The effectiveness of peer-supported interventions for encouraging dietary behaviour change in adults: a systematic review

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Abstract

Objective: There is an urgent need to find effective methods of supporting individuals to make dietary behaviour changes. Peer supported interventions (PSI) have been suggested as a cost-effective strategy to support chronic disease self-management. However, the effect of PSI on dietary behaviour is unclear. This systematic review aimed to assess the effectiveness of PSI for encouraging dietary behaviour change in adults and consider intervention characteristics linked with effectiveness.

Design: Electronic databases were searched until June 2018 for randomised controlled trials assessing the effectiveness of PSI in comparison with an alternative intervention and/or control on a dietary related outcome in adults. Following a title and abstract screen, two reviewers independently screened full texts and data were extracted by one reviewer and independently checked by another. Results were synthesised narratively.

Setting: Randomised controlled trials

Subjects: Adult studies

Results: The fifty four included studies varied in participants, intervention details and results. More PSI reported a positive or mixed effect on diet than no effect. Most interventions used a group model and were lay-led by peer supporters. Several studies did not report intervention intensity, fidelity and peer training and support in detail. Studies reporting positive effects employed more Behaviour Change Techniques (BCT) than studies reporting no effect, however heterogeneity between studies was considerable.

Conclusion: As evidence was mixed, further interventions need to assess the effect of PSI on dietary behaviour and describe intervention content (theoretical basis, BCTs, intensity and peer training/ support) and include a detailed process evaluation. (PROSPERO:CRD42014009994).

Keywords: Peer-supported intervention, diet, dietary behaviour change, systematic review

Introduction

Strong evidence suggests that consumption of a healthy diet can reduce chronic disease risk[1] but there is an urgent need to find effective methods of supporting individuals to make and sustain healthy dietary behaviour change. Lifestyle interventions encouraging dietary behaviour change are often intensive and expensive to roll out through healthcare systems. Hence, there is increasing interest in the use of peer-supported interventions (PSI), as a potential flexible, cost-effective and more scalable strategy for improving health behaviours[2]. PSI have been shown to be an effective

strategy for supporting self-management of chronic diseases, such as diabetes[3, 4], and improvement of health behaviours, including physical activity [5,6], however, the effect of PSI on dietary behaviour change is not yet clear.

Findings from intervention studies are inconsistent, largely owing to heterogeneity between studies in terms of populations studied, PSI models and delivery[7]. There is no widely accepted definition of a PSI, which has led to broad interpretations of its meaning. PSI are typically delivered by lay individuals or Community Health Workers (CHWs), as opposed to health professionals, and these individuals may assume different roles, including a peer supporter, peer educator, peer counsellor, peer facilitator or peer case manager[8]. PSI can be delivered via different models, including group, dyadic or a combination and via face to face, telephone, or web. A recent systematic review suggested that a dyadic PSI model may be more effective in encouraging behaviour change than a group-based model or a combination of dyadic and group based support[8]. Current literature, however, does not clearly describe an optimal PSI model, peer role or the attributes, skills and training and support requirements needed to effectively undertake a peer role, and there is limited information on measurement of fidelity of PSI delivery. While optimal PSI durations have been suggested for improving chronic disease self-management[4] and physical activity [6], the duration of PSI needed to effectively encourage dietary behaviour change is not known. PSI to improve health behaviour have included various population groups[8], however, it is not clear if PSI may be more effective in encouraging behaviour change among specific groups within the adult population. Additionally, previous research has not considered the impact of behaviour change theory/ techniques used on PSI effectiveness [5, 8]. Behaviour change theory and techniques are a key element of behaviour change interventions and it has been demonstrated that theories and techniques used, could impact the effectiveness of behaviour change interventions[9]. Information on these PSI characteristics is therefore needed to guide the development of PSIs targeting dietary behaviour change for public health.

Previous systematic reviews have examined the effect of PSI on health behaviours[5, 8] but, to our knowledge, none have focused on dietary behaviour change in the general adult population. An evaluation of existing evidence is required to determine the effectiveness of PSI for encouraging dietary behaviour change in adults, which in turn will help to inform the design of future studies, and eventual public health policy and practice. Therefore, this systematic review aims to examine randomised controlled trials (RCTs) that measure the effectiveness of PSI on dietary outcomes in adults, in comparison with other types of intervention and/or a control and to consider intervention characteristics that may be linked with effectiveness including PSI model used, peer role, peer

attributes, behaviour change theory/ techniques used, intervention duration and intensity and population studied.

Methods

The review protocol is registered on PROSPERO (www.crd.york.ac.uk/PROSPERO/), (ID no. CRD42014009994). Subsequent to protocol registration, it was decided to include all types of PSI rather than peer support alone to enable comparison of effectiveness of interventions by peer role. PSIs were described according to definitions provided in a recently conducted review[8]. This section reports the review protocol according to PRISMA guidelines[10].

Search strategy

A search strategy was devised considering key search terms used in previous PSI or dietary related reviews. A structured search using the devised strategy was then conducted in five electronic databases MEDLINE, EMBASE, PSYC-INFO, CINAHL and the COCHRANE library. Databases were searched from inception until 14th June 2018. The search strategy consisted of subject headings and keyword terms relating to PSI and were combined with terms relating to dietary behaviour change. The search strategy developed in MEDLINE is presented as an example (Supplementary material, Table S1). This strategy was tailored for other databases. Searches were limited to those published in English language, human studies and adult studies in all databases where possible. Applying an age limit can lead to loss of studies that are not yet coded in the database by age. To assess the impact of this limit, the search was limited for each age limit in each database and ran selecting to 'not' include these limits, leaving studies not coded by age. A significant number of studies were not coded by age in EMBASE, therefore, the search was re-run in this database without limiting for age.

Studies obtained were screened for suitability for inclusion in the review using the following inclusion and exclusion criteria which was defined *a priori*.

Inclusion criteria:

- Adult subjects
- Assessed effectiveness of a PSI on dietary behaviour change in comparison with other interventions and/or a control.

- Dietary or weight related primary or secondary outcome. Dietary outcomes: any measurement of diet such as estimated intake, change in intake of energy, nutrients or food groups or biomarker data. Weight related outcomes: weight, body mass index (BMI), waist circumference (WC) and waist to hip ratio (WHR). While weight related outcomes are an indirect indication of dietary behaviour, few RCTs have assessed dietary behaviour change outcomes, so inclusion of anthropometric measures provided useful additional information.
- RCT design to determine whether a cause-effect relationship between PSI and dietary or weight related outcomes exist. This study design was selected as it is the gold standard method for assessing the effect of interventions. Other study designs such as quasi-experimental studies were excluded as due to lack of randomisation, systematic differences between intervention groups are not eliminated at the outset which weakens the ability to determine causality.
- As the length of time needed to establish dietary behaviour change is not clear, interventions of all durations and lengths of follow up were included.

Exclusion criteria:

- Studies targeting pregnant women, eating disorders or malnutrition
- Studies considering multiple behaviours where the effects of the intervention on diet could not be determined
- Multi-component interventions where the effects of the PSI could not be determined
- Studies where it was unclear if the intervention was peer-led
- Interventions that included a peer-led component but were primarily professionally led
- Web interventions that did not have an interactive/ tailored component

Initially, titles of studies were removed where it was clear that they would not be relevant for inclusion. Abstracts of potentially relevant titles were then obtained and screened. This process was conducted by the principal reviewer, due to the large volume of studies obtained. Full texts of potentially relevant abstracts were then obtained and were all screened independently by two researchers, with discrepancies resolved through discussion.

Data extraction

Data extraction was undertaken by the principal reviewer using a data extraction form, which was developed for the review and pilot tested on a small sample of studies (n=5) to ensure the desired data

was captured. Data extraction was independently checked by another reviewer, with discrepancies between reviewers being resolved through discussion. Extracted data included participation details (number in analysis, gender, age, geographical region and characteristics), intervention details (intervention groups and outcome measure) and PSI details (content, Behaviour Change Techniques (BCTs) and theoretical framework used, model, peer, peer role, peer training and support, fidelity of PSI delivery and duration/ intensity) and results (effect of PSI versus other intervention and/or control). BCTs are strategies used to facilitate behaviour change and are therefore key components of dietary behaviour change interventions. BCTs used in each PSI were extracted to provide insight into intervention characteristics associated with effectiveness of PSI to encourage dietary behaviour change. BCTs were identified using a 40-item taxonomy of BCTs to aid dietary behaviour change[11]. BCTs used by both the experimental intervention and the comparison intervention were not included. To enable comparison of studies, PSI details, including intensity, model and peer roles were extracted and categorised as suggested by a recent review of peer-led interventions[8]. As a measure of PSI intensity, it was recorded if the PSI was (i) a single intervention, (ii) an intervention with multiple time points, or (iii) an on-going intervention. PSI models were recorded as group, dyadic or hybrid (group and dyadic) and peer roles were defined as one or more of the following: peer case manager (helps individuals access or coordinate health and social services including referral to resources, or managing intervention activities); peer counsellor (provides knowledge, guidance and tools to help individuals set and reach their health goals); peer educator (delivers formal education utilising a protocolled curriculum and approach); peer facilitator (facilitates group interactions to create or strengthen relationships to help individuals set and reach goals together; and peer support (informal, unstructured support such as providing reminders, encouragement or reinforcement, informal coaching, and sharing personal experiences or narrative)[8].

Additionally, risk of bias was assessed at the study level by the principal reviewer to aid with interpretation of the strength of findings. The JADAD scale[12], was used, a widely used quality assessment tool due to its simplicity, reliability and validity. The scale assesses randomisation, blinding and participant follow up. Five points were awarded if, (i) the study was described as randomised, (ii) the method used to generate the sequence of randomisation was described and appropriate, (iii) the method of double blinding was described, (iv) the method of double blinding was appropriate, and (v) the number of and reasons for withdrawals were stated. Based on the JADAD score range obtained, methodological quality was categorised as low (0-1 points), moderate (2 points) or high (3-5 points).

Data synthesis

Due to the heterogeneity of included studies, a narrative synthesis of results was undertaken[13]. A descriptive overview is provided of included studies, which includes information extracted on participation details, intervention details and PSI details. Findings were synthesised on the effect of PSI on dietary behaviour change outcomes, specifically, if PSI were more effective than alternative methods of support. This was synthesised for all studies and then by type of dietary outcome measure used (dietary or anthropometric). Relationships in the data were explored through looking at the effect of PSI characteristics on dietary behaviour change including PSI model used, peer type/ role used, behaviour change theory/ techniques used, PSI duration/ intensity and population studied. Specifically, this was done through comparison of these characteristics in studies reporting that PSI were more effective than alternative methods, or reporting mixed results, with studies that found no significant difference between PSI and control groups. This was explored initially in all studies and then by type of dietary outcome used. To help ensure a robust analysis was conducted, the methodological quality of included studies were assessed[12] and the results of high quality studies on the effect of PSI on dietary behaviour change outcome(s) were compared with the overall results from all studies on the effect of PSI on dietary behaviour change outcome(s) to confirm that they were consistent.

Results

Effect of PSI on dietary behaviour change

A total of 54 studies were included within the review[14-67] (**Figure 1**). The effect of PSI on dietary behaviour change outcomes varied (**Table 1**). In comparison with alternative methods of support or a control, 15 studies (28%) reported that PSI were more effective for encouraging dietary behaviour change, 17 (31%) reported that there were no significant differences between methods, 6 (11%) reported mixed results within each dietary behaviour change outcome measured i.e. different results for different intervention groups/ time points and 16 (30%) reported mixed results between dietary behaviour change outcomes measured i.e. different results for different dietary outcome measures in studies measuring more than one dietary outcome measure. To consider these findings further, studies were categorised into subsets based on outcome(s) used. Outcomes included dietary pattern (n=11), fruit and vegetable intake (n=17), fat intake (n=18), intake of other nutrients/ foods (n=13), weight (n=27), BMI (n=23) and waist and hip measurements (n=18).

A total of 35 studies assessed the effect of PSI on dietary outcomes (**Table 2**). 11 studies assessed the effect of PSI on overall dietary pattern. Four (36%) of these studies used questionnaires to measure diet that were not validated for the study population. Just over half of the studies assessing dietary patterns reported that there was no significant difference between PSI and a control for improving diet (n=6; 55%). In total, 17 studies assessed the effect of PSI on fruit and vegetable intake. Most used validated measures of fruit and vegetable assessment including food diaries, Food Frequency Questionnaires (FFQ) and specific questions on diet. Five studies (29%) reported that PSI were more effective than alternative interventions and/or a control for improving fruit and vegetable intake. Ten studies (59%) reported no significant difference between PSI and alternative interventions and/or a control for improving fruit and vegetable intake. The remaining two studies (12%) reported mixed results. 18 studies examined the effect of PSI on fat intake. Most used validated measures including food diaries, FFQ, dietary recalls and specific questions on diet. Eight studies (44%) reported that PSI were more effective than a control for improving fat intake, eight studies (44%) found no significant difference between PSI and an alternative intervention and/or a control for improving fat intake and two studies (11%) reported mixed results. 13 studies assessed the effect of PSI on intake of other nutrients/foods, including energy, protein, carbohydrates, starch, fibre, sugar, sugar sweetened beverages, non-sugar sweetened beverages, salt and fast foods. Most studies used validated measures to assess intakes of these nutrients including food diaries, FFQ, dietary recalls and specific questions on diet. One study out of 13 (8%) reported that a PSI was more effective than a control for reducing salt intake. Eight studies out of 13 (62%) reported no significant difference in intake of various nutrients between PSI and alternative interventions and/or a control. The remaining four studies (31%) reported mixed results.

A total of 40 studies assessed the effect of PSI on anthropometric outcomes. Anthropometric data was objectively measured in these studies, however methods of obtaining measurements were only described in 18 (45%) of these studies. Studies often measured more than one anthropometric outcome, therefore results on the effect of PSI on these measurements are based on a number of the same studies. Of the 27 studies examining the effect of PSI on weight (**Table 3**), 12 studies (44%) reported that PSI were more effective than alternative interventions and/or a control for improving weight, ten studies (37%) reported no significant difference in weight between PSI and alternative interventions and/or a control and five studies (19%) reported mixed results. Of the 23 studies examining the effect of PSI on BMI, eight studies (35%) reported PSI were more effective than a control for improving BMI, 13 studies (57%) reported no significant difference in BMI between PSI and alternative interventions and/or a control and two studies (9%) reported mixed results. Of the 18 studies examining the effect of PSI on waist and hip measurements, seven studies (39%) reported

that PSI were more effective than a control for improving waist and hip measurements. 11 studies (61%) reported no significant difference in waist and hip measurements between PSI alternative interventions and/or a control. Studies measuring anthropometric outcomes that found positive effects of PSI were largely weight management interventions, whereas studies reporting no significant difference between PSI and alternative interventions and/or a control or mixed results were generally behaviour change interventions that include improving diet rather than explicit weight loss.

Effect of PSI characteristics on dietary behaviour change

As demonstrated in **Table 4**, included studies were published from 1987-2018. Studies compared a PSI to a control (n=42; 78%) or alternative support intervention and control (n=12; 22%). Key elements of PSI included: education, use of BCTs and provision of emotional support. The total number of participants included was 18,144, of which 8115 received a PSI. Numbers receiving the PSI in studies ranged from <10 to >1000. Most studies included both genders (n=42; 78%), but approximately one quarter of studies included females only (n=12; 22%). The mean age of participants reported ranged from 28 to 71 years and, where only range was reported, the youngest age was 21 and oldest was 70.

This section of the results presents PSI characteristics that were analysed to determine if they were linked with effectiveness in encouraging dietary behaviour change which include PSI model used, peer role, peer attributes, behaviour change theory/ techniques used, intervention duration and intensity and population studied (ethnicity and characteristics). Findings on peer role and attributes also include a description of peer training and support and measurement of fidelity of PSI delivery across studies.

PSI were highly heterogeneous. PSI models used included group (n=30; 56%), dyadic (n=10; 19%) and a hybrid of models (n=14; 26%). Group support was largely delivered face-face (n=22; 73%) or was delivered via teleconference (n=1; 3%) or was web-based (n=7; 23%). Dyadic support was delivered face-face (n=4; 40%), via telephone (n=1; 10%) or via face-face and/or telephone (n=5; 50%). There were no clear differences in PSI model between the 15 studies that reported PSI to be a more effective form of support versus the studies that reported no significant difference between support methods. Of studies using a group PSI (n=30), approximately one third reported positive effects of PSI (n=10; 33%), whereas of studies using a dyadic PSI (n=10), one fifth reported positive effects of PSI (n=2; 20%) and of studies using a hybrid PSI (n=14), approximately one fifth

reported positive effects of PSI (n=3; 21%). Of studies measuring the effect of PSI on dietary outcomes, there was no clear difference in PSI models used in studies that reported PSI to be a more effective form of support and studies reporting no significant difference between methods of support. Studies that reported PSI to be more effective for improving weight, BMI and waist measurements mostly used group based support, whereas studies that reported no significant difference in methods of support for anthropometric outcomes, used a range of PSI models.

In six studies, the PSI was delivered by study participants to one another. In the remaining 48 studies, the PSI was peer-led by lay individuals (n=30; 63%), CHWs (n=9; 19%), CHWs and health professionals (n=4; 8%) and lay individuals and health professionals (n=5; 10%). PSI were delivered via a commercial programme in a small number of studies (n=6; 11%). Peer roles included a peer supporter (n=24), peer educator (n=22), peer counsellor (n=22), peer facilitator (n=6) and peer case manager (n=5). Studies that reported PSI to be a more effective form of support (n=15; 28%) mostly used lay-led support (n=11; 73%), whereas studies reporting no significant difference between methods of support (n=17; 31%) used a range of individuals to deliver the PSI including lay individuals (n=8; 47%), other participants (n=3; 18%) CHWs (n=5; 29%) and a combination of CHWs and health professionals (n=1; 6%). There were no clear differences in peer role between the studies that reported PSI to be a more effective form of support versus the studies that reported no significant difference between support methods. Studies where the peer assumed the role of PCM (n=2; 4%) both reported no significant difference, whereas other peer roles were used in studies reporting PSI to be a more effective form of support and studies reporting no significant difference between support methods. Over half of studies that reported positive effects of PSI (n=15; 28%), involved the peer providing PS (n=9; 60%). It was apparent that a third of studies (n=2; 33%) that reported no significant difference in PSI for improving overall dietary pattern, used a PCM as the peer role. This peer role was not used in the five studies that reported that PSI were more effective than alternative methods of support for improving overall dietary pattern. Over one third of studies that reported that PSI were more effective than alternative methods for improving fat intake (n=3; 37.5%) included health professionals within the PSI delivery, whereas health professionals were not included in the eight studies that reported no significant difference in methods of support for improving fat intake. Half of studies that reported that PSI were more effective than alternative methods of support for improving weight (n=6; 50%) used PS as the peer role, whereas only one study reporting no significant difference in methods of support for improving weight (n=1; 10%), used this peer role. Most studies that reported that PSI were more effective for improving BMI were lay-led (n=6; 75%), whereas almost half of studies that reported no significant difference in methods of support for improving BMI, used a CHW (n=6; 46%). There

were no clear differences in peer roles and types of peer used between studies reporting positive effects of PSI and studies reporting no significant difference between methods of support for improving other dietary or anthropometric outcomes.

Of the 48 studies that were peer-led, just over half (n=33; 69%) reported that peers were trained to facilitate the intervention. Training programmes ranged in duration from three hours to a 36 hour programme delivered over nine weeks and frequently covered: programme delivery; peer role; group facilitation; behaviour change theory and techniques; adult learning; diet and nutrition principals, disease specific information; taking health assessments; population specific information; and supporting skills for supporting individuals such as having empathy and dealing with resistance. In two studies, programme activities were demonstrated via role play and, in a small number of studies, (n=5; 10%) individuals undertaking a peer role had the opportunity to practice programme delivery. Few studies (n=7; 15%) discussed provision of support to individuals undertaking a peer role, but this included: bi-weekly or monthly meetings with others undertaking a peer role to exchange experiences of delivering a PSI; working alongside an experienced, trained peer, bi-monthly supervisory meetings with a health professional and regular contact with researchers throughout the program to discuss challenges, answer questions and provide feedback.

Just over one third of studies (n=20; 37%) measured fidelity of the PSI delivery. Those that did measured it through:

- Observation, audio recording or a review of sessions to ensure the structured programme was being followed and performance criteria were being met
- Supervision of programme delivery by a health professional
- Notes on PSI sessions kept by individuals undertaking a peer role and contact records with participants
- Participant diaries of advice received during the intervention
- Records of contact between individuals undertaking a peer role and the researchers
- Focus groups/interviews with individuals undertaking a peer role, participants and the researchers about their experience of the intervention
- A participant questionnaire regarding the delivered intervention.

The theoretical basis of the PSI was stated in just over half of studies (n=28; 52%). The most commonly used theories in included studies were Social Cognitive Theory[68] (n=11; 39%), the Transtheoretical Model[69] (n=8; 29%) and Social Support Theory[70] (n=7; 25%), but it is not known

if different or any theories were used in studies where theory was not reported. A summary of BCTs used to encourage dietary behaviour change are shown in **Table 4**. The use of BCTs was clearly described in 25 studies (46%). It is therefore not known in some studies if techniques were used, or if further techniques to those reported were used. Of the 25 studies that clearly described BCTs, over one quarter of these studies (n=7; 28%) reported that the PSI was more effective than alternative interventions and/or a control for improving dietary behaviour change outcomes. These seven studies used a mean of six BCTs. The most frequently used BCTs were behavioural goal setting (used by n=5; 71%), prompting self-monitoring (used by n=4; 57%) and provision of feedback (used by n=4; 57%). The 18 remaining studies that clearly described BCTs reported mixed results (n=13; 52%) or no significant difference between the PSI and alternative interventions and/or a control (n=5; 20%). The five studies that reported no significant difference used a mean of three BCTs, with frequently incorporated techniques being planning for social support/ social change (n=3; 60%) and barrier identification/ problem solving (n=3; 60%). Studies that include behaviour change theory (n=28; 52%) report positive effects of PSI (n=7; 25%; no significant difference between methods of support (n=9; 32%) and mixed results (n=12; 43%). Similarly, studies that do not discuss inclusion of behaviour change theory (n=26; 48%) also report positive effects of PSI (n=8; 31%), no significant difference between methods of support (n=8; 31%) and mixed results (n=10; 38%). Considering the main behaviour change theories that were used in the 28 studies that discussed inclusion of behaviour change theory; Social Cognitive Theory[68] (n=11; 39%), the Transtheoretical Model[69] (n=8; 29%) and Social Support Theory[70] (n=7; 25%), there were no clear differences in PSI effectiveness with inclusion of each of these theories.

Intervention periods ranged from 6 weeks to 30 months. The duration of over half of the 15 studies reporting a positive effect of PSI were ≥ 1 year (n=9; 60%), whereas the duration of over half of the 17 studies that reported no significant difference between PSI and alternative methods of support and/or a control (n=11; 65%) was < 1 year. There were no obvious differences in study intensity between studies reporting a positive effect of PSI on dietary behaviour change and studies reporting no significant difference or mixed results.

Most studies took place in the USA (n=41; 76%). The remaining studies took place in China (n=2; 4%), the UK (n=2; 4%), Republic of Ireland (n=1; 2%), the Netherlands (n=1; 2%), Canada (n=1; 2%), Australia (n=1; 2%), India (n=1; 2%), Iran (n=1; 2%), South Africa (n=1; 2%), Mali (n=1; 2%), and one study (2%) took place across three locations (Australia, Germany and the UK). Of the 41 studies that reported participant ethnicity, the ethnicities most commonly included by studies were White Americans (n=10; 24%), African-Americans (n=8; 20%) and Hispanics (n=5; 12%).

Studies including a mostly Hispanic or White American population mostly reported mixed results. Of studies including a mostly African-American population, studies reported different findings on the effectiveness of PSI for improving dietary behaviour, four studies (50%) reported that the PSI was more effective than alternative methods of support, two reported mixed results (25%) and two reported no significant difference between methods of support (25%). A range of population groups were used across studies. The main population groups included individuals with T2DM (n=20; 37%) and overweight/ obese individuals (n=14; 26%). Considering the two main population groups included in the study, studies that included overweight/ obese individuals (n=14; 26%), all reported positive (n=5; 36%) or mixed effects of PSI (n=9; 64%) on dietary behaviour change outcomes. Studies that included individuals with T2DM (n=20; 37%) mainly reported no significant difference (n=11; 55%) or mixed results (n=6; 30%). Considering studies measuring the effect of PSI on fat intake, studies that reported no significant difference (n=8; 44%) largely included individuals with T2DM (n=5; 63%), whereas in studies that reported positive results (n=8; 44%), population groups varied. Studies that reported PSI to be more effective for improving weight (n=12; 44%) or that reported mixed results (n=5; 19%) mostly included overweight/ obese individuals (n=12; 71%), whereas half of studies that reported no significant difference between methods of support for improving weight (n=10; 37%) included a sample of individuals with T2DM (n=5; 50%). Studies that reported that PSI were more effective than a control for improving waist and hip measurements (n=7; 39%) largely included overweight/obese individuals (n=5; 71%), whereas studies that reported no significant difference (n=11; 61%) included various populations. There were no clear differences in populations included between studies reporting positive effects of PSI and studies reporting no significant difference between methods of support for improving other dietary or anthropometric outcomes.

Risk of bias

As shown in **Table 4**, over one third of included studies were classified as low (n=19; 35%) or moderate (n=21; 39%) methodological quality and approximately one quarter of studies were classified as high methodological quality (n=14; 26%). Half of included studies (n=27; 50%), described the method of randomisation and used an appropriate method (e.g. computer generated randomisation sequence). Double blinding was not reported by any studies as it is generally not feasible to blind participants in the delivery of PSI, however, in one web-based study, participants were blinded to randomisation and another study blinded participants to the study hypothesis. In a small number of studies outcome assessment was blinded (n=9; 17%) or the research team were blinded to randomisation (n=6; 11%). Less than half of included studies (n=22; 41%) recorded the

number of participants that withdrew from the study and the reasons that they withdrew. Studies that were classified as low methodological quality (n=19; 35%) did not describe the method of randomisation, use double blinding or record the number of participants that withdrew from the study and the reasons that they withdrew.

More studies classified as high methodological quality reported positive or mixed effects of PSI on dietary behaviour change outcomes (n=8; 57%) than reporting no significant difference between methods of support (n=6; 43%). This is consistent with overall results from all studies on the effect of PSI on dietary behaviour change.

Discussion

This review aimed to assess the effectiveness of PSI for encouraging dietary behaviour change in adults and consider intervention characteristics that might be linked with effectiveness. Findings were inconsistent and therefore do not provide clear evidence supporting the effect of PSI on dietary behaviour, whilst there is also insufficient evidence to make firm conclusions on what characteristics of PSI are linked with effectiveness.

Effect of PSI on dietary behaviour change

Overall, the effect of PSI on dietary behaviour change varied, however, the majority of studies reported that PSI were more effective than alternative interventions and/or a control for improving a dietary behaviour change related outcome(s) or reported mixed results, while 31% found no significant benefits of PSI. Examination of PSI details highlighted that most studies were group based or used a combination of models and were lay-led.

Across studies, there was limited detail on intervention development, content and process evaluation, as recommended in the Medical Research Council framework for development and evaluation of complex interventions to improve health[71]. Only one study[24] was reported according to the Template for Intervention Description and Replication (TIDieR) checklist[72], which enables better reporting of intervention details. Several studies did not describe the intensity of the PSI. Just under half of studies that used peers to facilitate the intervention did not mention if training was provided for undertaking this role and limited information was available from studies that reported including training. Few studies discussed provision of support for individuals undertaking a peer role and just over one third measured the fidelity of the delivered PSI. It is therefore possible that

the PSI offered may not have been optimal for encouraging dietary behaviour change. Future interventions assessing the effect of PSI on dietary behaviour change should clearly describe these processes using the available guidance for intervention reporting to enable better detection of factors that may contribute to the effectiveness of PSI to encourage dietary behaviour change.

There was high heterogeneity between studies. Previous reviews considering the effect of PSI on health behaviours have also reported heterogeneity between studies[3, 5, 73]. The mixed evidence found may be due to variation in study characteristics. Sample sizes varied widely. Some studies including small sample sizes may have had insufficient power to detect change in dietary behaviour. Studies also measured different outcomes which are difficult to compare. It may be easier to increase fruit and vegetable intake, for example, than to lose weight or decrease fat intake. Heterogeneity in results, however, was observed within most outcomes.

Effect of PSI characteristics on dietary behaviour change

Study characteristics linked with PSI effectiveness for achieving dietary behaviour change, based on studies assessing anthropometric outcomes, included use of a weight management intervention and targeting an overweight/obese sample. This group may have greater motivation for behaviour change than the general population. Further research is needed to determine if PSI are particularly effective for certain population groups or dietary related outcomes. It is possible that the ethnicity of populations included in studies may impact the effectiveness of PSI. However, as shown in this review, studies conducted with the same ethnic groups reported different effects of PSI and as small numbers of studies included each ethnic group, further research is needed to investigate this. Studies used different intervention models and types of peer to facilitate the intervention, which may differently affect dietary behaviour. More studies using a group PSI model were effective than studies using other PSI models. Evidence from systematic reviews considering the effect of PSI on health behaviours have found no significant effect of PSI models on behaviour change[5] or suggested that dyadic support may be most effective[8]. It has been stated that, based on current evidence, no one PSI model is superior to another for achieving change[3] and different models may be suited to different populations and settings[74], or a combination of models may offer optimal support[22]. Lay-led support was linked with PSI effectiveness in this review. Some studies used other participants, who were not trained for delivering a PSI, or included a health professional in the PSI team, which changes the reciprocal PSI relationship[75]. Studies assessing effectiveness of PSI on fat intake, however, were linked with effectiveness where health professionals were included in the PSI team. It is possible that professional guidance is helpful for making this type of dietary

behaviour change. Use of a peer supporter was also linked with PSI effectiveness in this review, which is consistent with a previous review[8]. Process evaluations of PSI should include determining an optimal peer role and the key characteristics and skills required to undertake it[76]. Intervention duration ranged from six weeks to 30 months. Over half of studies reporting positive effects of PSI (n=9; 60%) were at least 1 year in duration which may imply that a longer PSI duration is needed to effectively establish dietary change in adults. Minimal research exists that considers the ideal length of time required for successful dietary interventions.

There were no clear differences in PSI effectiveness with use of different behaviour change theories. BCTs used in interventions shown to be effective in this review included behavioural goal setting, prompting self-monitoring and provision of feedback. These BCTs have been associated with improved dietary behaviour in other systematic reviews[77] and may be useful to incorporate into future PSI to successfully facilitate dietary behaviour change. Studies reporting positive effects of PSI employed more BCTs to target dietary behaviour change than studies reporting no effect. Previous research, however, suggests that the number of BCTs employed in interventions does not have an effect on behaviour change[78], therefore it may be more important to consider the appropriate BCTs to include rather than the number. Studies included in this review used different combinations of BCTs. The optimal number and type of BCTs to use are likely to depend on the type of dietary behaviour change and the population being investigated. Further research is needed to determine optimal combinations of BCTs and behaviour change theories for use in PSI to encourage dietary behaviour change in adults. This will be determined by better reporting of intervention development, content and process evaluation and using feasibility and pilot studies to address issues in study design.

The implementation of well-designed and described PSI interventions to encourage dietary behaviour change will provide an evidence base for further exploration of study characteristics linked with effectiveness in encouraging dietary behaviour change in adults.

Limitations

In the interpretation of these findings, it is important to consider the following limitations at the review level. Firstly, considering the search stage, the incorporation of the different search terms associated with PSI yielded a large volume of studies that did not necessarily incorporate a PSI. This, however, helped to ensure that key studies were captured. The search did not include grey literature, therefore some studies may have been missed and the impact of publication bias could

not be determined due to the heterogeneity of results. The search also excluded study designs other than RCTs. Future reviews of PSI could consider inclusion of other study designs to examine the additional information that they may provide. Secondly, title and abstract screening and data extraction was conducted by one reviewer, however, two reviewers independently screened all potentially relevant full texts and data extraction was checked by a second reviewer. Thirdly, owing to the methodological diversity of included studies in terms of design and outcomes, the data could not be meta-analysed. The narrative synthesis undertaken, however was implemented rigorously to reduce the potential of bias. At the study level, firstly it should be considered that over one third of studies were classified as low methodological quality, largely as blinding is generally not feasible in PSI. Secondly, measurement of dietary behaviour change outcomes may have been subject to bias as self-report methods of dietary assessment were used[79-81] rather than objective markers of actual change such as nutritional biomarkers, and it was not clear in all studies if anthropometric measurements were taken using a standardised approach.

Conclusion

The majority of studies (69%) reported that PSI were more effective than alternative methods of support or a control for improving a dietary behaviour change related outcome(s) or reported mixed results and 31% found no significant benefits of PSI. As evidence was mixed, however, the effect of PSI in encouraging dietary behaviour change in adults is not clear. This is the first systematic review of the effect of PSI on dietary behaviour in adults and has demonstrated that there is currently insufficient evidence to recommended incorporation of PSI into public health policy and practice for encouraging dietary behaviour change in adults. Further well-designed interventions need to be undertaken to build an evidence base for the use of PSI for achieving dietary behaviour change. This review has highlighted specific details needed in future research to advance this field. Descriptive reporting of intervention development and content (including the theoretical basis, BCTs used, intervention intensity and peer training and support needs) is needed. Researchers should also report process evaluations of intervention elements that worked or not and ideally examine how behaviour change theory and techniques are linked with effectiveness via mediator and moderator analysis.

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Table 1: Summary of the effect of PSI on dietary behaviour change outcomes (n=54)

Study (Author and year)	Dietary behaviour change outcome(s) measured	Effect of PSI			
		PSI more effective than alternative	No sig diff between PSI and control	Mixed within each outcome*	Mixed between outcomes*
Garrett *et al*., 2005 [28]	**Dietary pattern**	✓			
Robinson-Whelen *et al*., 2006 [32]	**Dietary pattern**	✓			
Resnicow *et al*., 2004 [58]	**FV**	✓			
Campbell *et al*., 1999 [55]	**FV**	✓			
Toobert *et al*., 2007 [35]	**Fat**	✓			
West *et al*., 2011 [26]	**Weight**	✓			
Ackermann *et al.,* 2015 [29]	**Weight**	✓			
Lutes *et al*., 2017 [48]	**Weight**	✓			
Safford *et al*., 2015 [52]	**BMI**	✓			
Katula *et al*., 2013 [61]	**Multiple weight** *(Weight, BMI, WC)*	✓			
Block *et al.,* 2015 [41]	**Multiple weight** *(Weight, BMI, WC)*	✓			
Yang *et al.,* 2016 [33]	**Multiple weight** *(Weight, BMI, WC)*	✓			
Jebb *et al.,* 2011 [31]	**Multiple weight** *(Weight, WC)*	✓			
Debussche *et al*., 2018 [24]	**Multiple weight** *(BMI, WC)*	✓			
Heshka *et al*., 2003 [16]	**Multiple weight** *(Weight, BMI, WC/WHR)*	✓			
Corkery *et al*., 1997 [44]	**Dietary pattern**		✓		
Gary *et al*., 2003 [49]	**Dietary pattern**		✓		
Stoddard *et al*., 2004 [56]	**FV**		✓		
Allicock *et al*., 2012 [67]	**FV**		✓		
Van der Wulp *et al*., 2012 [51]	**Fat**		✓		
Glasgow *et al*., 2003 [38]	**Multiple dietary** *(Fat, Other nutrients/ foods)*		✓		
Prezio *et al*., 2013 [47]	**BMI**		✓		
Peimani *et al*., 2018 [57]	**BMI**		✓		
Islam *et al.,* 2013 [60]	**Multiple weight** *(Weight, BMI, WC)*		✓		
Perez-Escamilla *et al*., 2015 [46]	**Multiple weight** *(Weight, BMI, WC)*		✓		
Verheijden *et al*.,2004 [39]	**Multiple weight** *(BMI, WC/WHR)*		✓		
Sreedevi *et al.,* 2017 [53]	**Multiple weight** *(BMI, WHR)*		✓		
Carrasquillo *et al*., 2017 [65]	**Diet and Weight** (FV, BMI)		✓		
Cade *et al*., 2009 [19]	**Diet and Weight** *(FV, Fat, Other nutrients/ foods, Weight, BMI)*		✓		
Spencer *et al*., 2011 [64]	**Diet and Weight** *(FV, Fat, Other nutrients/ foods, BMI)*		✓		
Mash *et al*., 2014 [23]	**Diet and Weight** *(Dietary pattern, Weight, WC)*		✓		
Xiang *et al.,* 2017 [18]	**Diet and Weight** *(Dietary pattern, BMI)*		✓		
Toobert *et al*., 2011 [34]	**Fat**			✓	
Perri *et al*., 1987 [14]	**Weight**			✓	
Jolly *et al.,* 2011 [66]	**Weight**			✓	
Staten *et al*., 2004 [62]	**Diet and Weight** *(FV, BMI, WC/WHR)*			✓	
MacKinnon *et al*., 2010 [30]	**Diet and Weight** *(FV, BMI)*			✓	

Table 1 (Continued): Summary of the effect of PSI on dietary behaviour change outcomes (n=54)

Study (Author and year)	Dietary behaviour change outcome(s) measured	Effect of PSI			
		PSI more effective than alternative	No sig diff between PSI and control	Mixed within each outcome*	Mixed between outcomes*
Winett *et al*., 2007 [37]	**Diet and Weight** *(FV, Fat, Other nutrients/ foods, Weight)*			✓	
Sternfeld *et al*., 2009 [40]	**Multiple dietary** *(FV, Fat, Other nutrients/ foods)*				✓
Chang *et al*., 2017 [43]	**Multiple dietary** *(FV, Fat, Other nutrients/ foods)*				✓
Djuric *et al*., 2002 [15]	**Multiple weight** *(Weight, BMI)*				✓
McNabb *et al*., 1997 [25]	**Diet and Weight** *(Fat, Other nutrients/ foods, Weight, BMI, WC/WHR)*				✓
Keyserling *et al*. 2008 [63]	**Diet and Weight** *(Dietary pattern, FV, Weight)*				✓
Babamoto *et al*., 2009 [50]	**Diet and Weight** *(FV, Fat, BMI)*				✓
Lorig *et al*., 2009 [20]	**Diet and Weight** *(Dietary pattern, Fat, Weight)*				✓
Balcazar *et al*., 2010 [59]	**Diet and Weight** *(Fat, Other nutrients/ foods, Weight, BMI, WC/WHR)*				✓
Parikh *et al*., 2010 [21]	**Diet and Weight** *(FV, Fat, Other nutrients/ foods, Weight, WC)*				✓
Rosal *et al*., 2011 [54]	**Diet and Weight** *(Dietary pattern, fat, Other nutrients/ foods, weight, WC)*				✓
Smith *et al*., 2011 [22]	**Diet and Weight** *(Dietary pattern BMI)*				✓
Pinto *et al*., 2013 [17]	**Diet and Weight** *(Other nutrients/ foods, Weight)*				✓
Rothschild *et al.,* 2014 [45]	**Diet and Weight** *(FV, Weight)*				✓
Baig *et al*., 2015 [27]	**Diet and Weight** *(Dietary pattern, FV, Fat, WC)*				✓
Hageman *et al.,* 2017 [36]	**Diet and Weight** *(Fat, Other nutrients/ foods, Weight, WC)*				✓
Jane *et al*., 2017 [42]	**Diet and Weight** *(Fat, Other nutrients/ foods, Weight, BMI, WC)*				✓

BCT, Behaviour change technique; **BMI,** Body Mass Index; **FV,** Fruit and vegetables; **PS,** Peer support; **WC,** Wasist circumference; **WHR,** Waist-hip ratio. *Mixed within each outcome: Different results for different intervention groups/ at different time points, Mixed between outcomes: different results for different dietary behaviour change outcome measures

Table 2: Effect of PSI on dietary outcomes (n=35)

Author & Year	Outcome measure Validated (v)	Intervention groups	Effect of PSI[1] ↑ — ↓ C	I
Dietary pattern (n=11)				
Garrett *et al.*, 2005 [28]	6 item q'naire on diabetes self-care	1) Small group activity (PSI) 2) Control	✓	
Robinson-Whelen *et al.*, 2006 [32]	48 item q'naire on health behaviours	1) Health promotion programme (PSI) 2) Control	✓	
Keyserling *et al.* 2008 [63]	54 item FFQ (v) (New leaf dietary risk assessment)	1) Enhanced intervention (PSI) 2) Minimal intervention	✓	
Lorig *et al.*, 2009 [20]	3-item FFQ to measure healthy eating practices	1) Peer-led diabetes self-management programme (PSI) 2) Usual care	✓	
Rosal et al., 2011 [54]	24-hour dietary recalls (x3 at baseline, x1 at 4 months and x3 at 12 months)	1) Tailored diabetes self-management 2) Usual care	✓	
Corkery *et al.*, 1997 [44]	10 item q'naire on diabetes self-care	1) PSI 2) Control		✓
Gary *et al.*, 2003 [49]	FFQ (v)	1) Usual care 2) Usual care and PSI 3) Usual care+ Nurse case manager 4) Usual care+ Nurse case manager + PSI		✓
Smith *et al.*, 2011 [22]	Diabetes self-care self-report q'naire (v)	1) PSI 2) Control		✓
Mash *et al.*, 2014 [23]	1 item from Summary of Diabetes Self-Care Activity Scale	1) Diabetes education program 2) Usual care and education		✓
Baig *et al.*, 2015 [27]	1 item from Summary of Diabetes Self-Care Activity Scale	1) Church based self-management intervention 2) Usual care and education		✓
Xiang *et al.*, 2017 [18]	Diabetes self-care self-report q'naire including 4 items on diet (v)	1) Patient-to-patient education 2) Control		✓
FV intake (n=17)				
Campbell *et al.*, 1999 [55]	15 item FFQ (validated against 3-d food records) (v)	1) 5-a-day intervention (PSI) 2) Control	✓	
Resnicow *et al.*, 2004 [58]	17-item FV FFQ and 2 item q'naire of usual FV intake/ d (v)	1) Body and soul intervention (PSI) 2) Control	✓	
Keyserling *et al.*, 2008 [63]	Serum carotenoids	1) Enhanced intervention (PSI) 2) Minimal intervention	✓	
Babamoto *et al.*, 2009 [50]	Diabetes health measures q'naire	1) CHW education (PSI) 2) Case management 3) Usual care	✓	
Sternfeld *et al.*, 2009 [40]	FFQ (v)	1) A lifestyle intervention via email (ALIVE) programme (PSI) 2) Control	✓	
Winett *et al.*, 2007* [37]	FFQ (v)	1) Guide to health intervention(GTH) 2) GTH with church based supports (PSI) 3) Control	✓	✓
Mackinnon *et al.*, 2010** [30]	Dietary q'naire	1) Team-based, peer-led scripted health promotion (PSI) 2) Control	✓	✓
Stoddard *et al.*, 2004 [56]	1 item assessment on average, servings of FV/ day	1) Enhanced intervention (PSI) 2) Minimal intervention		✓
Cade *et al.*, 2009 [19]	3 day food diary and q'naire (v)	1) Diabetes specific expert patient programme (PSI) 2) Individual dietetic counselling control		✓
Parikh *et al.*, 2010 [21]	FFQ and self-report dietary q'naire (v)	1) Peer-led lifestyle intervention 2) Delayed intervention control		✓

Table 2 (Continued): Effect of PSI on dietary outcomes (n=35)

Author & Year	Outcome measure Validated (v)	Intervention groups	Effect of PSI[1]			
			↑	— C	— I	↓
FV intake (continued)						
Spencer *et al*., 2011 [64]	6-item interview administered FFQ from CDC Behavioural Risk Factor Surveillance System (v)	1) Diabetes self-management 2) Delayed control		✓		
Allicock *et al*., 2012 [67]	9-item FV q'naire and 2-item measure of usual FV intake (v)	1) Body and soul group (PSI) 2 Control		✓		
Rothschild *et al*., 2014 [45]	1 item from Summary of Diabetes Self-Care Activity Scale	1) Self-management intervention 2) Education only control		✓		
Baig *et al*., 2015 [27]	1 item from Summary of Diabetes Self-Care Activity Scale	1) Church based self-management intervention 2) Usual care and education		✓		
Carrasquillo *et al*., 2017 [65]	6-item interview administered FFQ (v)	1) CHW intervention 2) Enhanced usual care		✓		
Chang *et al*., 2017 [43]	7 item FV FFQ (v)	1) PSI 2) Written information control		✓		
Staten *et al*., 2004 [62]	24 hour diet recall	1) Counselling- active control 2) Counselling and health education 3) Counselling, health education and PSI		✓	✓	
Fat intake (n=18)						
McNabb *et al*., 1997 [25]	Dietary recall checklist on fat and fibre intake (v)	1) Experimental group (PSI) 2) Wait list control	✓			
Resnicow *et al*., 2004 [58]	15-item q'naire on fat intake (v)	1) Body and soul intervention (PSI) 2) Control	✓			
Toobert *et al*., 2007 [35]	FFQ to document % kcal from sat fat. Validated with plasma fatty acids (v)	1) Mediterranean lifestyle programme (PSI) 2) Usual care	✓			
Sternfeld *et al*., 2009 [40]	FFQ (v)	1) A lifestyle intervention via email (ALIVE) programme (PSI) 2) Control	✓			
Balcazar *et al*., 2010 [59]	35-item behavioural habits q'naire	1) CHW education (PSI) 2) Control	✓			
Rosal *et al*., 2011 [54]	24-hour dietary recalls (x3 at baseline, x1 at 4 months and x3 at 12 months)	1) Tailored diabetes self-management 2) Usual care	✓			
Baig *et al*., 2015 [27]	1 item from Summary of Diabetes Self-Care Activity Scale	1) Church based self-management intervention 2) Usual care and education	✓			
Chang *et al*., 2017 [43]	17 item FFQ (v)	1) PSI 2) Written information control	✓			
Toobert *et al*., 2011** [34]	FFQ to document % kcal fat (v)	1) Viva Bien and UC (PSI) 2) Usual care	✓	✓		
Glasgow *et al*., 2003 [38]	15-item q'naire on fat intake and 20-item Fat & Fibre behaviour q'naire (v)	1) Information only 2) PSI		✓		
Cade *et al*., 2009 [19]	3 day food diary and q'naire (v)	1) Diabetes specific expert patient programme (PSI) 2) Individual dietetic counselling control		✓		
Parikh *et al*., 2010 [21]	FFQ and self-report dietary q'naire (v)	1) Peer-led lifestyle intervention 2) Delayed intervention control		✓		
Spencer *et al*., 2011 [64]	13-item interview administered FFQ from CDC Behavioural Risk Factor Surveillance System (v)	1) Diabetes self-management 2) Delayed control		✓		
Van der Wulp *et al*., 2012 [51]	35-item q'naire on fat intake (Fatlist)	1) Peer-led self-management (PSI) 2) Control		✓		
Winett *et al*., 2007 [37]	FFQ to document % kcal from fat (v)	1) Guide to health (GTH) intervention 2) GTH intervention with church based supports (PSI) 3) Control		✓	✓	

Table 2 (Continued): Effect of PSI on dietary outcomes (n=35)

Author & Year	Outcome measure	Intervention groups	Effect of PSI[1]			
			↑	— C	— I	↓
Fat intake (continued)						
Babamoto *et al*., 2009 [50]	Diabetes health measures q'naire	1) CHW education (PSI) 2) Case management 3) UC		✓	✓	
Jane *et al*., 2017 [42]	3-d food record	1) Social media delivered weight management program 2) Written information 3) Standard care		✓	✓	
Hageman *et al.,* 2017** [36]	Block Health Habit and History Questionnaire (v)	1)Web Intervention 2)Web Intervention +PSI 3)Web Intervention + professional counselling		✓	✓	✓
Intake of other nutrients/ foods (n=13)						
Balcazar *et al*., 2010 [59]	*Salt* 35-item behavioural habits q'naire	1) CHW education (PSI) 2) Control	✓			
Winett *et al*., 2007* [37]	*Fibre* FFQ to document % kcal from fibre (v) servings	1) Guide to health (GTH) intervention 2) GTH intervention with church based supports (PSI) 3) Control	✓		✓	
McNabb *et al*., 1997 [25]	*Fibre* Dietary recall checklist on fat and fibre intake (v)	1) Experimental group (PSI) 2) Wait list control		✓		
Glasgow *et al*., 2003 [38]	*Fibre* 20-item fat and fibre behaviour q'naire (v)	1) Information only 2) PSI		✓		
Cade *et al*.,2009 [19]	*Energy, protein, starch, fibre* 3 day food diary and q'naire	1) Diabetes specific expert patient programme (PSI) 2) Individual dietetic counselling control		✓		
Sternfeld *et al.,* 2009 [40]	*Sugar* FFQ (v)	1) A lifestyle intervention via email (ALIVE) programme (PSI) 2) Control		✓		
Parikh *et al.,* 2010 [21]	*Sugar-sweetened beverages* FFQ and self-report dietary q'naire (v)	1) Peer-led lifestyle intervention 2) Delayed intervention control		✓		
Spencer *et al*., 2011 [64]	*Sugar-sweetened beverages* 2-item interview administered FFQ from CDC Behavioural Risk Factor Surveillance System (v)	1) Diabetes self-management 2) Delayed control		✓		
Hageman *et al.,* 2017 [36]	*Energy* Block Health Habit and History Questionnaire (v)	1)Web Intervention 2)Web Intervention +PSI 3)Web Intervention + professional counselling		✓	✓	
Pinto *et al.,* 2013 [17]	*Energy* Block FFQ (v)	1)Professionally led behavioural weight loss 2) Weight watchers (PSI) 3) Professionally delivered behavioural weight loss & weight watchers			✓	
Chang *et al*., 2017 [43]	*Fast foods* 12 item FFQ (v)	1) PSI 2) Written information control	✓			
	Sugar-sweetened beverages 7 item FFQ (v)			✓		
	Non-sugar sweetened beverages 12 item FFQ (v)					✓

Table 2 (Continued): Effect of PSI on dietary outcomes (n=35)

Author & Year	Outcome measure	Intervention groups	Effect of PSI[1]			
			↑	— C	— I	↓
Intake of other nutrients/ foods (continued)						
Rosal *et al*., 2011 (54)	*Carbohydrates* 24-hour dietary recalls (x3 at baseline, x1 at 4 months and x3 at 12 months) *Energy* 24-hour dietary recalls as above	1) Tailored diabetes self-management 2) Usual care	✓	✓		
Jane *et al*., 2017 (42)	Energy Carbohydrate Protein Alcohol Fibre 3-d food diary (all)	1) Social media delivered weight management program 2) Written information 3) Standard care	✓	✓ ✓ ✓ ✓	✓ ✓ ✓ ✓ ✓	

FFQ, Food frequency questionnaire; **CHW,** Community Health Worker; **PSI,** Peer-supported intervention.

[1]Effect of PSI summarised as: PSI more effective than alternative method of support in improving dietary outcome, (C) no significant difference between PSI and control group in improving dietary outcome, (I) no significant difference between PSI and intervention group in improving dietary outcomes and PSI less effective than other method of support in improving dietary outcome.

***Different results for different intervention groups, ** Different results at different time points.*

Table 3: Effect of PSI on anthropometric outcomes (n=40)

Author & Year	Intervention groups	Effect of PSI[1]			
		↑	— C	— I	↓
Weight (n=27)					
McNabb *et al*., 1997 [25]	1) Experimental group (PSI) 2) Wait list control	✓			
Heshka *et al*., 2003 [16]	1) Self-help weight loss group 2) Weight watchers (PSI)	✓			
Parikh *et al.,* 2010 [21]	1) Peer-led lifestyle intervention 2) Delayed intervention control	✓			
Jebb *et al.,* 2011 [31]	1) Weight watchers (PSI) 2) Standard care	✓			
West *et al*., 2011 [26]	1) Diabetes prevention program 2) Cognitive training	✓			
Katula *et al*., 2013 [61]	1) Diabetes prevention program lifestyle weight loss intervention 2) Enhanced usual care	✓			
Pinto *et al.,* 2013 [17]	1)Professionally led behavioural weight loss 2) Weight watchers (PSI) 3) Professionally delivered behavioural weight loss & weight watchers	✓			
Rothschild *et al.,* 2014 [45]	1) Self-management intervention 2) Education only control	✓			
Ackermann *et al.,* 2015 [29]	1) YMCA intervention – group based counselling 2) Usual care	✓			
Block *et al.,* 2015 [41]	1) Alive-PD intervention 2) Usual care	✓			
Yang *et al.,* 2016 [33]	1) Weight Watchers (PSI) 2) Nutrition Education control	✓			
Lutes et al., 2017 [48]	1) Small changes lifestyle intervention 2) Mail based education control	✓			
Jolly *et al.,* 2011* [66]	1) Weight watchers (PSI) 2) Slimming world (PSI) 3) Exercise minimal intervention	✓	✓		
Jane *et al*., 2017 [42]	1) Social media delivered weight management program 2) Written information 3) Standard care	✓		✓	
Winett *et al*., 2007** [37]	1) Guide to health (GTH) intervention 2) GTH intervention with church based support (PSI) 3) Control	✓	✓	✓	
Keyserling *et al*., 2008 [63]	1) Enhanced intervention (PSI) 2) Minimal intervention		✓		
Cade *et al*., 2009 [19]	1) Diabetes specific expert patient programme (PSI) 2) Individual dietetic counselling control		✓		
Lorig *et al*., 2009 [20]	1) Peer-led diabetes self-management programme (PSI) 2) Usual care		✓		
Balcazar *et al*., 2010 [59]	1) CHW education (PSI) 2) Control		✓		
Rosal *et al*., 2011 [54]	1) Tailored diabetes self-management 2) Usual care		✓		
Mash *et al*., 2014 [23]	1) Diabetes education program 2) Usual care and education		✓		
Islam *et al.,* 2013 [47]	1) Project RICE – CHW intervention 2) Control		✓		
Baig *et al*., 2015 [27]	1) Church based self-management 2) Usual care and education		✓		
Perez-Escamilla *et al*., 2015 [46]	1) Structured blood glucose control program 2) Usual care		✓		
Hageman *et al.,* 2017 [36]	1)Web Intervention 2)Web Intervention +PSI 3)Web Intervention + professional counselling		✓	✓	

Table 3 (Continued): Effect of PSI on anthropometric outcomes (n=40)

Author & Year	Intervention groups	Effect of PSI[1]			
		↑	— C	— I	↓
Weight (continued)					
Perri *et al*., 1987** [14]	1) Behaviour therapy +PSI 2) Behaviour therapy + therapist 3) Behaviour therapy		✓	✓	✓
Djuric *et al*., 2002* [15]	1) Control 2) Weight watchers (PSI) 3) Individualised counselling 4) Individualised counselling & weight watchers		✓		✓

Table 3 (Continued): Effect of PSI on anthropometric outcomes (n=40)

Author & Year	Intervention groups	Effect of PSI[1]			
		↑	— C	— I	↓
BMI (n=23)					
McNabb *et al*., 1997 [25]	1) Experimental group (PSI) 2) Wait list control	✓			
Heshka *et al*., 2003 [16]	1) Self-help weight loss group 2) Weight watchers (PSI)	✓			
Smith *et al.,* 2011 [22]	1) PSI 2) Control	✓			
Katula et al., 2013 [61]	1) Diabetes prevention program lifestyle weight loss intervention 2) Enhanced usual care	✓			
Block *et al.,* 2015 [41]	1) Alive-PD intervention 2) Usual care	✓			
Safford *et al*., 2015 [52]	1) PSI and brief education 2) Brief education	✓			
Yang *et al.,* 2016 [33]	1) Weight Watchers (PSI) 2) Nutrition Education control	✓			
Debussche *et al*., 2018 [24]	1) Peer-led self-management education 2) Usual care	✓			
Mackinnon *et al*., 2010** [30]	1) Team-based, peer-led scripted health promotion (PSI) 2) Control	✓	✓		
Babamoto *et al*., 2009* [50]	1) CHW education (PSI) 2) Case management 3) Usual care	✓		✓	
Djuric *et al*., 2002 [15]	1) Control 2) Weight watchers (PSI) 3) Individualised counselling 4) Individualised counselling & weight watchers		✓		
Verheijden *et al*.,2004 [39]	1) Web based intervention 2) Control		✓		
Cade *et al*., 2009 [19]	1) Diabetes specific expert patient programme (PSI) 2) Individual dietetic counselling control		✓		
Balcazar *et al*., 2010 [59]	1) CHW education (PSI) 2) Control		✓		
Spencer *et al*., 2011 [64]	1) Diabetes self-management 2) Delayed control		✓		
Islam *et al.,* 2013 [60]	1) Project RICE – CHW intervention 2) Control		✓		
Prezio *et al*., 2013 [47]	1) Culturally tailored diabetes education and management program 2) Usual care		✓		
Perez-Escamilla *et al*., 2015 [46]	1) Structured blood glucose control program 2) Usual care		✓		
Carrasquillo *et al*., 2017 [65]	1) CHW intervention 2) Enhanced usual care		✓		
Xiang *et al.,* 2017 [18]	1) Patient-to-patient education 2) Control		✓		
Peimani *et al*., 2018 [57]	1) Peer-led diabetes self-management 2) Education only control		✓		
Staten *et al.,* 2004 [62]	1) Counselling- active control 2) Counselling and health education 3) Counselling, health education and PSI		✓	✓	
Sreedevi *et al.,* 2017 [53]	1) Yoga 2) Peer Intervention 3) Control		✓	✓	

Table 3 (Continued): Effect of PSI on anthropometric outcomes (n=40)

Author & Year	Intervention groups	Effect of PSI[1]			
		↑	—		↓
			C	I	
WC/WHR (n=18)					
McNabb *et al*., 1997 [25]	1) Experimental group (PSI) 2) Wait list control	✓			
Heshka *et al*., 2003 [16]	1) Self-help weight loss group 2) Weight watchers (PSI)	✓			
Jebb *et al.,* 2011 [31]	1) Weight watchers (PSI) 2) Standard care	✓			
Katula *et al*., 2013 [61]	1) Diabetes prevention program lifestyle weight loss intervention 2) Enhanced usual care	✓			
Block *et al.,* 2015 [41]	1) Alive-PD- a web, internet, mobile phone intervention 2) Usual care	✓			
Yang *et al.,* 2016 [33]	1) Weight Watchers (PSI) 2) Nutrition Education control	✓			
Debussche *et al*., 2018 [24]	1) Peer-led self-management education 2) Usual care	✓			
Verheijden *et al*., 2004 [39]	1) Web based intervention 2) Control		✓		
Balcazar *et al*., 2010 [59]	1) CHW education (PSI) 2) Control		✓		
Parikh *et al.,* 2010 [21]	1) Peer-led lifestyle intervention 2) Delayed intervention control		✓		
Rosal *et al*., 2011 [54]	1) Tailored diabetes self-management 2) Usual care		✓		
Islam *et al.,* 2013 [60]	1) Project RICE – CHW intervention 2) Control		✓		
Mash *et al*., 2014 [23]	1) Diabetes education program 2) Usual care and education		✓		
Baig *et al*., 2015 [27]	1) Church based self-management intervention 2) Usual care and education		✓		
Perez-Escamilla *et al*., 2015 [46]	1) Structured blood glucose control program 2) Usual care		✓		
Staten *et al*., 2004 [62]	1) Counselling- active control 2) Counselling and health education 3) Counselling, health education and PSI		✓	✓	
Hageman *et al*., 2017 [36]	1)Web Intervention 2)Web Intervention +PSI 3)Web Intervention + professional counselling		✓	✓	
Sreedevi *et al.,* 2017 [53]	1) Yoga 2) PSI 3) Control		✓	✓	

FFQ, Food Frequency Questionnaire; **CHW,** Community Health Worker; **PSI,** Peer-supported intervention.

[1]*Effect of PSI summarised as: PSI more effective than alternative method of support in improving anthropometric outcome, (C) no significant difference between PSI and control group in improving anthropometric outcome, (I) no significant difference between PSI and intervention group in improving anthropometric outcomes and PSI less effective than other method of support in improving anthropometric outcome.*

***Different results for different intervention groups, ** Different results at different time points.*

Table 4: Characteristics and methodological quality of studies assessing the effect of PSI on dietary behaviour change in adults (n=54)

Author & Year	Study location	Participants				Intervention groups	Duration: PSI Intensity	PSI				Quality[12]
		No. in analysis (PSI)	Gender	Age (years) Mean (SD)/ range	Characteristics			Model(s)	Peer role	Peer	n BCTs[11]	
Perri *et al*., 1987 [14]	USA	85 (32)	M+F	21-60	Overweight	1) Behaviour therapy + PSI 2) Behaviour therapy + therapist 3) Behaviour therapy	50 weeks: M	Group	PS	Health professional + other participants	3	Low
Djuric *et al*., 2002 [15]	USA	39 (8)	F	36-70	Mostly white Obese women with stage I or II breast cancer	1) Control 2) Weight watchers 3) Individualised counselling 4) Individualised counselling & weight watchers	12 months: M	Group	PS	Lay individual	-	Moderate
Heshka *et al*., 2003 [16]	USA	307 (148)	M+F	1) 44 (10.0) 2) 45 (10.0)	Overweight/ obese	1) Self-help weight loss group 2) Weight watchers	2 years: M	Group	PS	Lay individual	-	High
Pinto *et al*., 2013 [17]	USA	141 (49)	M+F	49.7 (9.2)	Mostly non-white Overweight/ obese	1)Professionally led behavioural weight loss 2) Weight watchers 3) Professionally delivered behavioural weight loss & weight watchers	48 weeks: M	Group	PS	Lay individual	-	Low
Xiang *et al.,* 2017 [18]	China	51 (29)	M+F	1) 53.0 (7.3) 2) 55.4 (9.7)	T2DM with poorly controlled blood glucose	1) Patient-to-patient education 2) Control	6 months: M	Group	PS	Lay individual	-	High
Cade *et al*., 2009 [19]	UK	239 (112)	M+F	1) 65.4 (11.6) 2) 66.2 (11.5)	Mostly white European T2DM	1) Diabetes specific expert patient programme 2) Individual dietetic counselling control	7 weeks: M	Group	PE	Lay individual	-	Low
Lorig *et al*., 2009 [20]	USA	294 (161)	M+F	66.7	Mostly white, non-Hispanic T2DM	1) Peer-led diabetes self-management programme 2) Usual care	6 weeks: M	Group	PE	Lay individual	5	Moderate
Parikh *et al*., 2010 [21]	USA	72 (35)	M+F	48 (16.5)	Mostly Hispanic Overweight with pre-diabetes	1) Peer-led lifestyle intervention 2) Delayed intervention control	12 months: M	Group	PE	Lay individual	-	Moderate
Smith *et al*., 2011 [22]	Republic of Ireland	337 (166)	M+F	1) 66.1 (11.11) 2. 63.2 (11.04)	T2DM	1) PSI 2) Control	2 years: M	Group	PE	Lay individual	-	High
Mash *et al*., 2014 [23]	South Africa	1570 (710)	M+F	1) 55.8 (11.5) 2) 56.4 (11.6)	T2DM	1) Diabetes education program 2) Usual care and education	4 months: M	Group	PE	Lay individual	-	Moderate
Debussche *et al*., 2018 [24]	Africa	140 (70)	M+F	52.5 (9.8)	T2DM	1) Peer-led self-management education 2) Usual care	12 months: M	Group	PE	Lay individual	-	Moderate
McNabb *et al*., 1997 [25]	USA	33 (15)	F	1) 56.5 (14.5) 2) 56.6 (13.0)	African-American Obese women at urban churches	1) Experimental group 2) Wait list control	14 weeks: M	Group	PC	Lay individual	3	Low

Table 4 (Continued): Characteristics and methodological quality of studies assessing the effect of PSI on dietary behaviour change in adults (n=54)

Author & Year	Study location	Participants				Intervention groups	Duration: PSI Intensity	PSI				Quality[12]
		No. in analysis (PSI)	Gender	Age (years) Mean (SD)/ range	Characteristics			Model(s)	Peer role	Peer	n BCTs[11]	
West *et al*., 2011 [26]	USA	228 (116)	M+F	71.2 (6.6)	Obese older adults from Senior Centres White	1) Diabetes prevention program 2) Cognitive training control	12 weeks: M	Group	PC	Lay individual	7	High
Baig *et al*., 2015 [27]	USA	84 (43)	M+F	53.7 (11.6)	Diabetic Latino	1) Church based self-management intervention 2) Usual care and education	8 weeks: M	Group	PC	Lay individual	4	Moderate
Garrett *et al*., 2005 [28]	USA	462 (195)	M+F	Not specified	Mostly Caucasian Diabetes management programme member	1) Small group activity 2) Control	Not stated: S	Group	PE, PS	Lay individual	-	Low
Ackermann *et al.,* 2015 [29]	USA	509 (257)	M+F	51.0 (12.1)	African American/ non-Hispanic white At risk of T2DM	1) YMCA adaptation of Diabetes Prevention Programme 2) Usual care	12 months: M	Group	PE, PS	Lay individual	-	Moderate
MacKinnon *et al*., 2010[30]	USA	424 (161)	M+F	40.7	Mostly white, non-Hispanic Fire fighters	1) Team-based, peer-led scripted health promotion 2) One-on-one motivational interviewing health coaching 3) Control	2 years: M	Group	PE, PF	Lay individual	4	Low
Jebb *et al.,* 2011 [31]	Australia, Germany, UK	444 (230)	M+F	1) 46.5 (13.5) 2) 48.2 (12.2)	Overweight/ obese	1) Weight watchers (PSI) 2) Standard care	12 months: M	Group	PC, PS	Lay individual	-	Moderate
Robinson-Whelen *et al*., 2006 [32]	USA	129 (54)	F	58.61 (9.17)	Mostly white or African American Older women with physical disabilities	1) Health promotion programme 2) Control	8 weeks: M	Group	PF, PS	Lay individual	5	Moderate
Yang *et al.,* 2016 [33]	China	251 (118)	M+F	1) 48.7 (10.6) 2) 49.7 (10.1)	Chinese – Mostly Han Overweight/ obese individuals from 2 residential communities	1) Weight Watchers 2) Nutrition Education control	6 months: M	Group	PC, PE, PS	Lay individual	7	Low
Toobert *et al*., 2011 [34]	USA	280 (142)	F	57.1 (10.09)	Latinas T2DM	1) Viva Bien and usual care 2) Usual care	12 months: M	Group	PE, PF	Lay individual + dietitian	-	Moderate
Toobert *et al*., 2007 [35]	USA	279 (163)	F	61	Postmenopausal women with T2DM	1) Mediterranean lifestyle programme 2) Usual care	2 years: M	Group	PC, PE	Lay individual + health professionals	6	Low
Hageman *et al.,* 2017 [36]	USA	301 (100)	F	53.9 (6.9)	Mostly White Overweight/ obese women living in rural geographical locations	1)Web Intervention 2)Web Intervention + PSI 3)Web Intervention + counselling	30 months: M	Group (Web-based)	PS	Lay individual	1	High

Table 4 (Continued): Characteristics and methodological quality of studies assessing the effect of PSI on dietary behaviour change in adults (n=54)

Author & Year	Study location	Participants				Intervention groups	Duration: PSI Intensity	PSI				Quality[12]
		No. in analysis (PSI)	Gender	Age (years) Mean (SD)/ range	Characteristics			Model(s)	Peer role	Peer	n BCTs[11]	
Winett *et al*., 2007 [37]	USA	935 (334)	M+F	1) 53.1 (15.2), 2) 49.9 (17.6), 3) 51.2 (13.9)	Mostly African American General public	1) Guide to health intervention 2) Guide to health intervention with church based supports 3) Control	12 weeks: O	Group (Web-based)	PS	Lay individual + other participants	3	Moderate
Glasgow *et al*., 2003 [38]	USA	320 (80)	M+F	59 (9.2)	T2DM	1) Information only 2) PSI	10 months: O	Group (Web-based)	PS	Other participants	1	Low
Verheijden *et al*.,2004 [39]	Canada	130 (66)	M+F	63	High CVD risk	1) Web based intervention 2) Control	8 months: O	Group (Web-based)	PS	Other participants	-	High
Sternfeld *et al*., 2009 [40]	USA	549 (232)	M+F	1) 44.8 (10.0) 2) 43.5 (11.0)	Mixed/unknown ethnicity Employee of a healthcare system	1) ALIVE email programme 2) Control	16 weeks: O	Group (Web-based)	PS	Other participants	5	Low
Block *et al.,* 2015 [41]	USA	339 (163)	M+F	55.0 (8.9)	Mostly White Individuals with pre-diabetes	1) Alive-PD intervention 2) Usual care	12 months: O	Group (Web-based)	PS	Other participants	10	Moderate
Jane *et al*., 2017 [42]	Australia	54 (19)	M+F	1) 47.0 (2.3) 2) 54.1 (2.3) 3) 50.2 (2.4)	Overweight/ Obese	1) Social media delivered weight management program 2) Written information 3) Ususal care	6 months: O	Group (Web based)	PS	Other participants	-	High
Chang *et al*., 2017 [43]	USA	338 (212)	F	1) 28.38 (5.02) 2) 28.86 (5.04)	Overweight/ Obese low-income mothers Non-Hispanic, white	1) PSI 2) Written information control	4 months: M	Group (Tele-conference)	PS, PC	Lay individual + dietitian	-	High
Corkery *et al*., 1997 [44]	USA	40 (24)	M+F	52.8 (11.7)	Hispanic New referral to diabetes clinic	1) PSI 2) Non PSI group	3.4 months (mean): O	Dyadic (Face-face)	PCM	Nurse + CHW	-	Low
Rothschild *et al.,* 2014 [45]	USA	144 (73)	M+F	53.7 (12.2)	T2DM Mexican Americans	1) Self-management intervention 2) Education only control	2 years: M	Dyadic (Face-face)	PC	CHW	6	Moderate
Perez-Escamilla *et al*., 2015 [46]	USA	211 (105)	M+F	56.3 (11.8)	T2DM Latino	1) Structured blood glucose control program 2) Usual care	12 months: M	Dyadic (Face-face)	PC	CHW	-	High
Prezio *et al*., 2013 [47]	USA	180 (90)	M+F	1) 47.9 (10.99) 2) 45.7 (10.69)	T2DM Hispanic and African American	1) Culturally tailored diabetes education and management program 2) Usual care	12 months: M	Dyadic (Face-face)	PC, PCM	CHW	5	High

Table 4 (Continued): Characteristics and methodological quality of studies assessing the effect of PSI on dietary behaviour change in adults (n=54)

Author & Year	Study location	Participants				Intervention groups	Duration: PSI Intensity	PSI				Quality[12]
		No. in analysis (PSI)	Gender	Age (years) Mean (SD)/ range	Characteristics			Model(s)	Peer role	Peer	n BCTs[11]	
Lutes *et al*., 2017 [48]	USA	200 (100)	F	53.45 (10.24)	T2DM, living in rural geographical location African American	1) Small changes lifestyle intervention 2) Mail based education control	12 months: M	Dyadic (Telephone)	PC	CHW	10	Moderate
Gary *et al*., 2003 [49]	USA	115 (41)	M+F	59	African-American T2DM	1) Usual care 2) Usual care and PSI 3) Usual care+ Nurse 4) Usual care+ Nurse + PSI	2 years: M	Dyadic (Face-face +/or telephone)	PCM	Lay individual	-	Moderate
Babamoto *et al*., 2009 [50]	USA	189 (75)	M+F	50 (11.9)	Hispanic T2DM	1) CHW education 2) Case management 3) Usual care	6 months: M	Dyadic (Face-face + telephone)	PC, PE	CHW	5	High
Van der Wulp *et al*., 2012 [51]	Netherlands	119 (59)	M+F	61 (median)	Mostly Dutch T2DM	1) Peer-led self-management 2) Control	Not stated: M	Dyadic (Face-face + telephone)	PC	Lay individual	5	High
Safford *et al*., 2015 [52]	USA	360 (168)	M+F	60.2 (12.1)	Diabetic African American	1) PSI and brief education 2) Brief education	10 months: M	Dyadic (Face-face + telephone)	PS	Lay individual	-	Moderate
Sreedevi *et al*., 2017 [53]	India	99 (32)	F	1) 51.97 (7.40) 2) 51.92 (8.32) 3) 51.92 (6.57)	Women with T2DM	1) Yoga based intervention 2) PSI 3) Control	3 months: M	Dyadic (Face-face + telephone)	PC, PS	Lay individual	-	High
Rosal *et al*., 2011 [54]	USA	252 (124)	M+F	63% in age category 45-64	T2DM Latino	1) Tailored diabetes self-management 2) Usual care	12 months: M	Hybrid (Group + Dyadic face-face)	PC	Lay individuals or nutritionist/ health educator and lay individual	8	High
Campbell *et al*., 1999 [55]	USA	2519 (1198)	M+F	53.8	Mostly African-American Church members	1) 5-a-day intervention 2) Control	20 months: O	Hybrid (Group + Dyadic face-face)	PE, PS	Lay individual	-	Moderate
Stoddard *et al*., 2004 [56]	USA	1105 (600)	F	58	Mostly white, non-Hispanic Uninsured and underinsured women	1) PSI 2) Control	12 months: M	Hybrid (Group + Dyadic face-face)	PC, PE, PF	Other participants	2	Low

Table 4 (Continued): Characteristics and methodological quality of studies assessing the effect of PSI on dietary behaviour change in adults (n=54)

Author & Year	Study location	Participants				Intervention groups	Duration: PSI Intensity	PSI				Quality[12]
		No. in analysis (PSI)	Gender	Age (years) Mean (SD)/ range	Characteristics			Model(s)	Peer role	Peer	n BCTs[11]	
Peimani *et al*., 2018 [57]	Iran	200 (100)	M+F	1) 59.0 (11.3) 2) 58.8 (11.7)	T2DM	1) Peer-led diabetes self-management support 2) Education only control	6 months: M	Hybrid (Group + telephone)	PS	Lay individual	-	Moderate
Resnicow *et al*., 2004 [58]	USA	854 (Not stated)	M+F	50.6	African-American Church member	1) Body and soul intervention 2) Control	6 months: O	Hybrid (Group + telephone)	PC, PE	Lay individual	1	Low
Balcazar *et al*., 2010 [59]	USA	284 (158)	M+F	54	Hispanic	1) CHW education 2) Control	4 months: M	Hybrid (Group + telephone)	PE	CHW	-	Low
Islam *et al.,* 2013 [60]	USA	35 (21)	M+F	59.7 (8.1)	Korean At risk of T2DM, aged 18 -75y	1) Project RICE intervention 2) Control	6 months: M	Hybrid (Group + telephone)	PC, PE	CHW	-	Low
Katula *et al*., 2013 [61]	USA	261 (127)	M+F	57.9 (9.5)	Overweight/ Obese at risk of T2DM White	1) Diabetes prevention program lifestyle weight loss intervention 2) Enhanced usual care	2 years: M	Hybrid (Group, dyadic face-face + telephone)	PE	CHW + dietitian	-	Low
Staten *et al*., 2004 [62]	USA	217 (67)	F	57.2 (4.8)	Hispanic Underinsured women	1) Counselling- control 2) Counselling & health education 3) Counselling, health education & PSI	12 months: M	Hybrid (Group, dyadic face-face + telephone)	PC, PE, PF	CHW + nurse	-	Low
Keyserling *et al*. 2008 [63]	USA	212 (106)	F	1) 54 (0.66) 2) 52 (0.64)	White or African American Women in a cancer detection/ CVD prevention programme	1) PSI 2) Control	12 months: M	Hybrid (Group, dyadic face-face + telephone)	PC, PF	CHW + health educator	9	Moderate
Spencer *et al*., 2011 [64]	USA	164 (72)	M+F	1) 50 2) 55	T2DM African American and Latino	1) Diabetes self-management 2) Delayed control	6 months: M	Hybrid (Group, Dyadic face-face + telephone)	PC, PCM	CHW	-	Moderate
Carrasquillo *et al*., 2017 [65]	USA	215 (111)	M+F	1) 55.3 (7.1) 2) 55.2 (6.1)	Patients of hospital outpatient clinics with high HbA1c levels Latino	1) PSI 2) Enhanced usual care	12 months: M	Hybrid (Group, dyadic face-face + telephone)	PE, PCM	CHW	-	Low

Table 4 (Continued): Characteristics and methodological quality of studies assessing the effect of PSI on dietary behaviour change in adults (n=54)

Author & Year	Study location	Participants				Intervention groups	Duration: PSI Intensity	PSI				Quality[12]
		No. in analysis (PSI)	Gender	Age (years) Mean (SD)/ range	Characteristics			Model(s)	Peer role	Peer	n BCTs[11]	
Jolly *et al.*, 2011 [66]	UK	243 (171)	M+F	1) 50.71 (14.56) 2) 48.84 (14.91) 3) 49.67 (13.83)	Mostly white British/ Irish Overweight/ obese	1) Weight watchers (PSI) 2) Slimming world (PSI) 3) Exercise minimal intervention	12 weeks: M	Hybrid (Group + optional dyadic face-face/ telephone)	PE, PS	Lay individual	1) 6 2) 8	Moderate
Allicock *et al.*, 2012 [67]	USA	562 (273)	M+F	51.6	Mostly African-American Church member	1) Body and soul group 2) Control	6 months: O	Hybrid (Group + optional dyadic face-face/ telephone)	PC, PS	Lay individual	2	Low

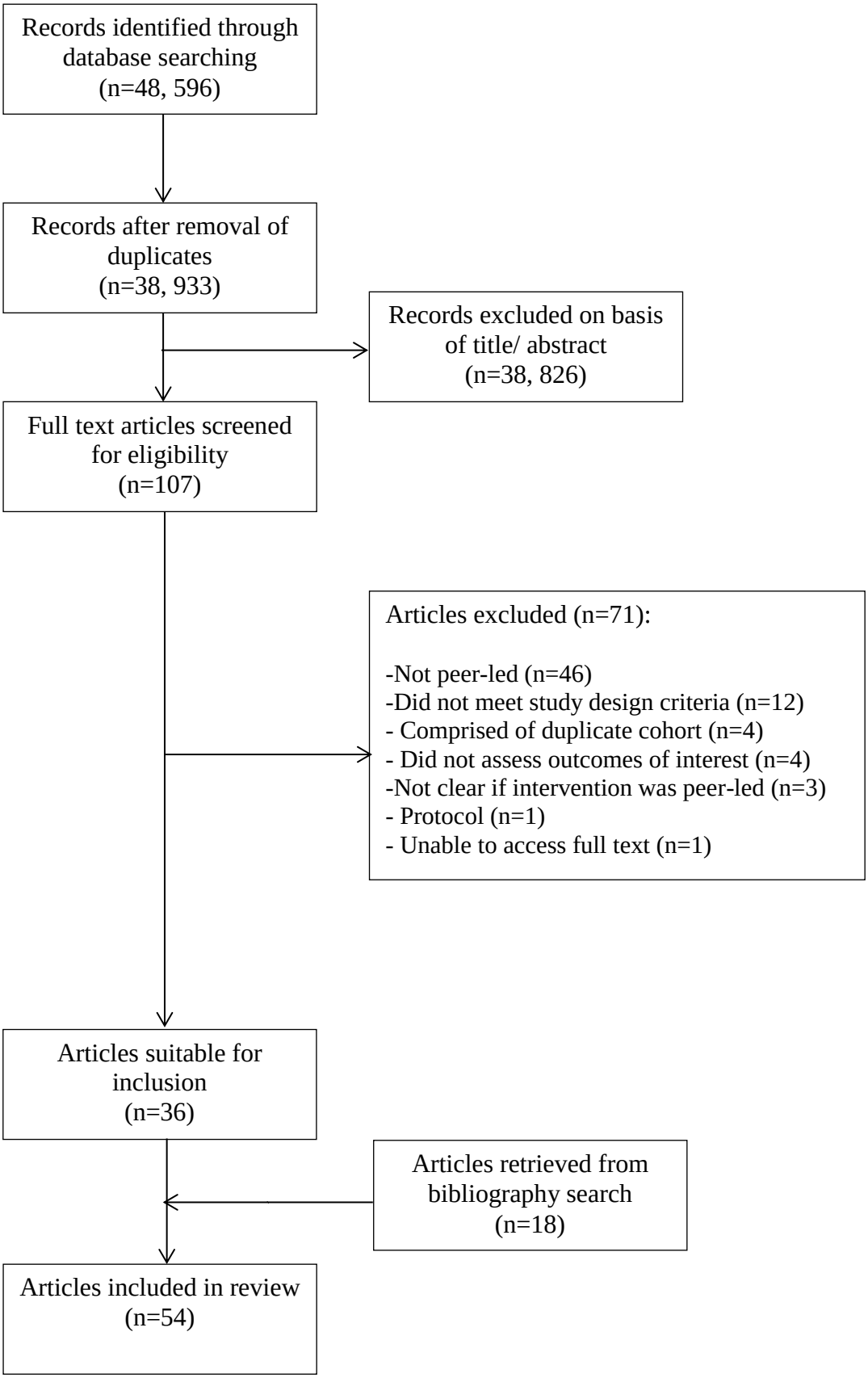

Figure 1: Summary of review study selection process

Supplementary material

Table S1: Example search strategy ran in Ovid MEDLINE

#	Searches
1	peer*.mp. or Peer Group/
2	Social Support/ or peer support.mp. or Self-Help Groups/
3	lay leader.mp.
4	Community Health Workers/ or health advisor.mp.
5	Counseling/ or counsel*.mp.
6	Telephone/ or telephone support.mp.
7	web support.mp.
8	computer support.mp.
9	1 or 2 or 3 or 4 or 5 or 6 or 7 or 8
10	Diet/ or Diet*.mp.
11	Food*.mp. or Food/
12	nutrition.mp.
13	intake.mp.
14	food habits.mp. or Food Habits/
15	diet* change.mp.
16	behavio?r* change.mp.
17	Health Behavior/
18	10 or 11 or 12 or 13 or 14 or 15 or 16 or 17
19	9 and 18
20	limit 19 to (english language and humans)
21	limit 20 to "all adult (19 plus years)"