • 2.2 Feedback on behaviour ++ • 2.3 Self-monitoring of behaviour ++ • 4.1 Instruction on how to perform a behaviour ++ • 5.1 Information about health consequences ++ • 7.3 Reduce prompts/cues ++	Diet, smoking, physical activity, alcohol use, drug use, other (sleep)	Integrated risk reduction intervention	• Duration: 24 months • Frequency: NR • Length of sessions: NR	• Delivery method: individual • Setting: NR • Professional: lifestyle coach	TAU
Ganguli 2011[66]	NR	Diet, physical activity	Behaviour therapy for weight loss	• Duration: 14 weeks • Frequency: 20 sessions • Length of sessions: NR	• Delivery method: NR • Setting: community • Professional: mental health clinicians	TAU

TABLE 8 Intervention characteristics for included RCTs (*continued*)

Study (first author, year of publication)	BCTs (BCTT v1)	Targeted risk behaviour(s)	Intervention	Intensity (duration, frequency and length of sessions)	Delivery (method, setting and professional)	Control
Gaughran 2017[67]	• 13.2 Framing/reframing + • 3.1 Social support (unspecified) ++ • 4.1 Instruction on how to perform a behaviour ++	Diet, smoking, physical activity, alcohol use, drug use	IMPaCT intervention	• Duration: 12 months • Frequency: NR • Length of sessions: NR	• Delivery method: individual • Setting: community • Professional: care co-ordinator	TAU
George 2000[68]	• 1.1 Goal-setting (behaviour) ++ • 1.2 Problem-solving ++ • 11.1 Pharmacological support ++ • 3.1 Social support (unspecified) ++ • 4.1 Instruction on how to perform a behaviour ++	Smoking	Smoking cessation	• Duration: 12 weeks • Frequency: 10 sessions, tapering nicotine patches for 2 weeks • Length of sessions: 1 hour	• Delivery method: group • Setting: community • Professional: NR	TAU
Gilbody 2019[69]	• 1.1 Goal-setting (behaviour) ++ • 1.2 Problem-solving ++ • 1.4 Action-planning ++ • 1.5 Review behaviour goal(s) ++ • 1.6 Discrepancy between current behaviour and goal ++ • 11.3 Conserving mental resources ++ • 2.5 Monitoring outcome(s) of behaviour by others without feedback + • 3.3 Social support (emotional) ++ • 9.2 Pros and cons ++	Smoking	SCIMITAR+	• Duration: 12 months • Frequency: monthly • Length of sessions: NR	• Delivery method: individual • Setting: outpatient • Professional: mental health specialist, psychiatrist, nurse, primary care physician	TAU

Study (first author, year of publication)	BCTs (BCTT v1)	Targeted risk behaviour(s)	Intervention	Intensity (duration, frequency and length of sessions)	Delivery (method, setting and professional)	Control
Gillhoff 2010[70]	• 1.2 Problem-solving ++ • 4.1 Instruction on how to perform a behaviour ++	Diet, physical activity	Multimodal lifestyle intervention	• Duration: 5 months • Frequency: 11 sessions • Length of sessions: NR	• Delivery method: group • Setting: community • Professional: NR	TAU
Graham 2016[71]	• 1.2 Problem-solving ++ • 1.4 Action-planning+ • 2.2 Feedback on behaviour ++ • 3.1 Social support (unspecified) ++ • 3.3 Social support (emotional) + • 5.1 Information about health consequences ++ • 9.2 Pros and cons ++	Alcohol use, drug use	Brief integrated motivational intervention	• Duration: 2 weeks • Frequency: 4–6 sessions • Length of sessions: NR	• Delivery method: individual • Setting: inpatient • Professional: inpatient unit staff	TAU
Green 2015[72]	• 1.2 Problem-solving ++ • 1.3 Goal-setting (outcome) ++ • 1.4 Action-planning + • 2.3 Self-monitoring of behaviour ++ • 3.1 Social support (unspecified) + • 4.1 Instruction on how to perform a behaviour ++ • 8.2 Behaviour substitution + • 8.3 Habit formation +	Diet, physical activity	STRIDE intervention	• Duration: 12 months • Frequency: 32 sessions • Length of sessions: NR	• Delivery method: group • Setting: outpatient • Professional: mental health counsellor and nutritionist	TAU
Hjorth 2014[73]	• 1.4 Action-planning + • 3.1 Social support (unspecified) ++ • 4.1 Instruction on how to perform a behaviour + • 5.1 Information about health consequences +	Smoking, physical activity, alcohol use	Active awareness and motivational interviewing	• Duration: 12 months • Frequency: NR • Length of sessions: NR	• Delivery method: individual and group • Setting: inpatient facility • Professional: experience of psychiatric nursing and care of physical health in patients with severe mental illness	TAU

TABLE 8 Intervention characteristics for included RCTs (*continued*)

Study (first author, year of publication)	BCTs (BCTT v1)	Targeted risk behaviour(s)	Intervention	Intensity (duration, frequency and length of sessions)	Delivery (method, setting and professional)	Control
Hjorthøj 2013[74]	• 1.2 Problem-solving + • 11.2 Reduce negative emotions ++ • 3.1 Social support (unspecified) ++ • 4.1 Instruction on how to perform a behaviour ++ • 5.1 Information about health consequences + • 9.2 Pros and cons ++	Drug use	CapOpus – motivational interviewing/CBT + TAU	• Duration: 6 months • Frequency: first month: one or two weekly sessions, followed by: one weekly session; total 24 sessions • Length of sessions: 1 hour	• Delivery method: individual • Setting: at home or patient facility • Professional: addiction consultants trained in motivational interviewing	TAU
Holt 2019[75]	• 1.2 Problem-solving + • 1.4 Action-planning ++ • 2.3 Self-monitoring of behaviour + • 8.2 Behaviour substitution + • 8.3 Habit formation +	Diet, physical activity	STEPWISE – weight management	• Duration: 12 months • Frequency/length of sessions: four weekly 2.5-hour sessions, followed by 10-minute telephone sessions delivered every 2 weeks for the remaining intervention period; 2.5-hour booster sessions at months 4, 7 and 10	• Delivery method: group sessions • Setting: NHS mental health trusts • Professional: trained facilitators with expertise in the development of obesity and lifestyle intervention programmes, mental health-care professionals and researchers	TAU
Iglesias-García 2010[76]	• 3.1 Social support (unspecified) + • 8.3 Habit formation + • 9.1 Credible source +	Diet, physical activity	Weight management intervention	• Duration: 3 months • Frequency: weekly • Length of sessions: 1 hour	• Delivery method: group • Setting: community mental health centre • Professional: accredited psychiatric nurse	TAU

Study (first author, year of publication)	BCTs (BCTT v1)	Targeted risk behaviour(s)	Intervention	Intensity (duration, frequency and length of sessions)	Delivery (method, setting and professional)	Control
Jean-Baptiste 2007[77]	• 1.1 Goal-setting (behaviour) ++ • 10.2 Material reward (behaviour) + • 2.2 Feedback on behaviour ++ • 2.3 Self-monitoring of behaviour ++ • 3.1 Social support (unspecified) + • 4.1 Instruction on how to perform a behaviour + • 5.1 Information about health consequences + • 9.1 Credible source +	Diet, physical activity	Weight management intervention	• Duration: 16 weeks • Frequency: weekly • Length of sessions: 45–60 minutes	• Delivery method: group • Setting: NR • Professional: dietitians and psychiatrist	TAU
Jones 2019[78]	• 1.2 Problem-solving ++ • 1.4 Action-planning ++ • 11.2 Reduce negative emotions ++ • 3.1 Social support (unspecified) ++ • 4.2 Information about antecedents ++	Alcohol use	Motivational interviewing and CBT	• Duration: 6 months • Frequency: up to 20 sessions • Length of sessions: 45–60 minutes	• Delivery method: individual • Setting: determined by participant, usually home • Professional: trained therapists	TAU
Kaltsatou 2015[79]	• 2.1 Monitoring of behaviour by others without feedback ++ • 4.1 Instruction on how to perform a behaviour + • 9.1 Credible source +	Physical activity	Exercise training with Greek traditional dancing	• Duration: 8 months • Frequency: 3 times a week • Length of sessions: 1 hour	• Delivery method: group • Setting: psychiatric outpatient department • Professional: physical exercise instructor with previous experience in rehabilitation programmes	TAU

continued

TABLE 8 Intervention characteristics for included RCTs (*continued*)

Study (first author, year of publication)	BCTs (BCTT v1)	Targeted risk behaviour(s)	Intervention	Intensity (duration, frequency and length of sessions)	Delivery (method, setting and professional)	Control
Khazaal 2007[80]	• 13.2 Framing/reframing + • 2.3 Self-monitoring of behaviour ++ • 3.1 Social support (unspecified) ++ • 3.3 Social support (emotional) + • 4.1 Instruction on how to perform a behaviour +	Diet, physical activity	CBT	• Duration: 12 weeks • Frequency: weekly • Length of sessions: 2 hours	• Delivery method: group • Setting: NR • Professional: senior psychologists	TAU+
Kilbourne 2012[81]	• 1.1 Goal-setting (behaviour) ++ • 1.2 Problem-solving + • 1.7 Review outcome goal(s) + • 3.1 Social support (unspecified) ++ • 8.1 Behavioural practice/ rehearsal ++ • 8.2 Behaviour substitution ++	Diet, physical activity	Life Goals Collaborative Care (LGCC) – mix of motivational interviewing and CBT	• Duration: 6 months • Frequency: first month – weekly sessions, remainder – monthly telephone/face-to-face contact appointment • Length of sessions: first month – 2 hours, remainder – 20 minutes	• Delivery method: group • Setting: NR • Professional: qualified social work interventionist	TAU+
Kwon 2006[82]	• 1.4 Action-planning ++ • 1.5 Review behaviour goals ++ • 2.3 Self-monitoring of behaviour ++ • 5.1 Information about health consequences +	Diet, physical activity	Weight management intervention	• Duration: 12 weeks • Frequency: first month – weekly, remainder – every other week • Length of sessions: NR	• Delivery method: individual • Setting: outpatient clinical centre • Professional: dietitian, exercise co-ordinator	TAU+
Lee 2014[83]	• 1.1 Goal-setting (behaviour) ++ • 2.3 Self-monitoring of behaviour ++ • 2.6 Biofeedback + • 2.7 Feedback on outcome(s) of behaviour ++ • 3.1 Social support (practical) ++ • 4.1 Instruction on how to perform a behaviour ++	Physical activity	Telephone-delivered physical activity intervention	• Duration: 8 weeks • Frequency: weekly • Length of sessions: 10–15 minutes	• Delivery method: individual • Setting: home • Professional: researcher	TAU

Study (first author, year of publication)	BCTs (BCTT v1)	Targeted risk behaviour(s)	Intervention	Intensity (duration, frequency and length of sessions)	Delivery (method, setting and professional)	Control
Littrell 2003[84]	• 1.1 Goal-setting (behaviour) ++ • 2.4 Self-monitoring of outcome(s) of behaviour + • 3.1 Social support (unspecified) + • 5.1 Information about health consequences + • 9.2 Pros and cons +	Diet, physical activity	Weight management intervention	• Duration: 4 months • Frequency: weekly • Length of sessions: 1 hour	• Delivery method: individual and group • Setting: NR • Professional: master's-level clinician	TAU
Marzolini 2009[85]	• 2.4 Self-monitoring of outcome(s) of behaviour ++ • 4.1 Instruction on how to perform the behaviour + • 5.1 Information about health consequences +	Physical activity	Exercise training	• Duration: 12 weeks • Frequency: twice per week • Length of sessions: 90 minutes	• Delivery method: group • Setting: community centre • Professional: multidisciplinary team of health professionals (cardiac rehabilitation exercise specialist, registered nurses, social workers, mental health service providers)	TAU
Masa-Font 2015[86]	• 2.2 Feedback on behaviour ++ • 2.3 Self-monitoring of behaviour ++ • 5.1 Information about health consequences +	Diet, physical activity	Physical activity and diet programme (CAPiCOR trial)	• Duration: 12 weeks • Frequency: twice per week, first 8 weeks dietary sessions twice per week • Length of sessions: first eight sessions – 40 minutes, remainder – 60 minutes, dietary sessions: 20 minutes	• Delivery method: group • Setting: centres and surrounding areas • Professional: mental health and primary care nurses and physicians from the mental health teams/primary care teams	TAU
Mauri 2008[87]	• 1.1 Goal-setting (behaviour) ++ • 1.3 Goal-setting (outcome) ++ • 2.2 Feedback on behaviour ++ • 2.3 Self-monitoring of behaviour ++ • 2.4 Self-monitoring of outcomes of behaviour + • 6.1 Demonstration of the behaviour +	Diet, physical activity	Psychoeducation for weight loss	• Duration: 12 weeks • Frequency: weekly • Length of sessions: NR	• Delivery method: group and individual • Setting: outpatient • Professional: NR	TAU

TABLE 8 Intervention characteristics for included RCTs (*continued*)

Study (first author, year of publication)	BCTs (BCTT v1)	Targeted risk behaviour(s)	Intervention	Intensity (duration, frequency and length of sessions)	Delivery (method, setting and professional)	Control
McCreadie 2005,[88] free fruit, vegetables and meal planning	• 12.5 Adding objects to the environment ++ • 4.1 Instruction on how to perform a behaviour ++	Diet	Free fruit, vegetables and meal planning	• Duration: 6 months • Frequency: weekly • Length of sessions: 90 minutes	• Delivery method: group • Setting: home • Professional: NR	TAU
McCreadie 2005,[88] free fruit and vegetables	12.5 Adding objects to the environment ++	Diet	Free fruit and vegetables	• Duration: 6 months • Frequency: NR • Length of sessions: NR	• Delivery method: group • Setting: home • Professional: NR	TAU
McKibbin 2006[89]	• 10.3 Non-specific reward ++ • 2.2 Feedback on behaviour ++ • 2.3 Self-monitoring of behaviour ++ • 2.7 Feedback on outcome(s) of behaviour ++ • 4.1 Instruction on how to perform a behaviour ++ • 5.1 Information about health consequences ++	Diet, physical activity, other (diabetes)	Diabetes awareness and rehabilitation training	• Duration: 3 months • Frequency: counselling – weekly, 45 minutes; exercise – five times per week • Length of sessions: 30 minutes	• Delivery method: group • Setting: NR • Professional: NR	TAU+
Melamed 2008[90]	• 1.2 Problem-solving ++ • 10.10 Reward (outcome) ++ • 12.1 Restructuring the physical environment ++ • 2.3 Self-monitoring of behaviour + • 2.7 Feedback on outcome(s) of behaviour ++ • 3.3 Social support (emotional) ++ • 4.1 Instruction on how to perform a behaviour ++	Diet, physical activity	Group nutrition counselling and behaviour therapy	• Duration: 4 weeks • Frequency: weekly • Length of sessions: 1 hour	• Delivery method: group • Setting: inpatient • Professional: dietitians and trained nurses	TAU+

Study (first author, year of publication)	BCTs (BCTT v1)	Targeted risk behaviour(s)	Intervention	Intensity (duration, frequency and length of sessions)	Delivery (method, setting and professional)	Control
Methapatara 2011[91]	• 1.1 Goal setting (behaviour) ++ • 1.2 Problem-solving ++ • 1.5 Review behaviour goal(s) ++ • 2.2 feedback on behaviour ++ • 2.3 Self-monitoring of behaviour ++ • 4.1 Instruction on how to perform a behaviour ++	Diet, physical activity	Pedometer walking and motivational interviewing	• Duration: 12 weeks • Frequency: exercise three times per week • Length of sessions: 30–60 minutes	• Delivery method: group and individual • Setting: inpatient to outpatient • Professional: NR	TAU
Milano 2007[92]	• 1.4 Action planning ++ • 4.1 Instruction on how to perform a behaviour ++	Diet, physical activity	Physical activity, diet and olanzapine	• Duration: 12 months • Frequency: NR • Length of sessions: NR	• Delivery method: group and individual • Setting: NR • Professional: NR	TAU
Osborn 2018[93]	• 1.1 Goal-setting ++ • 1.4 Action-plan + • 1.5 Review behaviour goal(s) + • 2.2 Feedback on progress + • 11.1 Pharmacological support ++ • 3.2 Social support (practical) ++ • 1.2 Problem-solving + • 8.3 Habit formation +	Diet, smoking, physical activity, alcohol use	Primrose lifestyle intervention	• Duration: 6 months • Frequency: weekly • Length of sessions: NR	• Delivery method: individual • Setting: general practice • Professional: practice nurse or health-care assistant	TAU
Peckham 2017[94]	• 1.1 Goal-setting (behaviour) ++ • 1.2 Problem-solving ++ • 1.4 Action-planning ++ • 1.5 Review behaviour goal(s) ++ • 1.6 Discrepancy between current behaviour and goal ++ • 11.3 Conserving mental resources ++ • 2.5 Monitoring outcome(s) of behaviour by others without feedback + • 3.3 Social support (emotional) ++ • 9.2 Pros and cons ++	Smoking	Bespoke smoking intervention	• Duration: 6 months • Frequency: five times per week • Length of sessions: 5 hours	• Delivery method: individual • Setting: NR • Professional: trained mental health professionals	TAU

TABLE 8 Intervention characteristics for included RCTs (*continued*)

Study (first author, year of publication)	BCTs (BCTT v1)	Targeted risk behaviour(s)	Intervention	Intensity (duration, frequency and length of sessions)	Delivery (method, setting and professional)	Control
Penn 2000[95]	• 1.1 Goal-setting (behaviour) ++ • 1.2 Problem-solving ++	Smoking, alcohol use, drug use	12-step REBT or SMART	• Duration: 8 weeks • Frequency: weekly • Length of sessions: 1 hour	• Delivery method: group and individual • Setting: outpatient • Professional: NR	Head to head
Ratliff 2012[96]	• 10.8 Incentive (outcome) ++ • 3.1 Social support ++ • 4.1 Instruction on how to perform a behaviour ++ • 10.10 Reward (outcome) ++ • 10.8 Incentive (outcome) ++ • 3.1 Social support ++ • 4.1 Instruction on how to perform a behaviour ++	Diet, physical activity	Lifestyle modification with contingency management for attendance Lifestyle modification with contingency management for attendance	• Duration: 6 months • Frequency: twice per week • Length of sessions: 30 minutes	• Delivery method: group and individual • Setting: NR • Professional: NR	TAU
Romain 2019[97]	• 2.3 Self-monitoring of behaviour ++ • 4.1 Information on how to perform the behaviour ++ • 8.3 Habit formation +	Physical activity	Interval training	• Duration: 6 months • Frequency: twice per week • Length of sessions: 1 hour	• Delivery method: individual • Setting: community centre • Professional: exercise physiologist or medical student	TAU
Scheewe 2013[98]	• 2.5 Monitoring outcome(s) of behaviour by others without feedback + • 4.1 Instruction on how to perform a behaviour ++	Physical activity	Exercise therapy	• Duration: 8 weeks • Frequency: NR • Length of sessions: NR	• Delivery method: NR • Setting: NR • Professional: psychomotor therapist specialised in psychiatry	TAU
Scocco 2006[99]	• 1.4 Action-planning ++ • 2.3 Self-monitoring of behaviour ++ • 4.1 Instruction on how to perform a behaviour ++	Diet	Nutritional programme	• Duration: 12 weeks • Frequency: N/A • Length of sessions: N/A	• Delivery method: individual • Setting: NR • Professional: nutritionist	TAU

Study (first author, year of publication)	BCTs (BCTT v1)	Targeted risk behaviour(s)	Intervention	Intensity (duration, frequency and length of sessions)	Delivery (method, setting and professional)	Control
Sheridan Rains 2019[100]	• 10.1 Material incentive ++ • 10.2 Material reward ++ • 5.1 Information about health consequences +	Drug use	Contingency management	• Duration: 3 months • Frequency: NR • Length of sessions: NR	• Delivery method: individual • Setting: early intervention services • Professional: clinical staff	TAU+
Sorić 2019[101]	• 12.1 Restructuring the physical environment ++ • 4.1 Instruction on how to perform a behaviour ++ • 5.1 Information about health consequences ++	Diet	DASH diet	• Duration: 1 year • Frequency: weekly • Length of sessions: 1 hour	• Delivery method: individual • Setting: inpatient • Professional: researcher	TAU+
Speyer 2016,[102] care co-ordination	2.7 Feedback on outcome(s) of behaviour ++	Diet, smoking, physical activity, alcohol use, other (diabetes, cardiovascular disease, obstructive pulmonary disease)	Care co-ordination	• Duration: 1 session • Frequency: once • Length of sessions: 45 minutes	• Delivery method: individual • Setting: community/ electronic • Professional: occupational therapists, physiotherapists, dietitians with clinical experience in psychiatry	TAU
Speyer 2016,[102] CHANGE intervention	• 1.4 Action-planning ++ • 1.5 Review behaviour goal(s) ++ • 2.2 Feedback on behaviour ++ • 3.1 Social support (unspecified) ++ • 3.2 Social support (practical) ++	Diet, smoking, physical activity, alcohol use, other (diabetes, cardiovascular disease, obstructive pulmonary disease)	Lifestyle intervention CHANGE	• Duration: 1 session • Frequency: once • Length of sessions: 45 minutes	• Delivery method: individual • Setting: community/ electronic • Professional: occupational therapists, physiotherapists, dietitians with clinical experience in psychiatry	TAU
Steinberg 2016[103]	• 13.3 Incompatible beliefs ++ • 2.7 Feedback on outcome(s) of behaviour ++ • 3.1 Social support (unspecified) ++ • 3.3 Social support (emotional) ++	Smoking, other (personal medical conditions, finance)	Motivational interviewing with personalised feedback	• Duration: 1 year • Frequency: monthly • Length of sessions: NR	• Delivery method: individual • Setting: NR • Professional: therapist and clinician trained in motivational interviewing	TAU+

TABLE 8 Intervention characteristics for included RCTs (*continued*)

Study (first author, year of publication)	BCTs (BCTT v1)	Targeted risk behaviour(s)	Intervention	Intensity (duration, frequency and length of sessions)	Delivery (method, setting and professional)	Control
Sugawara 2018,[104] nutritional education	• 1.3 Goal-setting (outcome) ++ • 1.7 Review outcome goal(s) ++ • 2.3 Self-monitoring of behaviour ++ • 2.7 Feedback on outcome(s) of behaviour ++ • 4.1 Instruction on how to perform a behaviour ++	Diet	Nutritional education	• Duration: 1 year • Frequency: monthly • Length of sessions: 30–40 minutes	• Delivery method: individual • Setting: outpatient • Professional: psychiatrist/dietitian	TAU
Sugawara 2018,[104] weight loss advice	• 1.3 Goal-setting (outcome) ++ • 1.7 Review outcome goal(s) ++ • 2.7 Feedback on outcome(s) of behaviour ++	Diet	Weight loss advice	• Duration: 1 year • Frequency: monthly • Length of sessions: 30–40 minutes	• Delivery method: individual • Setting: outpatient • Professional: psychiatrist/dietitian	TAU
Sylvia 2019[105]	• 1.2 Problem-solving ++ • 4.1 Instruction on how to perform a behaviour ++	Diet, physical activity	Nutrition and exercise intervention	• Duration: 20 weeks • Frequency: 18 sessions • Length of sessions: NR	• Delivery method: individual • Setting: NR • Professional: master's-level clinical psychology doctoral students	TAU
Tantirangsee 2015,[106] brief session	• 3.1 Social support (unspecified) ++ • 5.1 Information about health consequences ++	Smoking, alcohol use, drug use	Single-session brief intervention	• Duration: 1 session • Frequency: once • Length of sessions: 30–45 minutes	• Delivery method: individual • Setting: clinic • Professional: psychiatric nurse	TAU
Tantirangsee 2015,[106] brief session with family support	• 1.2 Problem-solving ++ • 3.2 Social support (practical) ++ • 3.3 Social support (emotional) ++	Physical activity, alcohol use, drug use	Single-session brief intervention with family support	• Duration: 1 session • Frequency: once • Length of sessions: 30–45 minutes	• Delivery method: individual • Setting: clinic • Professional: psychiatric nurse	TAU

Study (first author, year of publication)	BCTs (BCTT v1)	Targeted risk behaviour(s)	Intervention	Intensity (duration, frequency and length of sessions)	Delivery (method, setting and professional)	Control
Usher 2013[107]	• 2.3 Self-monitoring of behaviour ++ • 4.1 Instruction on how to perform a behaviour ++ • 6.2 Social comparison ++ • 7.1 Prompts/cues +	Diet, physical activity	Weight management and exercise intervention	• Duration: 12 weeks • Frequency: weekly • Length of sessions: education 1 hour, exercise 30 minutes	• Delivery method: group • Setting: NR • Professional: nurse and researcher	TAU
Weber 2006[108]	• 1.1 Goal-setting (behaviour) ++ • 1.2 Problem-solving ++ • 11.2 Reduce negative emotions ++ • 2.3 Self-monitoring of behaviour ++ • 4.1 Instruction on how to perform a behaviour ++ • 5.1 Information about health consequences ++ • 7.1 Prompts/cues + • 9.2 Pros and cons ++	Diet, physical activity	Cognitive behavioural group	• Duration: 16 weeks • Frequency: weekly • Length of sessions: 1 hour	• Delivery method: group • Setting: mental health clinic • Professional: psychiatric nurse practitioner	TAU
Williams 2019[109]	• 1.2 Problem-solving ++ • 3.3 Social support (emotional) + • 4.1 Instruction on how to perform a behaviour ++ • 5.1 Information about health consequences ++ • 8.3 Habit formation +	Physical activity		• Duration: 17 weeks • Frequency: education session – once, health coaching – fortnightly, walking group – weekly • Length of sessions: health coaching – 30 minutes, walking group – 2 hours	• Delivery method: individual and group • Setting: community • Professional: health coaches	TAU
					continued	

TABLE 8 Intervention characteristics for included RCTs (*continued*)

Study (first author, year of publication)	BCTs (BCTT v1)	Targeted risk behaviour(s)	Intervention	Intensity (duration, frequency and length of sessions)	Delivery (method, setting and professional)	Control
Wu 2008[110]	• 1.1 Goal-setting (behaviour) ++ • 1.4 Action-planning ++ • 1.6 Discrepancy between current behaviour and goal ++ • 2.2 Feedback on behaviour ++	Diet, physical activity	Lifestyle intervention with placebo	• Duration: 12 weeks • Frequency: psychoeducation/diet: monthly, exercise: daily • Length of sessions: psychoeducation/diet– NR, exercise – 30 minutes	• Delivery method: group and individual • Setting: outpatient, self-management • Professional: dietitian and exercise physiologist	Other
Young 2017,[111] MOVE SMI	• 1.3 Goal-setting (outcome) ++ • 3.3 Social support (emotional) ++ • 8.1 Behavioural practice/ rehearsal ++	Diet, physical activity	MOVE SMI	• Duration: 6 months • Frequency: weekly • Length of sessions: 60 minutes	• Delivery method: group and individual • Setting: NR • Professional: coaches with lived experience, supervised group leaders	TAU
Young 2017,[111] webMOVE	• 1.3 Goal-setting (outcome) ++ • 2.3 Self-monitoring of behaviour ++ • 3.1 Social support (unspecified) ++	Diet, physical activity	WebMOVE	• Duration: 6 months • Frequency: twice per week, plus weekly peer coaching • Length of sessions: 30 minutes	• Delivery method: individual • Setting: online • Professional: coaches with lived experience, supervised group leaders	TAU

+, a BCT is probably present; ++, clear evidence that a BCT is present; DASH, Dietary Approaches to Stop Hypertension; IMPaCT, Improving health and reducing substance use in established psychosis; N/A, not applicable; NR, not reported; REBT, rational emotive behaviour therapy; RENEW, Recovering Energy Through Nutrition and Exercise for Weight Loss; SCIMITAR, Smoking Cessation Intervention for Serious Mental Ill Health Trial; SMART, self-management and recovery training; STEPWISE, STructured lifestyle Education for People WIth SchizophrEnia; VA, Veterans Affairs; WALC-S, Walk, Address sensations, Learn about exercise, Cue exercise behavior for persons with Schizophrenia spectrum disorders.

Appendix 5　Descriptions of interventions of included randomised controlled trials

TABLE 9 Descriptions of interventions and control conditions for included RCTs

Study (first author, year of publication)	Intervention	Description of intervention	Control type	Description of control
Attux 2013[45]	Weight management intervention	The Lifestyle Wellness Program is a 12-week weight management intervention aimed to control weight gain in schizophrenic patients who are taking antipsychotics. The programme involves weekly group sessions focusing on dietary choices, physical activity and self-esteem, to modify patients' lifestyles	TAU	Standard care: use of antipsychotics, regular visits to psychiatrist and attended regular sessions from psychosocial interventions offered by the programme they were already in
Baker 2006[46]	Motivational interviewing	Motivational interviewing. Sessions focused on reviewing personal triggers, strategies to cope with urges, and managing withdrawal, while supplying nicotine patches to enhance abstinence	TAU+	TAU+: had access to GPs and publicly funded community mental health teams, as well as access to SANE self-help books also given to intervention group
	CBT + NRT	CBT intervention focused on smoking cessation. Sessions focused on reviewing personal triggers, strategies to cope with urges, and managing withdrawal, while supplying nicotine patches to enhance abstinence	TAU+	TAU+: had access to GPs and publicly funded community mental health teams, as well as access to SANE self-help books also given to intervention group
Baker 2015[47]	Healthy lifestyles intervention – motivational interviewing	Motivational interviewing. Designed to encourage smoking cessation and improvements in diet and physical activity. Particular focus on CVD risk factors tailored towards the participant	TAU+	Telephone-based intervention. Participants had to take part in brief (10-minute) manualised telephone calls conducted to control for number of therapist contacts. Delivered once per week for 8 weeks, followed by three fortnightly sessions, followed by six monthly sessions. At weeks 4 and 8, no telephone call but 30-minute face-to-face session during which NRT is dispensed
	CBT + NRT	CBT-based intervention focusing on healthy lifestyle choices. Designed to encourage smoking cessation and improvements in diet and physical activity. Particular focus on CVD risk factors tailored towards the participant	TAU+	Telephone-based intervention. Participants had to take part in brief (10-minute) manualised telephone calls conducted to control for number of therapist contacts. Delivered once per week for 8 weeks, followed by three fortnightly sessions, followed by six monthly sessions. At weeks 4 and 8, no telephone call but 30-minute face-to-face session during which NRT is dispensed

TABLE 9 Descriptions of interventions and control conditions for included RCTs (*continued*)

Study (first author, year of publication)	Intervention	Description of intervention	Control type	Description of control
Battaglia 2013[48]	Soccer therapy	Soccer therapy: every training session lasted about 100–120 minutes and included the following: 1. a recording phase ($\approx$ 10 minutes) 2. a social interaction phase ($\approx$ 10 minutes) to enhance the participation effects 3. a warm-up period ($\approx$ 20 minutes) 4. a central training period ($\approx$ 40–60 minutes) made up of two games ($\approx$ 20–30 minutes each), including soccer technical–tactical exercises and a small-sided soccer games 5. a cool-down period ($\approx$ 10 minutes) 6. a feedback phase ($\approx$ 10 minutes). Progressively increased the duration of each game of the training period (20 minutes from week 1 to week 5; 25 minutes from week 5 to week 8; and 30 minutes from week 9 to week 10)	TAU	No intervention
Bechdolf 2012[49]	Motivational interviewing	Motivational interviewing: four sessions received during inpatient treatment. Session 1: feedback about behaviour, and informed about motivational interviewing. Session 2: negative consequences of substances emphasised. Session 3: participants are asked about their personal goals and the importance of those goals. In addition, attempts are made to resolve ambivalence about abstinence. Session 4: participants set realistic goals for substance use and plans to prevent relapse	TAU+	Four non-specific support sessions. Focus of sessions was on emotional support, therapeutic attention, empathic listening, bringing in therapeutic optimism, warmth, openness and co-operation
Beebe 2005[51]	Treadmill walking	Warm-up stretches, followed by treadmill walking at target heart rate and then cool-down stretches. Walking duration increased over course of intervention	TAU	No intervention
Beebe 2011[50]	Walking programme (WALC-S)	Walking information (walking not included in intervention, up to individuals): basic safety, walking for exercise, warm-up and cool-down, individualised walking or attendance goals. Address sensations: participants queried about discomforts in exercise, observed for signs of discomfort in warm-up and cool-down.	TAU+	Time and attention control. Focus on health behaviours such as medication adherence, humour and progressive muscle relaxation, smoking cessation, but did not include exercise or motivational content. Reminder calls made before each group

TABLE 9 Descriptions of interventions and control conditions for included RCTs (*continued*)

Study (first author, year of publication)	Intervention	Description of intervention	Control type	Description of control
		Written materials provided suggestions on reducing discomfort. Learn about exercise: information provided about benefit of exercise, overcoming barriers to exercise and assisted in making solutions to overcome barriers (when necessary). Cue exercise: calendars with walking days and times marked on were provided to cue attendance. Reminder calls made before group		
Bonfioli 2018[52]	Health promotion	Health education group sessions: two physical activity, five nutrition. Delivered by trainers and dietitians, over 6 months. Weekly walking sessions, guided by trainer. Prompting by telephone or in person to promote adherence	TAU	Routine care in community psychiatric services
Bonsack 2011[53]	Motivational interviewing	In addition to TAU. Four to six sessions conducted individually. First session lasted 1 hour, followed by feedback session of 45 minutes to 1 hour a week later. Two to four booster sessions for next 6 months. Participants were also offered three optional 1-hour group sessions	TAU	Psychiatric management by a team of at least one psychiatrist, psychiatric nurse or clinical psychologist. Antipsychotic medication, regular treatment monitoring, access to community-based rehabilitation activities
Brar 2005[54]	Behaviour weight loss programme	Manual-driven, didactic programme structured in an incremental and stepwise manner. Two therapy sessions per week for 6 weeks, followed by once per week for 8 weeks. Participants trained in a range of cognitive and behavioural techniques, such as self-monitoring and cognitive restructuring, and educated about healthy eating and burning calories through exercise	TAU	Encouraged to lose weight on their own with no instructions from investigators. Monthly anthropometric assessments
Brody 2017[55]	Combination extended treatment	Standard doses were used for buproprion and nicotine patches. Weekly medication management visits with a study physician. A 1-hour group CBT treatment each week	TAU	Standard doses were used for buproprion and nicotine patches. Weekly 15-minute medication management visits with a study physician. A 1-hour group CBT treatment each week
	Combination extended treatment + home visits	Standard doses were used for buproprion and nicotine patches. Weekly medication management visits with a study physician. A 1-hour group CBT treatment each week	TAU	Standard doses were used for buproprion and nicotine patches. Weekly 15-minute medication management visits with a study physician. A 1-hour group CBT treatment each week

TABLE 9 Descriptions of interventions and control conditions for included RCTs (*continued*)

Study (first author, year of publication)	Intervention	Description of intervention	Control type	Description of control
Brown 2006[57]	Lilly 'Meaningful Day' manual	Six weekly 50-minute health promotion sessions. Largely focused on weight reduction but tailored to the needs of individuals	TAU	TAU: no further details
Brown 2011[56]	RENEW weight loss programme	Weekly 3-hour session, with information on nutrition and physical activity, setting individualised goals, eating a meal together. Duration: 12 months – 3 months intensive, 3 months maintenance, 6 months intermittent support. Participants receive two meal replacements daily for the first 3 months	TAU	TAU: typical treatment included medication and case management and the opportunity for voluntary participation in day programming
Brunette 2020[58]	Web-based motivational intervention	One-session linear, modularised and interactive programme taking 30–90 minutes to complete. Three modules: 1. assessment/feedback 2. quit intention 3. education about cessation treatments	TAU	Computerised version of the National Cancer Institute's Patient Education Publications. Risk and protective factors for cancer and other smoking-related diseases
Christiansen 2018[59]	Motivational intervention	Four sessions motivating participants and helping prepare for a quit attempt. Included reviewing past quit attempts, building self-efficacy, setting goals to reduce smoking and plan quit attempt. All participants received nicotine patches	TAU+	Attentional control: same number of sessions as intervention, but reviewed booklets about effect of smoking on body; also received nicotine patch
Cordes 2011[60]	Weight management programme	Twelve biweekly weight management sessions. Four modules covering: assessment of eating and exercise behaviour, recommendations for a healthy isocaloric diet, recommendations for regular moderate physical activity, behavioural management strategies	TAU	Control: no further details
Daumit 2013[61]	Weight loss programme	Eighteen-month tailored behavioural weight loss intervention. Included individual and group weight management and exercise sessions. Goals to reduce calorie intake, healthy eating and moderate–intense aerobic exercise	TAU	Control: standard nutrition and physical activity information. Health classes offered quarterly unrelated to weight loss (e.g. cancer screening)
Evans 2005[62]	Nutrition intervention	Six one-to-one sessions. Discussion on healthy eating, exercise, label-reading, high-fibre diets	TAU	Control: standard nutrition and physical activity information

TABLE 9 Descriptions of interventions and control conditions for included RCTs (*continued*)

Study (first author, year of publication)	Intervention	Description of intervention	Control type	Description of control
Fernández Guijarro 2019[63]	Nurse-led lifestyle intervention	This programme consisted of 24 weekly group sessions led by mental health nurses. Each session began with 20 minutes of educational material on diet, physical activity, stress, alcohol misuse, smoking, etc., followed by 60 minutes of physical activity (e.g. walking, stretching) led by a nurse	TAU	Usual nurse care
Forsberg 2008[64]	Diet and physical activity intervention	Each group met twice per week for 2 hours over 12 months. Half of the sessions were teaching nutrition and the other half physical activity. Nutrition sessions included theoretical training, buying ingredients and preparing a meal. Physical activity sessions included fitness training, team games, bowling, swimming, etc.	TAU+	Control: met for a 2-hour session once per week for 40–48 weeks. Had the opportunity to learn and practise various artistic techniques, for example sketching, pencil drawing, oils
Frank 2015[65]	Integrated risk reduction intervention	Intervention included three sessions of bipolar disorder psychoeducation, four sessions of education on healthy sleep, four sessions on nutrition, four sessions on physical activity and two sessions on smoking cessation (if required). Consists of three components: psychiatric treatment by psychiatrist; assessment, referral, monitoring and co-ordination by nurse; and healthy lifestyle behaviours programme by a lifestyle coach	TAU	Psychiatric care with medical monitoring
Ganguli 2011[66]	Behaviour therapy for weight loss	Manualised 20-session behavioural weight loss intervention delivered over 14 weeks by mental health clinicians	TAU	TAU: no further details
Gaughran 2017[67]	IMPaCT intervention	Target one or more health behaviours from list of cannabis, alcohol, other substances, cigarettes, exercise, diet, etc. Prioritised behaviours considered problematic by patient. Intervention used a motivational interviewing and CBT approach supported by manual, reference book and service user handbook	TAU	Control: received training in best practice for physical health awareness to ensure more standardised TAU
George 2000[68]	Smoking cessation	Adapted for schizophrenia patients. Ten weekly sessions: 3 weeks of motivational enhancement therapy; 7 weeks of psychoeducation, social skills training and relapse prevention techniques. After 3 weeks, participants tried to quit and also received nicotine transdermal patches for 6 weeks	TAU	Control: 7-week American Lung Association Freedom from Smoking® group programme, and 3 weeks of supportive group counselling

continued

TABLE 9 Descriptions of interventions and control conditions for included RCTs (*continued*)

Study (first author, year of publication)	Intervention	Description of intervention	Control type	Description of control
Gilbody 2019[69]	SCIMITAR+	Bespoke smoking intervention. Mental health nurses working in conjunction with primary care physician/mental health specialist to provide tailored service. Delivered according to the *Manual of Smoking Cessation*, with adaptations for persons with SMI. These included several assessments before setting quit date, offering nicotine replacement before setting quit date, recognising purpose of smoking in context of mental illness, providing home visits, providing face-to-face support, support after unsuccessful quit attempt or relapse, informing primary care physician and psychiatrist of successful quit attempt (to review doses of antipsychotic medication if metabolism changes)	TAU	Usual care
Gillhoff 2010[70]	Multimodal lifestyle intervention	Eleven group sessions over 5 months and weekly fitness training. Sessions divided into three modules: lifestyle (including psychoeducation about bipolar disorder), nutrition and physical activity	TAU	Control: TAU; no further information provided
Graham 2016[71]	Brief integrated motivational intervention	Four to six sessions (lasting 15–30 minutes each) over a 2-week period. Three-step approach combining cognitive–behavioural and motivational approaches. First step provides personalised feedback on substance use. Second step aimed to help participants make decisions based on benefits and costs of misuse. Third step encouraged development of a change plan	TAU	TAU: assessment and monitoring of mental state, provision of medication and stabilisation of mental state
Green 2015[72]	STRIDE intervention	Weekly group meetings over 6 months in intensive phase. Based on the DASH diet, aimed to reduce obesity and diabetes risk. Aimed to lose 4.5–6.8 kg over 6 months. Then monthly group meetings to maintain weight loss over 6 months	TAU	TAU: no further details

TABLE 9 Descriptions of interventions and control conditions for included RCTs (*continued*)

Study (first author, year of publication)	Intervention	Description of intervention	Control type	Description of control
Hjorth 2014[73]	Active awareness and motivational interviewing	The intervention is an active awareness and motivational interviewing intervention that aims to increase knowledge and improve physical health among people with long-term psychiatric illnesses. Includes individual and group sessions focusing on physical health, smoking, antipsychotic medication and healthy food consumption	TAU	TAU: antipsychotic use and offered individual sessions
Hjorthøj 2013[74]	CapOpus – motivational interviewing/ CBT + TAU	Six-month manual-based intervention using motivational interviewing to enhance alliance and motivation, supported by CBT sessions focused on changing cannabis use	TAU	TAU: antipsychotic use and offered sessions using methods such as CBT (not specific to cannabis use)
Holt 2019[75]	STEPWISE: weight management	The STEPWISE weight management intervention is designed for people with mental health issues and schizophrenia to encourage them to change their behaviour in relation to eating and exercise. It also focuses on the psychological processes underlying weight management, and the challenges psychosis has on eating and weight	TAU	TAU: antipsychotic use; advice on lifestyle and risks of weight gain freely available
Iglesias-García 2010[76]	Weight management intervention	An education programme providing information and counselling on nutrition, exercise and health habits, and self-esteem, aiming to reduce weight in schizophrenic population, based on the idea that lifestyle therapies are more effective than pharmacological treatments for weight management in schizophrenic populations	TAU	TAU: weekly visits to clinic to assess anthropometric measures
Jean-Baptiste 2007[77]	Weight management intervention	Weight management intervention based on the principles of the Lifestyle, Exercise, Attitudes, Relationships and Nutrition (LEARN) programme to minimise weight gain and produce weight loss in SMI patients. The intervention encompasses behavioural modification techniques, exercise enhancement, food provision and tailored nutritional support to motivate weight loss in schizophrenia	TAU	Waiting list control: after a 16-week period, they received the intervention

TABLE 9 Descriptions of interventions and control conditions for included RCTs (*continued*)

Study (first author, year of publication)	Intervention	Description of intervention	Control type	Description of control
Jones 2019[78]	Motivational interviewing–CBT	Combination of motivational interviewing and CBT elements adapted from an approach designed for people with substance abuse disorder and psychosis. Offered up to 20 sessions in their preferred location, usually at home, typically for 45–60 minutes	TAU	Determined by each participant's responsible clinician, primarily medication and community mental health team support
Kaltsatou 2015[79]	Exercise training with Greek traditional dancing	Exercise training classes combined with Greek traditional dancing aimed at promoting physical activity based on the theory that social dance interventions increase social support and motivation in individuals with SMI. Each session is designed to promote physical activity, as intensity increases over time. Each session included 10-minute warm-up and cool-down sessions at the start and end, respectively; as well as 40 minutes of dancing	TAU	TAU: antipsychotic medication and some psychotherapy sessions
Khazaal 2007[80]	CBT	The 'apple-pie' group CBT intervention focuses on promoting positive eating behaviours, cognitive restructuring for thoughts relating to weight and eating behaviour and behaviour adaptation through monitoring weekly food intake	TAU+	TAU+: received brief nutritional education and nutritional recommendations to maintain effort to lose weight
Kilbourne 2012[81]	Life Goals Collaborative Care (LGCC): mix of motivational interviewing and CBT	The LGCC intervention was designed to help participants set personal self-management goals based on social cognitive theory to cope with chronic health conditions such as bipolar disorder and cardiometabolic risk factors. Sessions focused on diet, psychiatric symptoms, stigma issues and collaborative care	TAU+	TAU+: monthly receipt of information on wellness topics, in addition to mental health care and referral to off-site primary care services
Kwon 2006[82]	Weight management intervention	Weight management intervention using a CBT approach to promote weight loss among people with schizophrenia. The intervention incorporated a diet management programme as well as an exercise management programme to educate patients on using food and exercise diaries, eating behaviour improvement and lifestyle modification for weight control	TAU+	TAU+: antipsychotics plus monthly sessions providing advice on physical activity and eating behaviour, as well as food and exercise diaries

TABLE 9 Descriptions of interventions and control conditions for included RCTs (*continued*)

Study (first author, year of publication)	Intervention	Description of intervention	Control type	Description of control
Lee 2014[83]	Telephone-delivered physical activity intervention	Telephone-based physical activity intervention aimed at promoting physical activity among people with SMI. Guided by social cognitive theory, this intervention emphasises the importance of an interplay between personal, behavioural and environmental factors in human behaviours. Through social support, the intervention aims to improve individuals' self-efficacy, which, in turn, improves health-promoting behaviour (physical activity)	TAU	TAU: antipsychotics and written advice on physical activity
Littrell 2003[84]	Weight management intervention	Weekly psychoeducation classes using the 'solutions of wellness' modules to promote healthy eating, and fitness and exercise, specific to people with schizophrenia	TAU	Standard care
Marzolini 2009[85]	Exercise training	Weekly exercise sessions incorporating aerobic training and resistance (weight) training based on the notion that resistance training and aerobic training is more effective than aerobic training on its own. Emphasis on training heart rate during the exercises	TAU	TAU
Masa-Font 2015[86]	Physical activity and diet programme (CAPiCOR trial)	Physical activity and dietary intervention aimed at modifying CVD risk factors for SMD. Included physical activity sessions aimed to promote walking and safe practices, alongside dietary advice sessions providing knowledge on healthy dietary habits. Based on the notion that a collaborative programme is more beneficial	TAU	TAU: antipsychotics and regular psychiatry check-ups
Mauri 2008[87]	Psychoeducation for weight loss	1. Keep diary and measure bodyweight weekly 2. Eat regularly and take physical exercise 3. Control stimuli that lead to overeating 4. Identify the condition at high risk of poor compliance to the programme 5. Resolve problems leading to overeating and lack of physical activity 6. Learn to accept a reasonable weight 7. Maintain reasonable weight and prevent recurrence Adaptations provided. Personalised diet plan, and step counter with objective of 10,000 steps per day used	TAU	Olanzapine only

TABLE 9 Descriptions of interventions and control conditions for included RCTs (*continued*)

Study (first author, year of publication)	Intervention	Description of intervention	Control type	Description of control
McCreadie 2005[88]	Free fruit, vegetables and meal planning	Provision of fruit and vegetables with food preparation instructions	TAU	No intervention
	Free fruit and vegetables	Provision of fruit and vegetables	TAU	No intervention
McKibbin 2006[89]	Diabetes Awareness and Rehabilitation Training (DART)	DART: social cognitive theory provided theoretical foundation and is often used in diabetes education. Basic education (sessions 1–4, repeated sessions 13–16): introduction, understanding motivation, review of blood sugar, symptoms of high and low blood sugar, complications, how to best use glucose meter, doctor visits. Nutrition (sessions 5–8, repeated sessions 17–20): food groups, portion sizes, healthy meals and reading labels, replace sugar with fat and fibre. Exercise (sessions 9–12, repeated sessions 21–24): types of exercise, blood sugar and exercise, tracking exercise/ introduction of pedometers, foot care during exercise. Weekly weigh-ins, pedometers, healthy food sampling and reinforcements (such as raffle tickets for small health-related prizes) for attendance and behavioural change	TAU+	Usual care plus information
Melamed 2008[90]	Group nutrition counselling and behaviour therapy	Education sessions on topics: getting to know the food groups, importance of drinking water, calcium, vitamins, nutritious fibres, weight gain and physical illness, suggestions for menus for home-cooked food, reading food labels in the supermarket, group visits to the cafeteria, exercise, lipids. Weigh-ins, affirmation of successful weight loss, group support, points awarded for behavioural changes and weight loss. Methods for coping with temptation, problem-solving, self-monitoring of eating, and stress management. Healthy nutrition buffet tables were placed alongside standard buffet tables at meal times and participants sat at these with nutrition supervisors. Family visitors were encouraged not to bring sweets or sweetened drinks, and the cafeteria offered reduced price options. Exercise: 30-minute walks five times per week, with warm-up and cool-down. Aerobics guided by cassette tape were delivered when weather prevented walking	TAU+	Inpatient usual care

Health and Social Care Delivery Research 2022 Vol. 10 No. 6

TABLE 9 Descriptions of interventions and control conditions for included RCTs (*continued*)

Study (first author, year of publication)	Intervention	Description of intervention	Control type	Description of control
Methapatara 2011[91]	Pedometer walking and motivational interviewing (PWMI)	All participants given leaflet called 'What is a healthy lifestyle?'. PWMI: Session 1. Individual motivational interviewing with focus on obesity/overweight and motivation to have adequate daily walking Session 2. Group education on nutrition, exercise, warming up, cooling down and pedometer. Specific, measurable, achievable, relevant, time-bound (SMART) criteria used to set individual goal. Minimum 3000 steps per day Session 3. Not reported Session 4. Group practise pedometer walking under supervision. Four or five participants encouraged to walk and wear pedometer all day Session 5. Therapist feedback on participants' practice, informed about self-regulation principles to cope with lapse and relapse, and answering any questions patients might have. Those achieving 3000 steps per day were encouraged to pursue a new minimum of 5000 steps All five sessions complete within 1 week prior to patient discharge. Participants called 1 week after discharge to ask about difficulties in compliance. Those achieving step goals encourages to increase to 8000 steps per day	TAU	TAU and leaflet titled 'What is a healthy lifestyle?'
Milano 2007[92]	Physical activity, diet and olanzapine	All participants given olanzapine. Intervention group: followed diet with 500 kcal per day reduction, with nutritional balance, and nutritional advice. Physical activity plan for three times per week. Weeks 1 and 2: 5 minutes of fast step walking alternated with 3 minutes of slow running, for a total of 30 minutes. Weeks 3–5: 5 minutes of fast step walking alternated with 5 minutes of slow running, for a total of 30 minutes. Weeks 6–8: four cycles of 4 minutes of fast step walking	TAU	No intervention

TABLE 9 Descriptions of interventions and control conditions for included RCTs (*continued*)

Study (first author, year of publication)	Intervention	Description of intervention	Control type	Description of control
		alternated with 6 minutes of slow running, for a total of 40 minutes. Weeks 9–12: four cycles of 4 minutes of fast step walking alternated with 8 minutes of slow running, for a total of 48 minutes. Stretching at beginning and end of activity		
Osborn 2018[93]	Primrose intervention	This intervention is based on challenging eight key behaviour change strategies used to reduce CVD risk. Incorporates weekly/fortnightly sessions up to 6 months, during which nurse and participants agree on goals to lowering CVD risk	TAU	Feedback of screening results
Peckham 2017[94]	Bespoke smoking intervention	SCIMITAR: trained mental health and smoking cessation specialist works with GP or mental health specialist to provide cessation service tailored to each participant. Delivered in accordance with Smoking Cessation Manual. Includes support sessions specifically adapted for SMI, GP-prescribed pharmacotherapies (NRT, buproprion or varenicline), and regular follow-up. Example adaptations: 1. several assessments before setting a quit date 2. recognising purpose of smoking in mental health context, such as relieving medication side effects 3. need to involve other members of multidisciplinary team in planning successful quit attempt 4. greater need for home visits rather than planned GP surgery visits 5. additional face-to-face support following unsuccessful quit attempt or relapse 6. informing GP and psychiatrist of successful quit attempt so they can review antipsychotic medication changes if metabolism changes Participants were encouraged to reduce smoking to quit, to set their own quit dates and to make several attempts to quit if the initial attempt failed. All at discretion of providers	TAU	TAU

TABLE 9 Descriptions of interventions and control conditions for included RCTs (continued)

Study (first author, year of publication)	Intervention	Description of intervention	Control type	Description of control
Penn 2000[95]	12-step REBT	Intensive outpatient treatment/ partial hospitalisation up to 5 hours per day, 5 days per week. Weekly activities and topics: relapse prevention, SMI management, daily living skills, goal-setting, mental health and substance abuse education, lunch (including shopping and preparation), healthful recreation (including weekly outing), in-house and community 12-step meetings, written assignments, and individual sessions as needed. Case management and permission to complete the programme in multiple segments if needed. REBT: no ideological position on abstinence, strives to operate within goals and values of individual clients	Head to head	None
	SMART	Intensive outpatient treatment/ partial hospitalisation up to 5 hours per day, 5 days per week. Weekly activities and topics: relapse prevention, SMI management, daily living skills, goal-setting, mental health and substance abuse education, lunch (including shopping and preparation), healthful recreation (including weekly outing), in-house and community SMART meetings, written assignments, and individual sessions as needed. Case management and permission to complete the programme in multiple segments if needed. SMART: abstinence based and aim to serve people who desire to completely stop addictive behaviour	Head to head	None
Ratliff 2012[96]	Lifestyle modification with contingency management for weight	Lifestyle modification for all participants: Simplified Intervention to Modify Physical Activity and Eating Behaviour (SIMPLE). Standardised lifestyle programme based on social cognitive theory, designed to be used with SMI populations; all concepts presented in basic terms with cultural sensitivity. Weekly group sessions of 8–10 individuals. Topics broadly focus on nutrition and physical activity and include changing attitudes to support weight loss, and implementing social support	TAU	TAU

TABLE 9 Descriptions of interventions and control conditions for included RCTs (*continued*)

Study (first author, year of publication)	Intervention	Description of intervention	Control type	Description of control
		to aid weight loss. Contingencies for weight: US$20 for each baseline and week-8 assessment; maximum amount possibly earned from contingencies: US$140. Weight: US$5 for initial weight loss of at least 1 lb, US$10 for next weigh-in with weight loss of at least 1 lb, with subsequent weigh-ins escalating by US$5 increments. If no weight lost, payments reset at US$5		
	Lifestyle modification with contingency management attendance	Lifestyle modification for all participants: Simplified Intervention to Modify Physical Activity and Eating Behaviour (SIMPLE). Standardised lifestyle programme based on social cognitive theory, designed to be used with SMI populations; all concepts presented in basic terms with cultural sensitivity. Weekly group sessions of 8–10 individuals. Topics broadly focus on nutrition and physical activity and include changing attitudes to support weight loss, and implementing social support to aid weight loss. Contingencies for attendance: US$20 for each baseline and week-8 assessment; maximum amount possibly earned from contingencies: US$140. Attendance: US$17.50 for each weight loss group attendance	TAU	TAU
Romain 2019[97]	Interval training	Supervised interval training: 6 months of HIIT on a treadmill twice per week. Each exercise session lasted for 30 minutes. The sessions included a 5-minute low-intensity warm-up (walking), 10 intervals of 2 minutes' duration each, and a 5-minute cool-down (walking). Each interval was composed of a 30-second sprint followed by an active recovery of 90 seconds	TAU	TAU
Scheewe 2013[98]	Exercise therapy	Designed to improve cardiorespiratory fitness and primarily incorporates cardiovascular exercises. Strength exercises: six exercises a week, 3 × 10–15 repetitions for biceps, triceps, abdominal, quadriceps, pectoral, deltoid muscles. Programme followed recommendations of American College of Sports Medicine. Information on amount of training and compliance registered in logbook	TAU	Occupational therapy

TABLE 9 Descriptions of interventions and control conditions for included RCTs (*continued*)

Study (first author, year of publication)	Intervention	Description of intervention	Control type	Description of control
Scocco 2006[99]	Nutritional programme	Personal and dietary detailed notes, emphasis on energy intake and energy expenditure. A nutritional programme and food diary are drawn up. At check-ups, any difficulties are addressed and food diary is discussed	TAU	Olanzapine only
Sheridan Rains 2019[100]	Contingency management	The voucher value rose by £5 with every two clean samples and the bonuses were removed. In total, participants could receive £240	TAU+	Psychoeducation: standard psychoeducation delivered in six modules of 30 minutes' duration each. Presents information regarding the effects of cannabis; motivational materials; and strategies for coping, minimising potential harms and abstaining from cannabis
Sorić 2019[101]	DASH diet	Participants were asked to follow the DASH diet. The caloric intake of the prescribed diet was reduced by approximately 1673.6 kJ per day (400 kcal per day) when compared with the standard hospital diet. They also received a standard nutrition counselling programme	TAU+	Four group sessions of nutritional counselling: dietary guidelines, reading food labels, diet and chronic disease
Speyer 2016[102]	Lifestyle coaching	Lifestyle coaching: defined as affiliation to a CHANGE team member, offering tailored, manual-based intervention targeting physical inactivity, unhealthy dietary habits and smoking, and facilitating contact to participants' GPs for medical treatment of somatic comorbidities. Based on theory of stages of change, motivational interviewing and assertive approach adapted from assertive community treatment. Four manuals were created based on this to deal with four tracks: care co-ordination, smoking cessation, healthy diet and physical activity. Coach offered home visits with systematic exploration of possibilities for physical activity in daily life, dietary changes based on dietary exploration, food purchases and cooking habits. Personal and professional networks were included in plans, when possible. Affiliation with team member was for 1 year with at least one weekly meeting, variable duration, further support by text, telephone call, and e-mail. Participants encouraged to select if focus	TAU	GP consults as needed, annual metabolic testing, no formalised extra effort regarding lifestyle counselling or treatment of physical disorders

TABLE 9 Descriptions of interventions and control conditions for included RCTs (*continued*)

Study (first author, year of publication)	Intervention	Description of intervention	Control type	Description of control
		should be one or more of four tracks; coach supports participants in individual goals		
	Care co-ordination	Care co-ordination: incorporated into the CHANGE group, implemented as add-on to TAU. Manual based, co-ordinator was trained psychiatric nurse, facilitated contact to primary care to ensure optimal treatment of physical health problems. Co-ordinator contact comprised meetings, telephone calls and text messages. Frequency adjusted to individual need. First meeting consisted of general health talk about physical well-being and an evaluation of test results from physical exam; special attention paid to symptoms of obstructive pulmonary disease, diabetes and CVD. A decision tree used to plan the further course	TAU	GP consults as needed, annual metabolic testing, no formalised extra effort regarding lifestyle counselling or treatment of physical disorders
Steinberg 2016[103]	Motivational interviewing with personalised feedback	Personalised feedback regarding carbon monoxide reading, financial expenditures and information about medical conditions that participants endorsed as personally relevant. Feedback delivered in style consistent with motivational interviewing. Information on carbon monoxide and medical conditions was delivered using 'elicit–provide–elicit' strategy; financial expenditures were discussed in manner designed to develop discrepancy between how they were spending money and how they would prefer to be spending money. A modified importance–confidence–readiness ruler exercise focusing on self-reported importance for quitting and confidence in ability to quit was delivered. On conclusion, a referral to a local tobacco dependence treatment clinic was given	TAU+	Interactive education
Sugawara 2018[104]	Weight loss advice	Weight loss advice from attending psychiatrist, record weight in notebook to create shared understanding between patient and psychiatrist. Participants given target body weight at baseline. At visits, their body weight is measured and brief advice focused on numeric increase or decrease is given	TAU	Standard care for residual and breakthrough symptoms of schizophrenia

TABLE 9 Descriptions of interventions and control conditions for included RCTs (*continued*)

Study (first author, year of publication)	Intervention	Description of intervention	Control type	Description of control
	Nutritional education	In addition to the above. Individual nutrition education sessions over 1 year. Conducted by dietitians and based on Nutrition Needs in Psychiatry project (Sagae[160]). Four phases, with learning objectives as follows: understanding the composition of a balanced meal, understanding appropriate food requirements, reducing the consumption of snacks and reviewing the sessions. Each phase comprised three sessions. Dietary energy goals were based on calculating a participant's ideal body weight (kg) multiplied by 25 kcal. Participants kept daily food records, which dietitians reviewed and discussed with each patient and practised selecting foods using full-sized sample dish cards. First 3 months, participants advised to eat three regular balanced meals: staple food, main dish, side dish including vegetables or dairy. Second phase establishes participants consumption of staple foods (rice, wheat, etc.). Third phase educated about relation between weight gain and snacks. Final phase reinforced the learning by reviewing content	TAU	Standard care for residual and breakthrough symptoms of schizophrenia
Sylvia 2019[105]	Nutrition and exercise intervention	CBT-based intervention focusing on nutrition (sessions 1–6: psychoeducation and skills training to make better food choices), exercise (sessions 7–12: focusing on goal of moderate–intensive exercise 5 days per week for 30 minutes) and wellness (importance of healthy choices and how to problem-solve barriers to reducing risk behaviours)	TAU	Wait list
Tantirangsee 2015[106]	Single-session brief intervention	Single session by nurse giving personalised feedback from the ASSIST and motivating change using motivational interviewing techniques for brief interventions adapted by the WHO ASSIST group. Included following elements: discussion of substance use patterns and motives; education on intoxication, tolerance and withdrawal symptoms; how physical and mental health problems can be	TAU	Risk screened with the ASSIST and advised to stop using all substances, 5-minute appointment

continued

TABLE 9 Descriptions of interventions and control conditions for included RCTs (*continued*)

Study (first author, year of publication)	Intervention	Description of intervention	Control type	Description of control
		caused or exacerbated by substance use; behaviour change options designed to build motivation, intentions and goals; cognitive and spiritual strategies to identify high-risk situations and cope with cravings; and information on changing substance use, and accessing local services and supports		
	Single-session brief intervention with family support	Same as single session without family attendance. Nominated key relative in attendance, session covers same areas as other, supplemented with following: importance and methods of good communication between family members; general problem-solving techniques that the family can use to help members who face personal difficulties; and specific methods the family can use to help the participant stop or reduce their use of the substances declared during the ASSIST	TAU	Risk screened with ASSIST and advised to stop using all substances, 5-minute appointment
Usher 2013[107]	Weight management and exercise intervention	Sessions included education and discussion on health lifestyle topic of the week, and participants' progress with implementation of the healthy lifestyle components of the programme into their lives. Twelve topics: 1. let's get started 2. healthy eating choices 3. healthy snacks 4. recording and rewarding your success 5. exercise 6. exercise choices 7. healthy eating reviews 8. feelings, exercise and eating, part 1 9. feelings, exercise and eating, part 2 10. evaluating your success 11. how to keep motivated with the programme 12. healthy celebrations After group education, 30-minute exercise activity undertaken. Education programme developed in stepped, progressive way that is easily understood. Visual reminders and pictorial representations added in programme	TAU	Healthy lifestyle booklet

TABLE 9 Descriptions of interventions and control conditions for included RCTs (*continued*)

Study (first author, year of publication)	Intervention	Description of intervention	Control type	Description of control
Weber 2006[108]	Cognitive behavioural group	Content of groups based on strategies to promote risk reduction. Sessions included role plays, goal-setting, motivational scaling, problem-solving, risk vs. benefits comparisons, discussions on barriers to change, presentations on low-fat diets, and plans to increase activities such as walking. Participants keep food and activity diaries, which are checked each session	TAU	TAU
Williams 2019[109]	Walk this way intervention	Intervention aimed to address capability, opportunity and motivational barriers to reducing sedentary behaviour and increasing physical activity. Used a combination of group education, meeting regularly with a health coach to address any barriers to reducing sedentary behaviour and engaging in physical activity. Also had an optional weekly walking group	TAU	Care co-ordination plus written information on the benefits of increasing activity levels
Wu 2008[110]	Lifestyle intervention with placebo	Daily placebo (for metformin). Psychoeducational, dietary and exercise programs. Psychoeducational: roles of eating and activity in weight management. Topics included healthful weight management, benefits of nutrition, physical fitness, available behavioural techniques. Delivered in groups at baseline, every 4 weeks. Dietary: American Heart Association step 2 diet prescribed. Less than 30% calories from fat, 55% from carbohydrates, and > 15% protein, increase in fibre intake to a minimum of 15 g per 1000 kcal. Three-day food diary analysed to provide feedback on diet, no changes to caloric intake, but adjusted to fit plan. Three-day diary kept before each visit for comparison with plan, and discussions about adherence. Exercise: week 1 directed by exercise physiologist. Endurance exercise on treadmill seven times per week for 30 minutes, to attain 70% of heart rate reserve. After this, exercise was homebased without supervision, using collaboratively	TAU+	Placebo

TABLE 9 Descriptions of interventions and control conditions for included RCTs (*continued*)

Study (first author, year of publication)	Intervention	Description of intervention	Control type	Description of control
		developed programmes. Range of exercise and intensity offered for 30 minutes per day. Branch treadmill tests performed at each visit. Participants keep record of exercise activity and heart rate		
Young 2017[111]	WebMOVE	WebMOVE: includes (1) internet browser-based provision of 30 interactive educational modules, tracking of activity and weight, and individualised homework, plus (2) weekly telephonic peer coaching. Computer program based on MOVE SMI (Goldberg *et al.*[161]). Participants given pedometer. Two online modules per week, each completed in 30 minutes. Tailored for cognitive deficits in SMI: minimal text, all read aloud, fifth-grade reading level, explicit navigational aids, simple presentation of information. Use of goal-setting, homework, automated diet plans and quizzes. System accessible from kiosks at VA clinics, or anywhere with internet access. Weekly manualised peer coaching by telephone with motivational interviewing	TAU	Usual care
	MOVE SMI	MOVE SMI: in-person management programme, uses handouts, motivational techniques, visual learning aids, behavioural rehearsal, repetition, goal-setting, homework and diet plans. Tailored for cognitive deficits in SMI: minimal text, all read aloud, fifth-grade reading level, explicit navigational aids, simple presentation of information. Use of goal-setting, homework, automated diet plans and quizzes. System accessible from kiosks at VA clinics, or anywhere with internet access. Weekly manualised peer coaching by telephone with motivational interviewing	TAU	Usual care

ASSIST, Alcohol, Smoking and Substance Involvement Screening Test; CVD, cardiovascular disease; DASH, Dietary Approaches to Stop Hypertension; GP, general practitioner; HIIT, high-intensity interval training; IMPaCT, Improving health and reducing substance use in established psychosis; NRT, nicotine replacement therapy; REBT, rational emotive behaviour therapy; RENEW, Recovering Energy Through Nutrition and Exercise for Weight Loss; SCIMITAR, Smoking Cessation Intervention for Serious Mental Ill Health Trial; SMART, self-management and recovery training; STEPWISE, STructured lifestyle Education for People WIth SchizophrEnia; WALC-S, Walk, Address sensations, Learn about exercise, Cue exercise behavior for persons with Schizophrenia spectrum disorders; VA, Veterans Affairs; WHO, World Health Organization.

Appendix 6 Characteristics of included qualitative studies

TABLE 10 Characteristics of included qualitative studies for qualitative synthesis

Study (first author, year of publication, country)	Aim	Intervention	Targeted risk behaviour(s)	Population (sample size)	Qualitative approach and data collection
Aschbrenner[116] 2013, USA	To explore social facilitators of and barriers to health behaviour change among participants engaged in a healthy lifestyle programme for persons with serious mental illness (In SHAPE) embedded in community-based mental health settings	In SHAPE integrated health promotion programme	Physical activity, diet	Schizophrenia or schizoaffective disorder (73%) ($n = 30$)	• Thematic analysis • Focus groups
Bauer[117] 2018, USA	To understand the needs of individuals with bipolar disorder with regard to lifestyle interventions targeting nutrition and physical activity	Lifestyle intervention	Physical activity, diet	Bipolar disorder (100%) ($n = 10$)	• Theme analysis • Focus group and paired interviews
Carless[118] 2008, UK	To explore the ways in which narrative, identity and mental health relate to one another within the specific context of sport, exercise and serious mental illness	Experiences of sport and exercise interventions	Physical activity	Men with SMI ($n = 11$)	• Analysis of narrative • Participant observation and semistructured interviews
Firth[119] 2016, UK	To explore the perceived benefits of exercise as experienced by people with first-episode psychosis, and to establish the barriers to and facilitators of increasing physical activity in this patient group	Individualised exercise programme	Physical activity	First-episode psychosis (100%) ($n = 13$)	• Thematic analysis • Semistructured interviews
Fogarty[120] 2005, Australia	To determine the impact of a structured exercise programme on the physical and psychological well-being of people with a long-term diagnosis of schizophrenia or related psychosis	Exercise intervention	Physical activity	Schizophrenia (100%) ($n = 6$)	• Thematic analysis • Focus group interview
Forsberg[121] 2011, Sweden	To illuminate meanings of participating in a lifestyle programme as experienced by persons with psychiatric disabilities	Lifestyle programme	Physical activity, diet, alcohol, drug use, smoking	Schizophrenia (90.1%) ($n = 11$)	• Phenomenological hermeneutic approach • Individual interviews
Gossage-Worrall[122] 2019, UK	To assess fidelity and quality of implementation. To clarify causal mechanisms and identify contextual factors associated with variation in outcomes	STEPWISE	Physical activity, diet	Schizophrenia (100%) ($n = 24$)	• Thematic analysis • Semistructured interviews
Heffner[123] 2018, USA	Qualitative exploration of challenges and facilitators of quitting in an intervention study for smokers with bipolar disorder to facilitate development of more effective interventions	ACT and NRT	Smoking	Bipolar disorder (100%) ($n = 10$)	• Content analysis • Semistructured interview

Study (first author, year of publication, country)	Aim	Intervention	Targeted risk behaviour(s)	Population (sample size)	Qualitative approach and data collection
Hodgson[124] 2011, UK	(1) To determine the perceived effects of physical activity participation on mental well-being, social well-being and physical well-being; (2) to identify the barriers to physical activity adoption and adherence; and (3) to identify enabling factors influencing adherence to the activity programme	Exercise-based interventions (football and activity programmes)	Physical activity	Severe and enduring mental illness (100%). ($n = 17$)	• Thematic analysis • Interviews
Huck[125] 2018, USA	(1) To explore the nature of physical activity-related programming within one ACT setting and (2) to gain consumer perspectives related to interventions that would be likely to facilitate greater levels of participation. In addition, the research team hoped to consider how, (3) existing health behaviour theory might relate to these findings in order to offer a better understanding of how existing health behaviour theory applies to this group	ACT physical activity intervention	Physical activity	Schizophrenia (90%) ($n = 18$)	• Consensual qualitative research conventions, and inductive methodology • Focus groups and semistructured interviews
Jimenez[126–128] 2015, 2016, 2019, USA	(1) Identify facilitators of and barriers to engaging in health behaviour change; (2) identify exercise preferences among Latino adults with SMI participating in a health promotion intervention; and (3) identify the role of SMI in motivation, participation and adoption of health behaviour change among overweight Latino adults	In SHAPE integrated health promotion programme	Physical activity, diet	SMI (100%) ($n = 20$)	• Thematic analysis • Semistructured interviews
Keller-Hamilton[129] 2020, USA	(1) A more complete picture of the reasons why people with schizophrenia or bipolar disorder smoke and (2) information for clinicians and public health practitioners to better tailor smoking cessation services to adults with SMI	None – considering barriers to smoking cessation	Smoking	SMI (100%) ($n = 24$)	• Theme analysis • Focus groups
Klein[130] 2019, Australia	To address these important issues of acceptability, feasibility and usefulness in an Australian context, in relation to tailoring the Kick.it app for SMI populations	Kick.it smoking cessation app	Smoking	Paranoid schizophrenia (75%) ($n = 12$)	• Thematic analysis • Semistructured interviews

TABLE 10 Characteristics of included qualitative studies for qualitative synthesis (*continued*)

Study (first author, year of publication, country)	Aim	Intervention	Targeted risk behaviour(s)	Population (sample size)	Qualitative approach and data collection
Knowles[131] 2016, UK	To qualitatively explore the experiences of service users who received the bespoke smoking cessation intervention, particularly in comparison to their experience of standard stop-smoking services and in the light of their mental health difficulties	Bespoke mental health smoking cessation	Smoking	SMI (100%) (*n* = 13)	• Constant comparison method • Semistructured interviews
Luciano[132] 2014, USA	(1) What is the subjective experience of maintaining sobriety for people with cooccurring psychosis and substance use disorder? (2) What behavioural strategies supported continued lifestyle change from these participants' points of view?	Residential co-occurring treatment disorder clinic	Alcohol, drug use	Schizoaffective disorder (33%), schizophrenia (17%), bipolar disorder (33%), generalised anxiety disorder (17%) (*n* = 12)	• Grounded theory approach • Semistructured interviews
Maisto[133] 1999, USA	To discover what experiences individuals with co-occurring SMI and substance use disorder perceive as more and less beneficial in changing their substance use patterns	Outpatient psychiatric clinic	Alcohol, drug use	Schizophrenia (100%) (*n* = 21)	• Theme analysis • Focus groups
Mason[134] 2012, UK	To understand service users', referrers' and professional coaches' views of the project's positive and negative implications for mental and physical health, quality of life and social and community relationships	Coping through Football	Physical activity	Psychotic and/or depressive disorders (*n* = 12)	• Thematic analysis with grounded theory • Interviews
O'Hara[135] 2017, USA	To describe how 'group lifestyle balance' was adapted to fit the needs of people with SMI living in supportive housing	Peer-based group lifestyle balance	Physical activity, diet	Schizophrenia or schizoaffective disorder (50%), major depression (57%), bipolar disorder (57%) (*n* = 14)	• Content analysis • Focus groups
Oddie[136] 2009, UK	To gain a deeper understanding of participants' expectations, and of the acceptability and perceived benefits of the programme	Substance misuse programme	Alcohol, drug use	Predominantly paranoid schizophrenia, patients at medium-secure forensic mental health unit (*n* = 23)	• Thematic analysis • Semistructured interviews

Study (first author, year of publication, country)	Aim	Intervention	Targeted risk behaviour(s)	Population (sample size)	Qualitative approach and data collection
Olmos-Ochoa[137] 2019, USA	(1) To examine the effect of treatment condition (web or in person) on barriers to healthy eating and physical activity over time, (2) to examine the association between anticipated baseline barriers and patient engagement in their respective interventions, and (3) to determine whether or not patient engagement in treatment affected perceived barriers over the course of treatment	Web-based/in-person weight management	Physical activity, diet	Schizophrenia, schizoaffective disorder, bipolar disorder, recurrent major depressive disorder with psychosis, or chronic post-traumatic stress disorder ($n = 48$)	• Thematic analysis • Interviews
Penn[138] 2016, USA	To uncover themes that are important to the clients and counsellors, including ideas and concerns that we had not considered or been aware of	12-step recovery/ SMART recovery programme	Alcohol	Serious mental illness ($n = 12$)	• Content analysis • Focus groups
Roberts[139] 2013, UK	To explore incentives and barriers to engaging people with SMI in an educational lifestyle programme to gain important insights into the ways service users experience these interventions	Lifestyle intervention	Other: weight	Schizophrenia (86%), personality disorder (14%) ($n = 8$)	• Ethnography with thematic analysis • Observation and interviews
Rönngren[141] 2014, Sweden	(1) To explore the experiences of physical activity and eating habits of psychiatric clients by interviewing the Local Reference Group, community mental health-care users and community mental health-care workers. (2) To describe the development of a lifestyle programme for people with SMI based on information obtained from the interviews	LIFEHOPE.EU	Physical activity, diet	SMI ($n = $ NR)	• Content analysis • Focus groups
Rönngren[140] 2018, Sweden	To describe the acceptability of the lifestyle programme at a community mental health service group and to get information about the tools used for assessment of functional exercise capacity, cognitive performance, and self-reported health-related quality of life	Lifestyle programme	Physical activity, diet	SMI ($n = 13$)	• Content analysis • Focus groups
Thornton[142] 2011, Australia	To fill gaps in our knowledge by examining exposure, acceptability and attitudes regarding antismoking campaigns and tobacco knowledge among people with psychotic disorders	Public health antismoking campaigns	Smoking	Psychotic disorders ($n = 8$)	• Interpretative phenomenological analysis • Interviews

continued

TABLE 10 Characteristics of included qualitative studies for qualitative synthesis (*continued*)

Study (first author, year of publication, country)	Aim	Intervention	Targeted risk behaviour(s)	Population (sample size)	Qualitative approach and data collection
Verhaeghe[143] 2013, Belgium	To examine the factors influencing the integration of physical activity and healthy eating into the daily care of individuals with mental disorders living in sheltered housing and to gain insight into the relationships and complexities of these factors	Health promotion	Other: health promotion	Schizophrenia, schizoaffective disorders, bipolar and depressive disorders in sheltered housing ($n = 15$)	• Content analysis • Semistructured focus groups and interviews
Wärdig[144] 2015, Sweden	To describe how persons with psychosis perceive participation in a lifestyle intervention and to use these perceptions to present factors for consideration in future interventions	Lifestyle intervention	Physical activity, diet, alcohol, smoking	Psychosis (100%) in psychiatric outpatient care ($n = 40$)	• Phenomenography • Semistructured interviews
Watkins[145] 2020, Australia	To explore the personal experiences of the Keeping the Body in Mind programme participants, in particular the aspects of the programme that they perceived to be helpful in achieving physical health and other improvements	Keeping the Body in Mind lifestyle intervention	Physical activity, diet	First-episode psychosis (100%) ($n = 16$)	• Thematic analysis • Semistructured interviews
Weinstein[146] 2019, USA	To investigate social and structural factors that affect weight loss in partnership with community co-researchers enrolled in a group lifestyle programme for overweight/obese people with serious mental illness living in supportive housing settings	Group lifestyle programme	Physical activity, diet	SMI in supportive housing ($n = 8$)	• Thematic analysis • Photovoice
Yarborough[147] 2016, USA	To identify modifiable factors associated with making and maintaining healthy lifestyle changes in order to inform clinicians and improve the development of future interventions for individuals with serious mental illnesses	STRIDE lifestyle intervention	Physical activity, diet	Schizophrenia or schizoaffective disorder (41%), bipolar disorder (20%), affective psychosis (37%), post-traumatic stress disorder (2%) ($n = 84$)	• Thematic analysis • Interviews

ACT, acceptance and commitment therapy; NR, not reported; NRT, nicotine replacement therapy; SMART, self-management and recovery training; STEPWISE, STructured lifestyle Education for People WIth SchizophrEnia.

Appendix 7 Network diagrams

Total physical activity
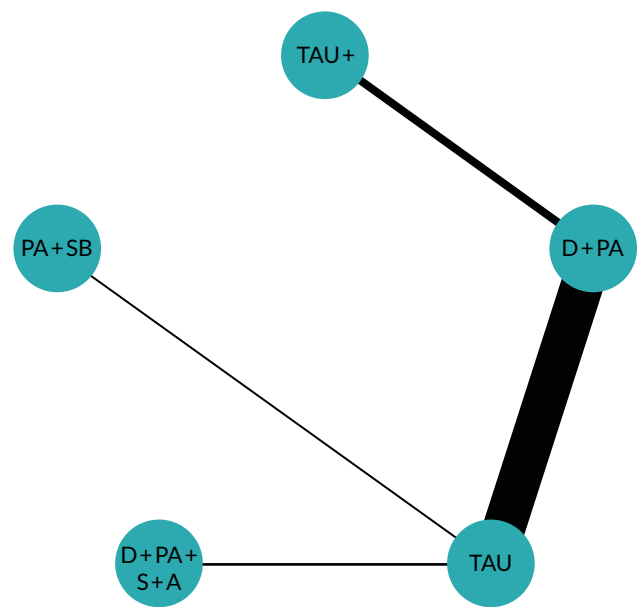
FIGURE 9 Network diagram illustrating risk behaviours targeted in studies reporting total PA (thickness of edge is weighted by sample size). A, alcohol use; D, diet; PA, physical activity; S, smoking; SB, sedentary behaviour.
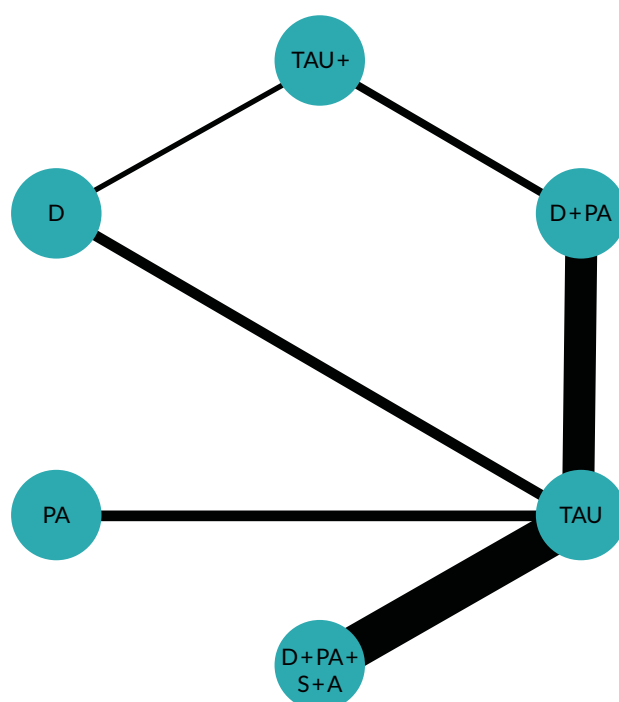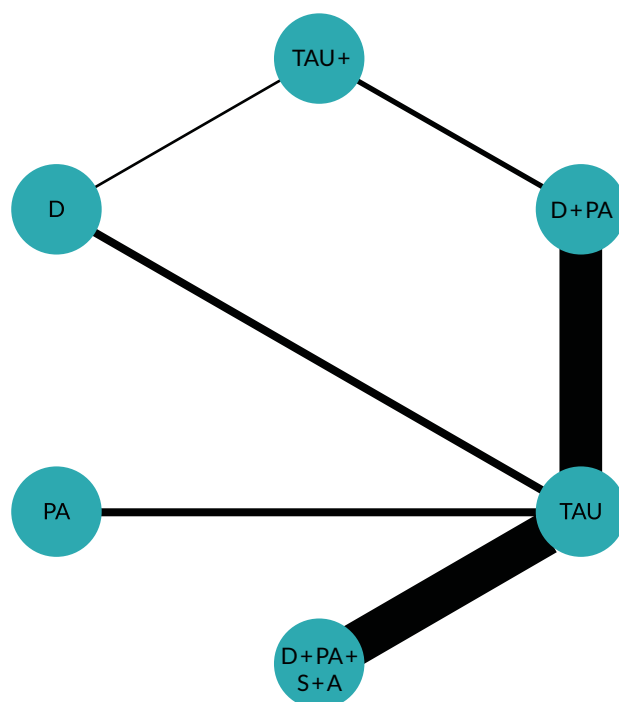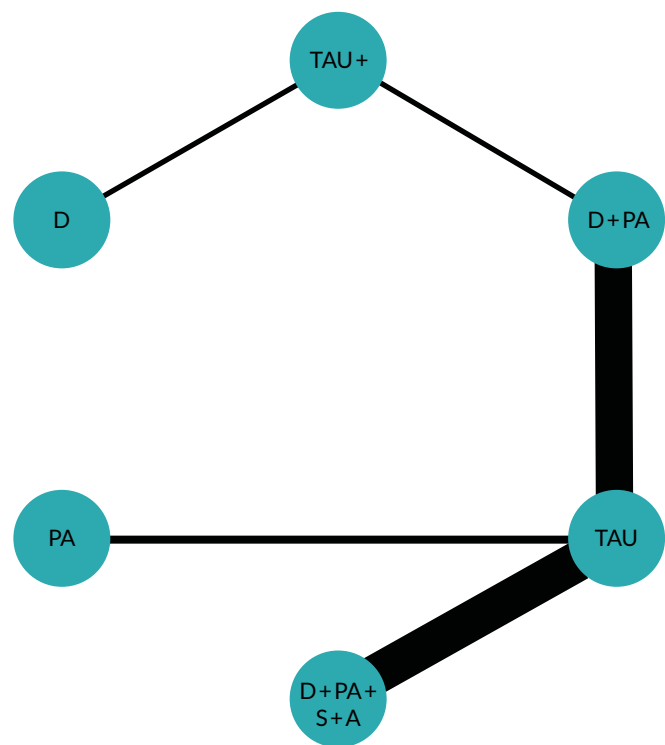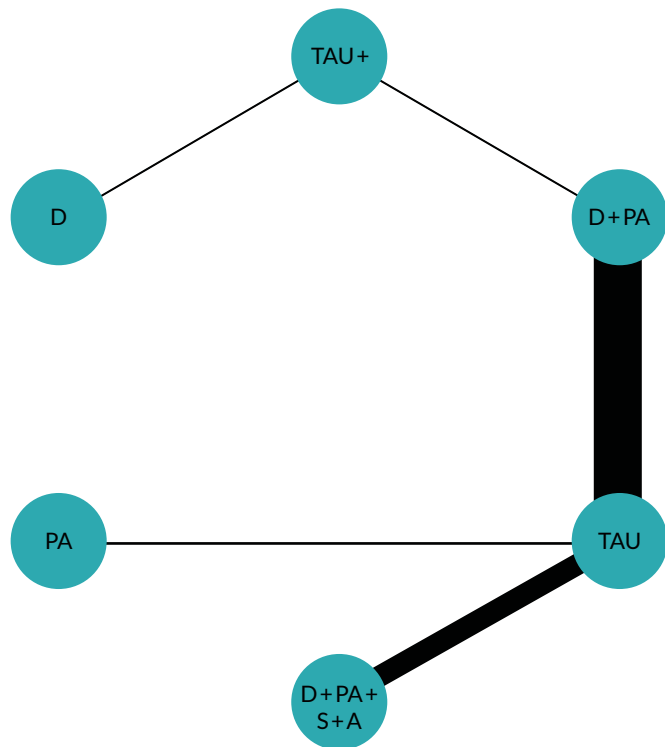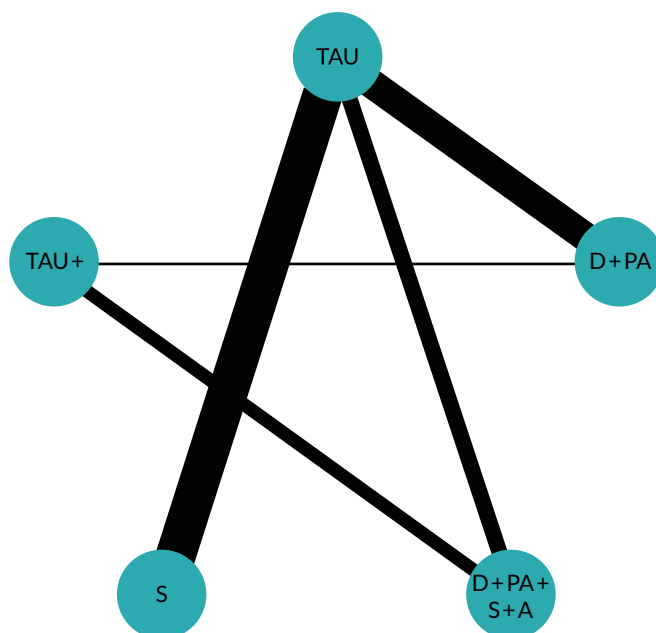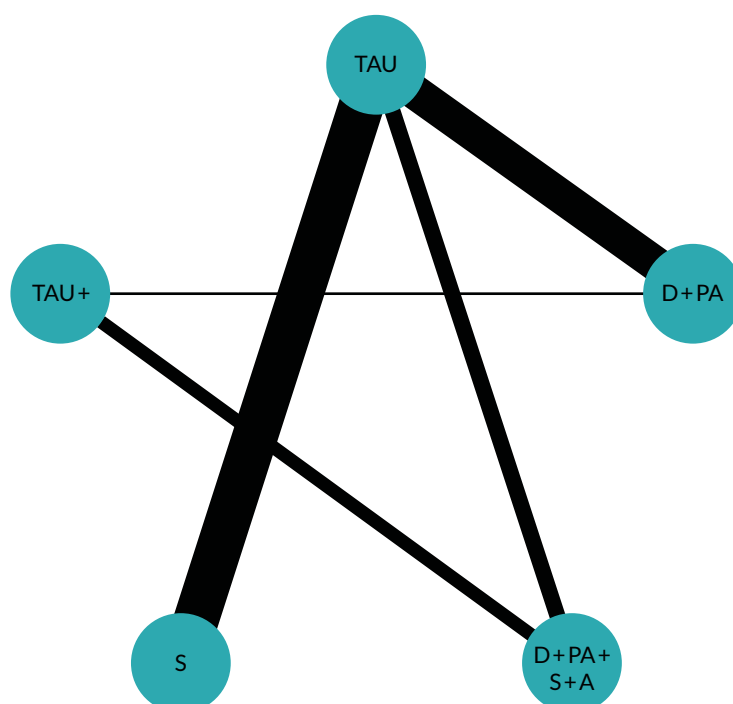
Alcohol use
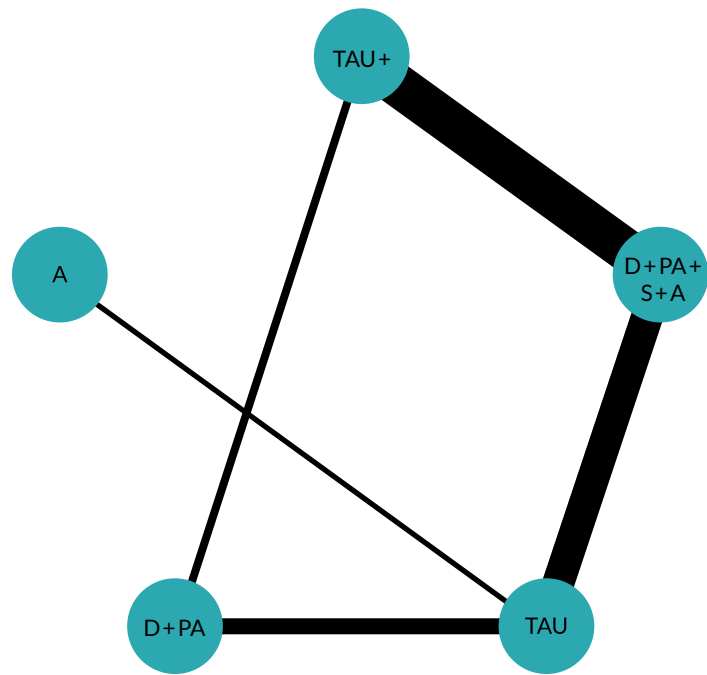
FIGURE 10 Network diagram illustrating risk behaviours targeted in studies reporting alcohol use (thickness of edge is weighted by sample size). A, alcohol use; D, diet; PA, physical activity; S, smoking.

Cannabis use
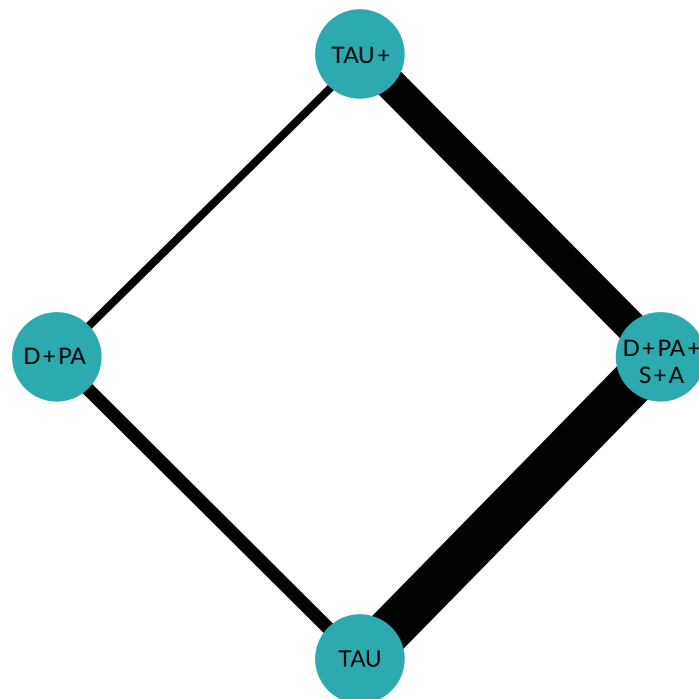
FIGURE 11 Network diagram illustrating risk behaviours targeted in studies reporting cannabis use (thickness of edge is weighted by sample size). A, alcohol use; D, diet; PA, physical activity; S, smoking.

Weight
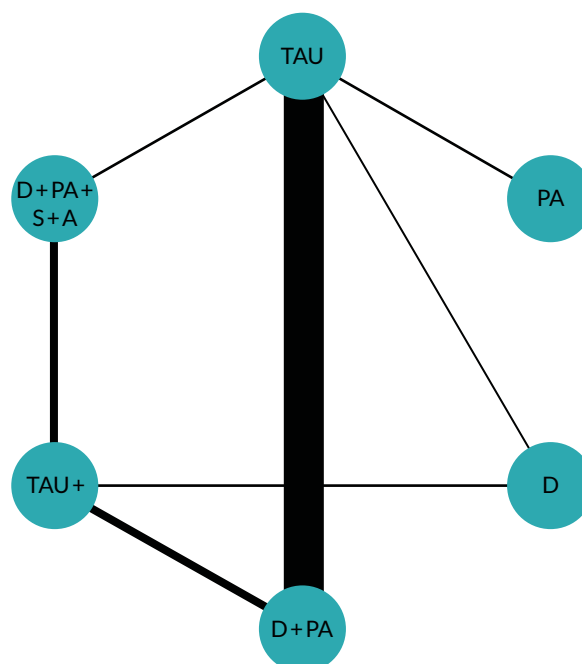
FIGURE 12 Network diagram illustrating risk behaviours targeted in studies reporting weight loss (thickness of edge is weighted by sample size). A, alcohol use; D, diet; PA, physical activity; S, smoking.

Body mass index
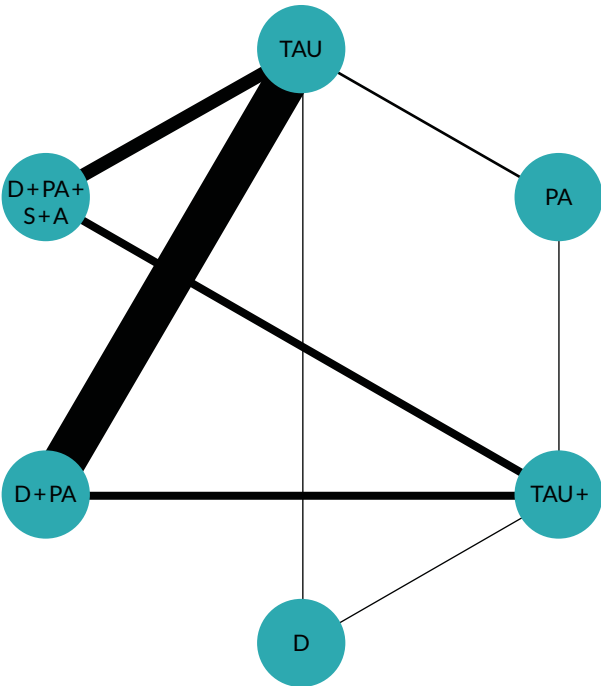
FIGURE 13 Network diagram illustrating risk behaviours targeted in targeted in studies reporting BMI (thickness of edge is weighted by sample size). A, alcohol use; D, diet; PA, physical activity; S, smoking.

Systolic blood pressure
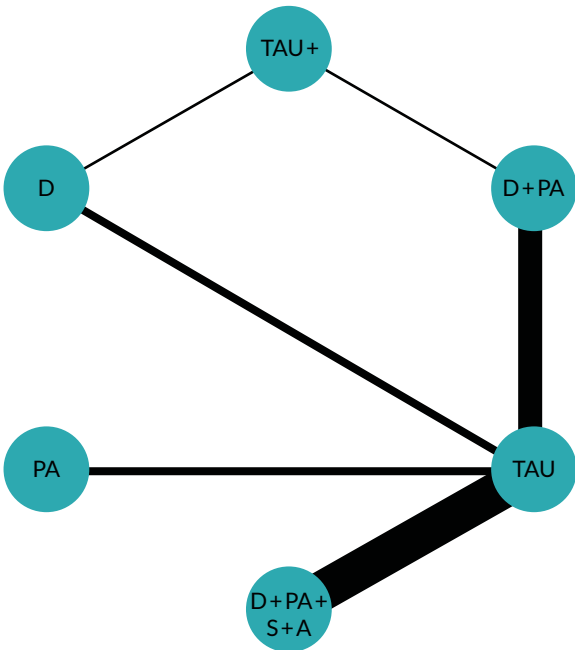
FIGURE 14 Network diagram illustrating risk behaviours targeted in studies reporting systolic blood pressure (thickness of edge is weighted by sample size). A, alcohol use; D, diet; PA, physical activity; S, smoking.

Diastolic blood pressure

FIGURE 15 Network diagram illustrating risk behaviours targeted in studies reporting diastolic blood pressure (thickness of edge is weighted by sample size). A, alcohol use; D, diet; PA, physical activity; S, smoking.

High-density lipoprotein cholesterol

FIGURE 16 Network diagram illustrating risk behaviours targeted in studies reporting HDL cholesterol (thickness of edge is weighted by sample size). A, alcohol use; D, diet; PA, physical activity; S, smoking.

Low-density lipoprotein cholesterol

FIGURE 17 Network diagram illustrating risk behaviours targeted in studies reporting LDL cholesterol (thickness of edge is weighted by sample size). A, alcohol use; D, diet; PA, physical activity; S, smoking.

Total cholesterol

FIGURE 18 Network diagram illustrating risk behaviours targeted in studies reporting total cholesterol (thickness of edge is weighted by sample size). A, alcohol use; D, diet; PA, physical activity; S, smoking.

Quality of life: mental health

FIGURE 19 Network diagram illustrating risk behaviours targeted in studies reporting mental health-related quality of life (thickness of edge is weighted by sample size). A, alcohol use; D, diet; PA, physical activity; S, smoking.

Quality of life: physical health

FIGURE 20 Network diagram illustrating risk behaviours targeted in studies reporting physical health-related quality of life (thickness of edge is weighted by sample size). A, alcohol use; D, diet; PA, physical activity; S, smoking.

Appendix 8 The GRADE–CERQual evidence profiles

TABLE 11 The CERQual evidence profiles assessing certainty of evidence for each subtheme of the qualitative data

Summary of review finding	Studies contributing to the review finding	Confidence in evidence based on CERQual assessment	Explanation of CERQual assessment
Interaction between physical and mental health			
Healthy behaviours improving mental health and well-being	- Firth 2016[119] - Forsberg 2011[121] - Heffner 2018[123] - Hodgson 2011[124] - Jimenez 2016[127] - Knowles 2016[131] - Luciano 2014[132] - Maisto 1999[133] - Mason 2012[134] - Verhaeghe 2013[143] - Watkins 2020[145] - Yarborough 2016[147]	High confidence	- Methodological limitations: very minor concerns - Coherence: very minor concerns - Adequacy: very minor concerns - Relevance: minor concerns
Being considered more holistically	- Bauer 2018[117] - Forsberg 2011[121] - Gossage-Worrall 2019[122] - Luciano 2014[132] - Penn 2016[138] - Yarborough 2016[147]	Moderate confidence	- Methodological limitations: minor concerns - Coherence: minor concerns - Adequacy: minor concerns - Relevance: moderate concerns
Self-medicating	- Firth 2016[119] - Heffner 2018[123] - Keller-Hamilton 2019[129] - Klein 2019[130] - Knowles 2016[131] - Maisto 1999[133] - Thornton 2011[142]	High confidence	- Methodological limitations: very minor concerns - Coherence: very minor concerns - Adequacy: very minor concerns - Relevance: minor concerns
Motivational contexts for change			
Individual factors	- Keller-Hamilton 2019[129] - Firth 2016[119] - Forsberg 2011[121] - Heffner 2018[123] - Huck 2018[125] - Jimenez 2015[126] and 2016[127] - Knowles 2016[131] - Maisto 1999[133] - Rönngren 2018[140] - Thornton 2011[142] - Yarborough 2016[147]	Moderate confidence	- Methodological limitations: minor concerns - Coherence: minor concerns - Adequacy: minor concerns - Relevance: moderate concerns

TABLE 11 The CERQual evidence profiles assessing certainty of evidence for each subtheme of the qualitative data (*continued*)

Summary of review finding	Studies contributing to the review finding	Confidence in evidence based on CERQual assessment	Explanation of CERQual assessment
Social factors	• Gossage-Worrall 2019[122] • Klein 2019[130] • Watkins 2020[145] • Aschbrenner 2013[116] • Carless 2008[118] • Firth 2016[119] • Fogarty 2005[120] • Heffner 2018[123] • Hodgson 2011[124] • Huck 2018[125] • Jimenez 2015[126] • Knowles 2016[131] • Luciano 2014[132] • Maisto 1999[133] • Mason 2012[134] • Rönngren 2014[141] • Verhaeghe 2013[143] • Wärdig 2015[144] • Yarborough 2016[147]	High confidence	• Methodological limitations: minor concerns • Coherence: very minor concerns • Adequacy: very minor concerns • Relevance: very minor concerns
Environmental factors	• Gossage-Worrall 2019[122] • Jimenez 2015[126] and 2019[128] • Klein 2019[130] • Olmos-Ochoa 2019[137] • Watkins 2020[145] • Weinstein 2019[146] • Aschbrenner 2013[116] • Firth 2016[119] • Fogarty 2005[120] • Forsberg 2011[121] • Heffner 2018[123] • Huck 2018[125] • Knowles 2016[131] • Luciano 2014[132] • Maisto 1999[133] • Penn 2016[138] • Roberts 2013[139] • Yarborough 2016[147]	Moderate confidence	• Methodological limitations: minor concerns • Coherence: minor concerns • Adequacy: very minor concerns • Relevance: moderate concerns
Barriers to behaviour change			
Individual factors	• Jimenez 2019[128] • Keller-Hamilton 2019[129] • Klein 2019[130] • Olmos-Ochoa 2019[137] • Weinstein 2019[146] • Aschbrenner 2013[116] • Carless 2008[118] • Firth 2016[119] • Forsberg 2011[121] • Heffner 2018[123] • Hodgson 2011[124] • Luciano 2014[132] • Maisto 1999[133] • Penn 2016[138] • Roberts 2013[139] • Thornton 2011[142] • Verhaeghe 2013[143]	High confidence	• Methodological limitations: very minor concerns • Coherence: very minor concerns • Adequacy: very minor concerns • Relevance: minor concerns

TABLE 11 The CERQual evidence profiles assessing certainty of evidence for each subtheme of the qualitative data (*continued*)

Summary of review finding	Studies contributing to the review finding	Confidence in evidence based on CERQual assessment	Explanation of CERQual assessment
	• Wardig 2015[144] • Yarborough 2016[147] • Gossage-Worrall 2019[122]		
Social factors	• Keller-Hamilton 2019[129] • Klein 2019[130] • Olmos-Ochoa 2019[137] • Aschbrenner 2013[116] • Heffner 2018[123] • Hodgson 2011[124] • Jimenez 2015[126] • Maisto 1999[133] • Mason 2012[134] • Ronngren 2014[141] • Yarborough 2016[147]	Moderate confidence	• Methodological limitations: minor concerns • Coherence: moderate concerns • Adequacy: minor concerns • Relevance: moderate concerns
Environmental factors	• Oddie 2009[136] • Gossage-Worrall 2019[122] • Jimenez 2015[126] and 2019[128] • Keller-Hamilton 2019[129] • Olmos-Ochoa 2019[137] • Weinstein 2019[146] • Heffner 2018[123] • Hodgson 2011[124] • Huck 2018[125] • Knowles 2016[131] • Maisto 1999[133] • Roberts 2013[139] • Thornton 2011[142] • Verhaeghe 2013[143] • Yarborough 2016[147]		• Methodological limitations: moderate concerns • Coherence: moderate concerns • Adequacy: minor concerns • Relevance: moderate concerns
Experiences of behaviour change interventions and success			
Tailoring interventions to SMI populations	• Gossage-Worrall 2019[122] • Klein 2019[130] • Olmos-Ochoa 2019[137] • Watkins 2020[145] • Forsberg 2011[121] • Jimenez 2016[127] • Knowles 2016[131] • Luciano 2014[132] • Maisto 1999[133] • Mason 2012[134] • O'Hara 2017[135] • Penn 2016[138] • Yarborough 2016[147]	Moderate confidence	• Methodological limitations: very minor concerns • Coherence: moderate concerns • Adequacy: minor concerns • Relevance: moderate concerns
Knowledge and skills to enact behaviour change	• Klein 2019[130] • Olmos-Ochoa 2019[137] • Watkins 2020[145] • Weinstein 2019[146] • Firth 2016[119] • Fogarty 2005[120] • Heffner 2018[123] • Hodgson 2011[124]	Moderate confidence	• Methodological limitations: very minor concerns • Coherence: minor concerns • Adequacy: minor concerns

TABLE 11 The CERQual evidence profiles assessing certainty of evidence for each subtheme of the qualitative data (*continued*)

Summary of review finding	Studies contributing to the review finding	Confidence in evidence based on CERQual assessment	Explanation of CERQual assessment
	• Huck 2018[125] • Jimenez 2015[126] • Luciano 2014[132] • Maisto 1999[133] • Penn 2016[138] • Ronngren 2014[141] • Ronngren 2018[140] • Thornton 2011[142] • Wardig 2015[144] • Yarborough 2016[147]		• Relevance: moderate concerns
Group delivery formats	• Gossage-Worrall 2019[122] • Watkins 2020[145] • Carless 2008[118] • Firth 2016[119] • Hodgson 2011[124] • Huck 2018[125] • Luciano 2014[132] • Maisto 1999[133] • Mason 2012[134] • O'Hara 2017[135] • Roberts 2013[139] • Ronngren 2018[140] • Wardig 2015[144] • Yarborough 2016[147]	Moderate confidence	• Methodological limitations: very minor concerns • Coherence: minor concerns • Adequacy: very minor concerns • Relevance: moderate concerns
Choices and adapting interventions to suit the individual	• Klein 2019[130] • Watkins 2020[145] • Weinstein 2019[146] • Firth 2016[119] • Forsberg 2011[121] • Hodgson 2011[124] • Jimenez 2015[126] • Penn 2016[138] • Roberts 2013[139] • Wardig 2015[144] • Yarborough 2016[147]	Moderate confidence	• Methodological limitations: very minor concerns • Coherence: minor concerns • Adequacy: minor concerns • Relevance: minor concerns
Purpose to activity	• Watkins 2020[145] • Carless 2008[118] • Huck 2018[125] • Luciano 2014[132] • Maisto 1999[133] • Mason 2012[134]	Moderate confidence	• Methodological limitations: minor concerns • Coherence: minor concerns • Adequacy: minor concerns • Relevance: moderate concerns
Valued benefits of behaviour change interventions	• Watkins 2020[145] • Carless 2008[118] • Firth 2016[119] • Fogarty 2005[120] • Heffner 2018[123] • Hodgson 2011[124] • Jimenez 2016[127] • Luciano 2014[132] • Maisto 1999[133] • Mason 2012[134] • Penn 2016[138] • Ronngren 2018[140] • Wardig 2015[144] • Yarborough 2016[147]	Moderate confidence	• Methodological limitations: minor concerns • Coherence: minor concerns • Adequacy: minor concerns • Relevance: moderate concerns

EME
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