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Review 3: Community engagement for health via coalitions, collaborations and partnerships (on-line social media and social networks)

A systematic review and meta-analysis

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REPORT

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Glossary /abbreviations

ANOVA: analysis of variance

Beneficial effect: an outcome that is statistically significant and in favour of the intervention group, i.e. in a positive direction of effect.

Bidirectional communication: a method of communication which allows both engagees and engagers to express and receive the opinions of the other party.

BMI: Body Mass Index is the calculation of weight-for-height normally used to classify people's weight as underweight, overweight or obese. It is calculated by taking a person's weight in kilograms and dividing it by the square of the person's height in metres (kg/m^2).

Boolean minimisation: an algebraic formulisation that converts data into either 'true' or 'false' values; used in qualitative comparative analysis.

CERI: *Community engagement to reduce inequalities in health*. Our first review in this area (O'Mara et al. 2013).

Coalitions, partnerships, collaborations: a group or alliance comprised of community members with a shared purpose to perform a combined action. These can be temporary or ongoing and can be a pre-existing group or a group assembled for a specific project. In addition to community members, other members can be researchers, service providers, government organisations, non-governmental organisations or charities.

Collaboration: an action whereby community members have shared responsibility and authority for design, intervention delivery, or measurement tools and data collection with others or as part of a team.

Collective decision making: a participatory process in which multiple individuals act collectively to make a decision.

Community: a group of people identified by themselves or by others as sharing common health, social, cultural or geographical characteristics.

Community-based participatory research (CBPR): a partnership approach to research in which community members, organisational representatives and researchers share expertise and decision making and contribute to all aspects of the research process (Israel et al. 1998).

Community engagement: the direct or indirect process of involving communities in decision making and/or in the planning, design, governance and delivery of services, using methods of consultation, collaboration, and/or community control. Community-level interventions or interventions that involve a group of people connected by geographies, interests or identities in the design, development, implementation or evaluation of an intervention. Participants must include members of the public or patients (more than health professionals, pharmacists, public health nurses, other health semi-professionals) who are involved in the design, delivery or evaluation of the intervention. The treatment administrator/provider is more important for determining community engagement than the intervention setting. Intervention types to be excluded are legislation, policy and pharmacological.

Community mobilisation: a capacity-building process that involves community members, groups, coalitions or other organisations to work in conjunction with researchers and/or organisations to address the community's specific needs.

Community organisations, or community-based organisations: formal or informal groups of community members that are usually structured, non-profit-making groups or

associations that focus on developing new and existing services.

Community partnership, community coalitions, community task force: a group which forms to design, deliver and/or evaluate an intervention, and contains community members. This can also be described as a forum, committee or advisory group.

Conceptual framework: an analytical tool used to make conceptual distinctions and organise ideas.

Configuration: the term used to describe the combination of characteristics within a study during qualitative comparative analysis.

Consultation: a process through which information, advice, opinions or insight is sought from community members into a design, intervention or delivery, or measurement tools and data collection. Decision-making powers do not lie with those consulted and the findings are not necessarily acted upon.

Continuous outcome: outcomes for participants are measured on a numerical scale and the results ordinarily summarised using the mean.

DH: Department of Health (England).

Dichotomous (binary) outcome: an event that did or did not occur, e.g. death, pregnancy, disease state.

DoPHER: the Database of Promoting Health Effectiveness Reviews specialises in locating and coding current reviews in health promotion, and is maintained by the EPPI-Centre.

Framework synthesis: a structured approach to organising and analysing data in matrices or charts and developing further analyses from these.

Heterogeneity: of a non-uniform type.

Homogeneity: of a uniform type.

In-depth synthesis: a synthesis involving detailed scrutiny, as opposed to descriptive characterisation, of the available research.

Informed: this describes situations where community members are told about interventions and/or what is going to happen to them, how the intervention works and/or what the evaluation will look like.

Leading: this is a situation where community members take responsibility, and decision-making authority rests with the community for the design. It also applies to situations where community members have autonomy (doing it on their own), to make decisions about when and how aspects of the research are undertaken during the intervention delivery. Leading in evaluation means that community members have sole responsibility and authority for measurement tools and data collection.

Logical remainders: an empty truth table row indicating limited diversity of phenomena.

Mediator: a variable intervening in the causal pathway between two variables, e.g. if A is significantly associated with C, and if A influences B and B influences C, then B is a mediating variable.

Meta-analysis: a statistical approach used to combine the results from multiple individual studies with improved power and greater precision in estimating effect size.

Meta-regression: a form of meta-analysis used to examine the impact of moderator variables on study effect size via multiple regression analysis.

Moderator: a variable affecting the direction and/or strength of the association between a predictor and outcome variable.

Modifiable processes: a community engagement process with the capacity for change/alteration.

Necessary (of a condition): *must* be satisfied in order to obtain an outcome. A characteristic (or combination of characteristics) that must be present for a desired outcome to occur.

Negative effect: an outcome that is statistically significant, and the effect is in favour of the control group.

Negative trend: an outcome that is not statistically significant but the effect is in favour of the control group.

NICE: National Institute of Health and Care Excellence.

No effect: the review team has inferred this to mean that no differences were observed in outcomes between intervention and control groups, or the difference is not statistically or clinically significant.

Odds ratio (OR): a measure of association between an exposure and the outcome - the odds of an outcome occurring given a particular exposure, compared to the odds of the outcome occurring without exposure.

OECD: the Organisation for Economic Cooperation and Development. This consists of 34 democratic countries that support free-market economies and debate and develop economic and social policy.

Online social media: a group of mobile and/or web-based technologies where information is shared, exchanged, discussed or co-created.

Online social networking: using web-based services to create a public profile within a bounded system; this allows users to build connections with other users, viewing and communicating information.

Outcome evaluation (OE): a research method that measures changes that have occurred within a population as a result of an intervention, e.g., reduced body mass index, changed behaviours.

Peer: a person who shares the same age group or health risk/condition, or is similar in key aspects (e.g., ethnicity) to another.

PHAC: Public Health Advisory Committee. These committees are part of NICE.

Population churn: a measure of the turnover of individuals moving into or out of a group over a period of time.

Positive effect: an outcome that is statistically significant and the effect is in favour of the intervention group.

Positive trend: an outcome that is not statistically significant but the effect favours (i.e. there is a bigger effect size in) the intervention group.

Process evaluation (PE): a study that aims to understand the functioning of an intervention, by examining implementation, mechanisms of impact and contextual factors. Process evaluation is complementary to, but not a substitute for, high-quality outcome evaluation.

PROGRESS-Plus: used to denote markers of disadvantage: place of residence, race/ethnicity, occupation, gender, religion, education, socio-economic status, social capital and three further variables - age, disability and sexual orientation.

Qualitative comparative analysis (QCA): a means of analysing the contribution of different conditions, or combinations of conditions, to an outcome.

Quasi-experimental design: a research design that involves selecting groups of participants, upon which a variable is tested, without any randomisation in the pre-selection process.

Randomised controlled trial (RCT): a study that randomly assigns like participants to two (or more) groups in order to examine a specific intervention. These groups consist of an experimental group that receives the intervention, and a control or comparison group that receives a different treatment, a dummy treatment (a placebo), or no treatment at all. Outcomes are evaluated after a predetermined time span and differences in outcomes for the groups are compared looking for statistical differences. (see also **Outcome evaluation** and **Trial**).

RQ: research question.

Self-efficacy: a measure of individuals' belief in their own ability to achieve a task, goal or outcome.

Stage of change model: an upward spiral process, involving progress through a series of stages until reaching the 'lasting exit'. Each loop of the spiral consists of the stages precontemplation, contemplation, preparation, action and maintenance (Department of Health, Australia 2004).

Standardised mean difference: a measure of effect size of an intervention - the difference in means between study groups relative to the variability observed in that study.

Sufficient (of a condition): whether one condition (or one combination of conditions) alone produces the desired outcome; where more than one condition (or one combination of conditions) is needed to obtain an outcome of interest, both are necessary to obtain the desired outcome but neither on their own is sufficient.

Synthesis: the combination of separate elements to form a connected whole. In systematic reviews, this refers to a combination of the findings of individual studies in order to answer the review question.

Trial: any research or study that allocates participants or community members to one or more health-related interventions in order to evaluate the effects on various outcomes, e.g. on health, wellbeing, quality of life, attitudes etc. (see also **Outcome evaluation**).

TRoPHI: the Trials Register of Promoting Health Interventions, a database maintained by the EPPI-Centre that focuses on randomised and non-randomised controlled trials of interventions in health promotion and public health worldwide.

Abstract

Background

This report describes the methods and findings of a systematic review on community engagement (CE) for health via online social media and social networks. It is the third and final review of a programme of work on the use and effectiveness of CE in interventions that target health outcomes. Social networks are one of many forms of CE. Our first two reviews suggested that the extent and particular processes of CE may be linked to effects on people's health. The emergence of online, electronic peer-to-peer social network sites (e.g. Facebook) and online social media tools (e.g. Twitter) have increased exponentially in recent years, and existing evidence on their effectiveness is ambiguous.

Aims

We aim to evaluate the effectiveness of online social media/social networks on: the extent of CE across designs, delivery and evaluation; the types of health issues and populations that have been studied; their effectiveness in improving health and wellbeing and reducing health inequalities; and any particular features that account for heterogeneity in effect size estimates across studies.

Methods

Systematic review methods were applied to comprehensively locate and assess the available research evidence. The search strategy employed previously run searches used for Reviews 1 and 2 of this project (described elsewhere). The included studies were descriptively analysed and the findings were synthesised using three components: framework synthesis, meta-analysis and qualitative component analysis (QCA).

Results

A total of 11 studies were included in the review, none of which was set in the UK. The community was not explicitly involved in identifying the health need for any of the 11 studies. No studies demonstrated a high level of CE, where participants were involved in the three measured elements: design, delivery and evaluation. Framework analysis indicated that peer delivery of the intervention was the predominant type of CE. Two processes of CE were reported – bidirectional communication and the use of facilitators – but none of the studies evaluated these processes. Professional facilitators were used more often in healthy eating/physical activity studies. Peer facilitators were used more often in youth-focused interventions and professional facilitators were utilised more frequently for interventions targeting older populations. Studies focusing on women only may incorporate peer or professional facilitators to aid intervention delivery. Peer or professional facilitators were used slightly more consistently in interventions targeting minority ethnic groups. Meta-analyses and meta-regression showed no evidence of beneficial effects on any outcomes. There was moderate (I^2= 25≤50) to high (I^2= ≥50) heterogeneity between studies for primary outcomes, suggesting the existence of potential moderators. None of the tested study characteristics explained the variation in effect sizes. The QCA demonstrated that including a facilitator in online social media/social networking interventions showed higher effect sizes for studies that focused on topics other than healthy eating and physical activity.

Conclusions

The results from this study suggest that CE is not utilised across the design or evaluation of health interventions, and the type of CE undertaken with intervention delivery focuses on peer interactions alone. This suggests that there is very little co-creation of knowledge or

building of social capital occurring in evaluated health intervention studies using online social media/networking.

Executive summary

This report describes the methods and findings of a systematic review on community engagement for health via online social media and social networks. This is the third and final review of our work on the use and effectiveness of community engagement in interventions that target health behaviours and outcomes. The findings of Reviews 1 and 2 of this project suggested that both the extent and particular processes of community engagement might be linked to effects on people's health (Brunton et al. 2015a; 2015b). An ideal model of community engagement that works across all contexts, populations and health issues has not been identified (O'Mara-Eves et al. 2013). This review, unlike the previous reviews, focuses on all populations, rather than disadvantaged populations.

Background: Community engagement and social media/social networking

Involving communities in decision making and in the planning, design, governance and delivery of interventions has become central to guidance and national strategies for promoting public health (Department of Health (DH) 2002, 2004, 2005). The National Institute of Health and Care Excellence (NICE) plays a crucial role in providing guidance on best practice for community engagement. Since the publication of NICE community engagement guidance (NICE, 2008), there has been considerable activity with a view to understanding the nature of community engagement, its benefits, and challenges in its evaluation (for example Sheridan and Tobi 2010).

Social networks are one of many forms of community engagement including: volunteering, peer delivery, community coalitions and advocacy. The number of online, electronic peer-to peer social network sites (e.g. Facebook, LinkedIn) and social media tools (e.g. Twitter, Tumblr) has increased exponentially in recent years, mirroring the rapid technological advances in Internet interaction (Laranjo et al. 2015). This social interaction through online social media and online social networks is considered an emerging form of community engagement (Kavanaugh and Patterson 2001).

Existing evidence on the effectiveness of online social media networks applied to health is ambiguous, with reviews of intervention studies reporting null, positive and mixed findings. Many of these findings are difficult to interpret, as the reviews combine studies that contain both direct comparisons of standalone online social network/social media interventions and those which contain online social interventions as one part of more complex, multi-component interventions designed for self-management or therapy.

Our previous work on community engagement suggests further need for investigation of whether engagement across all aspects of design, delivery and evaluation could impact on effectiveness, and whether specific objectives such as injury prevention or infection prevention are more effective using online social media or social network interventions. For this review, we synthesise the most recent controlled trials of online social network and social media interventions.

Aims and objectives of the review

The review addressed the following five research questions:

> *RQ1. What is the extent of community engagement across design, delivery and evaluation in online social media and online social networking interventions?*
>
> *RQ2. What health issues and populations have been studied using online social media/social networking?*
>
> *RQ3. How effective are online social networks in improving health and wellbeing and reducing health inequalities?*
>
> *RQ4. Do particular programme features (e.g. health topic, extent of engagement,*

population type) account for heterogeneity in effect size estimates across studies?

RQ5. Which processes of community engagement are more aligned with effective interventions?

The aim of the in-depth synthesis undertaken in Review 3 is to examine and evaluate the extent of community engagement for studies employing online social media and/or online social networks. This is done for the purpose of informing NICE Public Health Advisory Committee (PHAC) members about the likely elements of successful online community engagement.

Methods

To be included in Review 3 of this project, studies had to:

- explicitly describe the use of online social media and/or online social networks;
- explicitly describe the use of community engagement; and
- provide data on health outcomes i.e. self-efficacy, behavioural outcomes or clinical or physiological outcomes.

The systematic review method was applied to assemble a comprehensive and unbiased summary of available research evidence on community engagement and online social media and social networks. The studies were descriptively analysed and the findings were synthesised using three components: framework synthesis, meta-analysis (where possible) and qualitative component analysis (QCA).

Framework synthesis

Modifiable processes of community engagement described under the 'Actions' column of the conceptual framework developed in the previous community engagement reviews (e.g. administrative support or training support) (see Appendix 3) were used as the 'framework' for the analysis. We 'populated' the framework with studies describing various processes, and then, where possible, thematically compared and contrasted aspects of each process looking at differences in age groups, gender or socio-economic disadvantage using an adaptation of previously developed methods (Oliver et al. 2008; Ritchie and Spence 1994; Thomas et al. 2012).

Meta-analysis

Outcomes were classified into domains i.e. self-efficacy, social support, health behaviour and clinical/physiological. The standardised mean difference (Cohen's *d*) was used to summarise the impact of community engagement interventions for these domains. Random effects meta-analyses were conducted separately for each domain and for the primary outcomes. To explore between-study heterogeneity, meta-regression models were fitted (where data permitted). A range of programme features including the extent of community engagement, the health target, the theoretical basis for the intervention and the inclusion of health professionals, was assessed. For each potential moderator, we reported the pooled effect size and corresponding 95% confidence intervals (CIs), proportion of between-cluster variability (adjusted R^2) accounted for by the moderator variable; I^2 - the proportion of residual between-study variation due to heterogeneity (Higgins and Thompson 2002) and Cochran's (1954) *Q* test for heterogeneity, with a *p*-value less than 0.05 taken to indicate evidence of heterogeneity (Borenstein et al. 2009).

Qualitative comparative analysis

Qualitative comparative analysis (QCA) was employed to generate theory about the *necessary* and *sufficient* components that are associated with effective interventions. The characteristics of the included studies that were examined in the meta-analysis were further analysed in the QCA. These included health topic, extent of engagement, the population under study and effect sizes. The QCA was undertaken in six stages (Rihoux and

Ragin 2008). These were:

1. Building the data table
2. Constructing a 'truth' table
3. Resolving contradictory configurations
4. Boolean minimisation
5. Consideration of logical remainders
6. Interpretation.

Findings

A total of eleven studies were included in this synthesis. This set of studies describes mostly RCT-evaluated interventions of (on average) six months or more conducted in non-UK countries, half of which focused on healthy eating/physical activity topics. The social media/social networking platforms that were used were mainly purpose built, were used to share relevant information about the health topic being addressed, and were of an equal or predominant part of a multi-component intervention strategy in the majority of the studies. The extent of community engagement was quite low and of a particular type across all studies: community members were not involved in identifying the health need or in the design or evaluation of the intervention, instead being involved in intervention delivery by communicating with each other on discussion forums.

Framework synthesis

The framework analysis indicated that there was little variation within studies in terms of the type of community engagement, in that peer delivery of the intervention was predominant. There was little variation within the extent of community engagement overall: community members led or collaborated on intervention delivery in all eleven included studies. Two processes of community engagement were reported: bidirectional communication and the use of facilitators, but none of the studies evaluated these processes.

Professional facilitators were found to be used more often in healthy eating/physical activity studies, but peer facilitators were more often seen in studies of disparate topics. Peer facilitators were used more often in youth-focused interventions, and professional facilitators were used more often in interventions targeting older participants.

Studies focused on women only may build in the use of either peer or professional facilitators to aid in the delivery of the intervention, although again the numbers of studies with these characteristics are very small.

Facilitators were used slightly more often in interventions directed towards minority ethnic groups, and the facilitators used could be either peer or professional in these cases. Finally, facilitators (peers or professionals) were not used more often in studies with a higher extent of community engagement, suggesting that in this set of studies, higher engagement is not related to the use of facilitators.

Meta-analyses and meta-regression

A series of meta-analyses showed no evidence of beneficial effects on any outcome (i.e., self-efficacy, social support, behaviour, clinical and primary health outcomes). When we focused on the primary outcomes, moderate heterogeneity between studies was observed, suggesting the existence of potential moderators. However, none of the tested study characteristics explained variation in the effect size estimates across studies.

Qualitative comparative analysis

Overall, the effect sizes for the studies in this review were very small overall. QCA suggested that including a facilitator in the delivery of online social media/social networking interventions demonstrated higher effect sizes for studies that focused on topics other than healthy eating and physical activity which did not employ the use of theory in intervention development. The use of this combination of conditions is conceptually well supported, lending confidence to its findings. However, it must be considered that these findings are exploratory in nature and should be evaluated robustly in future intervention development and evaluation.

Discussion

The findings from this analysis suggest that online social media and online social networks, despite being a growing area, have not been utilised greatly in terms of community engagement in health. The dataset that proved eligible for this review was very small (n=11) and consisted of no UK studies. This lack might not be significant as the studies took place in virtual environments. However, it does reflect the proportionate difference in published studies across countries.

Across the studies included in this review, it was found that researchers were using online social media and social networks as an 'add-on' tool, rather than as a community engagement initiative in its own right. Therefore, there is a subsequent lack of understanding about the direct effect of online social media and social networks on health outcome changes, since their use cannot be separated from other intervention components employed in the studies.

The QCA indicated that direct comparisons of community engagement (versus none) did not occur more often in studies with higher effects sizes. This might be a reflection of the minimal amount of community engagement, occurring in only three studies, rather than a lack of effect.

It was noted that the length of time after which the evaluation of the online social media or social network occurred varied across the studies. Considering the potential differences in the nature of online social media compared to social networks, we suggest that it is necessary to understand better how much time is needed to detect change in these different interventions and whether the timings of the evaluations were appropriate.

For Review 3, we found a lower overall extent of community engagement, particularly involvement in design and evaluation, than in the coalitions/collaborations/partnerships synthesis and the CERI review. Potentially, these might not be showing positive effects because there is so little 'true' community engagement in them (i.e. involving people in designing or evaluating the intervention). Currently, online social media and social networks appear to be used as a social support mechanism, but they are not evaluated well enough yet to be able to know whether these platforms are achieving this or not.

The process of community engagement identified in the review on coalitions, Reviews 1 and 2 (Brunton et al. 2015a, b) was not demonstrated in these studies.

The use facilitators was not described or evaluated in the included studies, making commentary on the nature or impact of their involvement difficult. The type of person who facilitated was varied (peer versus professional). Although facilitator type varied across health topics and age groups, this did not appear to impact on effects according to the QCA.

Across the studies we found no evidence of effectiveness for any outcomes, neither for our categories nor for the stated primary outcomes.

Moderate heterogeneity suggested that potential moderators were present, but none of

the hypothesized characteristics explained variation in effect sizes with respect to primary outcomes. Testing for moderators of self-efficacy, social support, behavioural and clinical outcomes was not possible due to the low number of included studies. Likewise, it was not possible to test for age, gender or low income as moderators of effectiveness.

QCA indicated that studies that used online facilitators tended to show slightly higher effect sizes, but only in non-healthy eating/physical activity interventions that were not based on theory. The small effect sizes noted in our synthesis resonate with those found in other reviews of online interventions for healthy eating and physical activity, and are considerably smaller than have been demonstrated in such interventions undertaken face to face. This suggests a need to test the relative effectiveness of face-to-face versus online interventions for weight management/obesity prevention.

The studies included in this review provide inconclusive evidence (i.e. of very small positive and negative effects) for the online social media or social networking interventions studied. Community engagement was limited, not stretching beyond participants infrequently being consulted about what should go into the intervention or discussing topics via the studies that incorporated online social networking sites into their study design. It can be argued that these studies show no evidence that participants are really co-creating knowledge or building social capital.

Gaps in the evidence

Some gaps in the evidence emerged from this synthesis. The moderate to high risk of bias in this set of studies suggests a need for more rigorously conducted evaluations in this area. No UK-based studies were located. We identified a gap in studies with participants were children younger than 16 years of age, amongst 30 to 40 year olds, or targeting people older than 60 years of age. Finally, most of the identified studies utilised some form of multi-component interventions in addition to social media/social networking. This creates challenges in identifying the 'active' component of an intervention. With each new review, a dataset of studies directly comparing the effects of community engagement is slowly being identified, and it is anticipated that future research will be able to rigorously evaluate a direct effect of community engagement on health outcomes.

Conclusions

The results from this study suggest that community engagement is not utilised across the design or evaluation of health interventions, and that the type of engagement undertaken within intervention delivery focuses on peer interactions alone. This suggests that very little co-creation of knowledge or building of social capital takes place (or is simply not reported) in evaluated health interventions. In general, studies of community engagement in social media/social networking interventions focused on young people aged 16 to 25 or those in their 40s, illustrating a gap in evaluated interventions focused on children, those aged 30 to 40 years and older people. Limited evaluations with disadvantaged groups were noted. Meta-analyses suggested evidence of very small mixed effects across studies; and a limited meta-regression indicated that effectiveness could not be ascribed to any programme features. Qualitative comparative analysis found that interventions utilising online facilitators tended to occur in effective outcome studies, but only in studies that did not focus on healthy eating or physical activity interventions. This, combined with the very small mixed effects found particularly in relation to face-to-face healthy eating/physical activity interventions, suggests a need to compare the effects of online versus face-to-face interventions on this topic. Future research to evaluate the direct effect of community engagement in changing outcomes is needed.

Evidence statements

RQ1. What is the extent of community engagement across design, delivery and evaluation in online social media and online social networking interventions?

There is evidence from all eleven studies of community engagement in the delivery of a variety of health interventions; however only two studies additionally involved community members in design consultation or collaboration,[6,10] and no studies described community member involvement in intervention evaluation. This is 'weak' evidence due to the unclear theoretical mechanisms underpinning the use of community members, the lack of evaluations of community engagement, and based on the high to moderate risk of bias across studies.

RQ2. What health issues and populations have been studied using online social media/social networking?

There is evidence of health issues focused on healthy eating/physical activity,[1,3,4,7,11] cancer detection and screening[8], diabetes,[6] general wellbeing and lifestyle,[5] sexual health,[2] flu immunisation[9], food safety.[10] However there were a low number of studies for each health topic and population. There is evidence of studies focused on populations under 25 years of age[2,4,6,10] or on those over 40 years of age,[1,7,8,11] but gaps in evaluated interventions in those aged under 16, 30 to 40 and over 60. There is inconsistent evidence of studies targeting women only[4,8] and no evidence of studies targeting men specifically. There is inconsistent evidence of social media/social networking interventions directed to minority ethnic groups.[2,3]

RQ3. How effective are online social networks in improving health and wellbeing and reducing health inequalities?

There is no evidence of effectiveness from ten RCTs[1-9, 11] and one quasi-experimental study[10] that online social networks or social media are effective in improving health and wellbeing or reducing health inequalities. Studies showed very small mixed effects; further the methodological quality of eight of the ten studies indicated a moderate or high risk of bias.

RQ4. Do particular programme features (e.g. health topic, extent of engagement, population type) account for heterogeneity in effect size estimates across studies?

Based on the eleven included studies there is no evidence that any programme features account for heterogeneity in the effect size estimates across studies. This is in part because so little variation in effect sizes occurred, and also because too few studies provided data amenable to regression analyses.

RQ5. Which processes of community engagement are more aligned with effective interventions?

Weak evidence from nine studies[1-4, 6-9, 11] suggests that employing either peers or professionals to facilitate online discussion forums more often has effective outcomes. This evidence is weak because of the high to moderate risk of bias across studies, the limited number of studies showing effective outcomes in comparison to those showing no effect, and the very small effect sizes between studies.

1. Brindal et al 2012 (-)[1]
2. Bull et al. 2012 (-)

[1] Studies which were deemed to have reported a majority of characteristics denoting good internal validity (i.e. study conduct) and external validity (i.e. generalisability) were rated with an overall ++. Studies rated an overall + if their internal validity scores were at least +. Studies rated an overall - if their internal validity score was rated as -.

3. Carr et al. 2013 (++)
4. Cavallo et al. 2012 (+)
5. Cobb and Poirier 2014 (+)
6. Hanberger et al. 2013 (+)
7. Hansen et al. 2012 (-)
8. Hwang et al. 2013 (-)
9. Lau et al. 2012 (++)
10. Mayer and Harrison 2012 (-)
11. Turner-McGrievy and Tate 2011 (+)

1. Background

1.1 Review context

This study is the third and final review of our work on the use and effectiveness of community engagement in interventions that target health behaviours and outcomes among disadvantaged communities. In the previous Reviews 1 and 2, we focused on projects that utilised coalitions, collaborations or partnerships with community members (Brunton et al. 2015a, b). Studies evaluating online social media and networks are the focus of this synthesis, using a subset of interventions that were identified but not synthesised in Review 1 (Brunton et al. 2015a).

1.2 Community engagement and social media/social networking

Preventable harmful behaviours, such as smoking, alcohol consumption and overeating, have been identified as a major cause of mortality and morbidity, and interventions to change such behaviours are key to improving population health (Michie and Johnston 2012). Involving communities in decision making and in the planning, design, governance and delivery of interventions has become central to guidance and national strategy for promoting public health (Department of Health (DH) 2002, 2004, 2005). The National Institute of Health and Care Excellence (NICE) plays a crucial role in providing guidance on best practice for community engagement. Since the publication of NICE community engagement guidance (NICE 2008), there has been considerable activity with a view to understanding the nature of community engagement, its benefits, and challenges in its evaluation (for example Sheridan and Tobi 2010).

Community engagement can take many forms, including volunteering, peer delivery, community coalitions, advocacy and social networks; and community members can be involved to varying degrees within a public health strategy, including leading, collaborating, consulting or being informed about the design, delivery or evaluation of an intervention (O'Mara-Eves et al. 2013). Our previous research suggests that interventions that utilise community engagement show large beneficial effects, and in projects where community members lead, or collaborate in the design, delivery and evaluation of health interventions, greater beneficial effects for behavioural outcomes are seen (O'Mara-Eves, et al. 2013; Brunton et al. 2015a, b). Further, behavioural outcomes appear to be larger for interventions focused on infection or injury prevention in comparison to other health domains such as healthy eating, physical activity or mental health (Brunton et al. 2015b).

The number of online, electronic peer-to peer social networking sites and social media applications has increased exponentially in recent years. Social network sites include MySpace, Facebook, LinkedIn, Cyworld and Bebo. Social media tools include those such as Twitter, which is now estimated to have approximately 15 million users in the UK (Wang 2013) and newer vehicles such as Tumblr, Instagram and Snapchat. This growth mirrors the rapid technological advances in Internet interaction via the Web and newer accessing methods such as cloud computing (Laranjo et al. 2015). This social interaction through online social media and online social networks is considered an emerging form of community engagement (Kavanaugh and Patterson 2001).

Online social media and online social networking are terms that are used interchangeably, but there are differences. Online social media refers to a group of mobile and web-based technologies where information is shared or exchanged, discussed or co-created (Kaplan and Haenlein 2010; Kietzmann and Hermkens 2011). However, online social networks are more interactive, with a focus on bidirectional/multidirectional interaction. Boyd and Ellison (2007) define online social network sites as 'web-based services that allow individuals to (1) construct a public or semi-public profile within a bounded system, (2)

articulate a list of other users with whom they share a connection, and (3) view and traverse their list of connections and those made by others within the system' (p.211). Therefore, while social media appear to engage communities broadly and perhaps somewhat superficially through information or knowledge exchange, social networking seeks to develop community engagement itself. This suggests that the use of an online social network or exchange of information through social media encompasses both a type of community engagement and a method of delivering an intervention. However, it is unclear how far community members build these 'virtual communities' through their involvement in the initiation, development and evaluation of the online social network or online social media application.

Online social networks allow individuals to build a network of connections with other users virtually. In the context of health promotion, such networks are usually employed as a platform for mental health and social support, and provision of health-related information (Eysenbach et al. 2004; Laranjo et al. 2015). Some suggest that the principles of social cognitive theory underlying information exchange in social media interventions present a potential for successful health promotion interventions (Yoon and Tourassi 2014). Online social media and online social networking sites are increasingly being used by both children and adults (Maher et al. 2014). There is thus a growing potential for reaching large numbers of diverse populations with health promotion interventions using online social media and social networks.

Nonetheless, existing evidence on the effectiveness of online social media networks applied to health is equivocal, with reviews of intervention studies reporting null, positive and mixed findings. For example, in a recent meta-analysis a positive mean effect on health behaviour outcomes was reported (Hedges' g = 0.24; 95% CI 0.04–0.43), though substantial heterogeneity in effect size estimates was present (Laranjo et al. 2015). A systematic review by Maher et al (2014) reported a range of effect sizes, but these generally did not reach statistical significance. In considering these findings, the authors noted that participant attrition was variable and fidelity and engagement were very low (5-15%). Two other systematic reviews report that there was no robust evidence for effectiveness of online social networks (Eysenbach et al. 2004; Niela-Vilén et al. 2014). Many of these findings are difficult to interpret, as the reviews combine studies that contain both direct comparisons of standalone online social network/social media interventions and those which contain online social interventions as one part of more complex, multi-component interventions designed for self-management or therapy. In the latter type of intervention, the studies effectively prevent an exclusive examination of the effectiveness attributable to online social media/social network element(s). Only some of the interventions were explicitly based on theories of behaviour change such as 'social network' and 'social cognitive' theories. These interventions may have been more effective because they were based on pre-existing theory (Taylor et al. 2012). In addition, some of the identified reviews were fairly limited in scope, focusing only on a small range of health behaviours and outcomes (Laranjo et al. 2015; Maher et al. 2014) or on specific populations such as parents or pregnant women (e.g. Niela-Vilén et al. 2014). One exception is a systematic review by Eysenbach et al. (2004), which examined health intervention in the broadest sense to include emotional and social support, health education or health-related behaviour change. In this review, social networks were defined as a:

> group of individuals with similar or common health related interests and predominately non-professional backgrounds (patients, healthy consumers or informal caregivers) who interact and communicate publicly through a computer communication network such as the internet, or through any other computer based tool (including non-text based systems such as voice bulletin board system) allowing social networks to build over a distance (p.1).

Of the 45 included studies, 20 RCTs were identified. These included six interventions categorised as standalone online social networks, though most of the 'standalone' interventions included trained health professionals as moderators or facilitators of the groups.

Our previous work on community engagement suggests further need for investigation of whether engagement across all aspects of design, delivery and evaluation could impact on effectiveness, and whether specific objectives such as injury prevention or infection prevention are more effective using online social media or social network interventions. Heterogeneity in effects across studies might also be explained by other intervention elements, such as whether the social network intervention was standalone or part of a multi-component intervention and whether health professionals acted as moderators or facilitators of the groups. The examination of participant characteristics and intervention elements using meta-regression and QCA may identify elements that moderate the effectiveness of online social network interventions and explain what works, for whom, and under what circumstances.

For this review, we will adopt the definition of online social networks provided in the review by Eysenbach et al. (2004), which encompasses a broader range of health behaviour targets than other reviews. We synthesise the most recent controlled trials of online social network and social media interventions.

1.3 Aims and objectives of the review

The aim of the synthesis undertaken in Review 3 is to examine and evaluate the processes and extent of community engagement in research projects that utilised social media and social networking. This is done for the purpose of informing NICE PHAC members about the likely components and processes required for successful community engagement online.

1.4 Research questions

The review addressed the following five research questions (RQ):

> *RQ1. What is the extent of community engagement across design, delivery and evaluation in online social media and online social networking interventions?*
>
> *RQ2. What health issues and populations have been studied using online social media/social networking?*
>
> *RQ3. How effective are online social networks in improving health and wellbeing and reducing health inequalities?*
>
> *RQ4. Do particular programme features (e.g. health topic, extent of engagement, population type) account for heterogeneity in effect size estimates across studies?*
>
> *RQ5. What processes are aligned with effective interventions?*

1.5 Review team

The review team comprised researchers from the Evidence for Policy and Practice Information and Coordinating (EPPI-) Centre at UCL Institute of Education. The team has a history of undertaking innovative systematic reviews that incorporate the public's views during the reviews' design, conduct and evaluation (i.e. advisory groups and report peer review). The EPPI-Centre team has undertaken a large-scale systematic review and meta-analysis examining the conceptual framework, processes, effectiveness and cost-effectiveness of community engagement strategies (O'Mara-Eves et al. 2013).

The team and their roles for the current review were as follows: Gillian Stokes, a Research Officer, was a co-investigator performing literature searches, screening, coding, data extraction and narrative synthesis, and led on the report write-up. Michelle Richardson, a Research Officer, was a co-investigator whose role was data extraction, screening, coding, data extraction and acting as lead analyst on the meta-analysis modelling. Ginny Brunton,

a Research Officer, acted as principal investigator, lead and project manager for the review, guiding conceptual development and leading on the qualitative comparative analysis and framework synthesis. Meena Khatwa, a Research Associate, assisted with data extraction. James Thomas, a Professor of Social Policy, was a co-investigator, contributing to conceptual development. Each team member has declared no conflict of interest.

2. Methodology

2.1 Searching for relevant literature

A detailed account of the original search process is reported elsewhere (Brunton et al. 2015a, b). In brief, citations of potentially relevant systematic reviews and trials were identified through searching key electronic registers. Screening of systematic reviews' included studies and reference lists provided potentially relevant trial citations. These were combined with citations identified from searching key electronic trials registers. Searching and screening of these trials on the basis of title and abstract identified a total of 226 potentially relevant community engagement studies. These have been combined with social media intervention studies identified in our previous review of community engagement (O'Mara-Eves et al. 2013). Backward (searching the references of included articles) and forward (searching for articles citing included articles using Web of Knowledge) citation chasing has also been used to locate further primary articles of potential relevance.

2.2 Screening

Reference titles and abstracts that were identified in two previous reviews on community engagement were re-screened for inclusion in this synthesis. The purpose of the re-screening was to identify studies that had used online social media or online social networking and that fitted within the predefined terms of community engagement. The search strategies employed are described in full in these reviews (O'Mara Eves et al. 2013 and Brunton et al. 2015a). Reference titles and abstracts had to meet the following inclusion criteria as specified previously in Review 1 (see Brunton et al. 2015a):

1) published in the English language; in an OECD country;
2) using a control/comparison group intervention design;
3) targeting disadvantaged populations;
4) evaluated using at least one health or social outcome.

To be included in the syntheses for Review 3, references additionally had to:

5) explicitly describe the use of online social media or online social networking;
6) provide data on community engagement;
7) provide data on health outcomes at a minimum.
8) be published after 2004 (inception date of Facebook).

The nine exclusion criteria were applied to the identified titles and abstracts of all the potentially relevant trials identified. Full-text reports of relevant references were retrieved and re-screened using the same criteria.

2.3 Data collection and analysis

The relevant full-text studies were then rated for their methodological rigour and quality using the critical appraisal checklists provided in the manual *Methods for the development of NICE public health guidance* (NICE 2012). Data extraction forms were developed to record relevant study characteristics (e.g., population and intervention elements) and statistical information for each trial that met the inclusion criteria. For each relevant outcome effect size, estimates and sample sizes (or statistics that could be used to derive these) were extracted for the treatment and control groups where available. Based on an earlier model of causality (O'Mara-Eves et al. 2013), data were extracted for each of the outcomes in the causal pathway (i.e., self-efficacy outcomes, social support outcomes, health behaviour outcomes and clinical outcomes) where present. Where more than one outcome measure was reported per outcome type from different points in the causal

pathway, the primary outcome was selected for that domain, with reference to the aims and objectives of the intervention. The single primary outcome for each study was also identified, as specified by the study authors, or if unspecified, was selected with reference to the aims and objectives of the intervention. Effect sizes were calculated to summarise the impact of the interventions. Because many of the outcomes used different scales and different combinations of continuous and dichotomous data, we used the standardised mean difference (White and Thomas 2005) to compare and combine results. We transformed binary data to standardised mean difference effect sizes using the methods described in Chinn (2000). Adjusted effect size estimates were used in preference to unadjusted when available. Effect sizes were extracted from each study for meta-regression. When necessary, authors were contacted for missing data to enable standardised effect sizes to be calculated. Data were reverse coded when necessary, such that a positive value indicated that the intervention favoured the intervention or treatment group. A positive *d* indicates that participants in the treatment group, on average, scored higher than those in the control group. An effect size estimate of $d = 1$ means that participants in the treatment group scored, on average, one standard deviation higher than participants in the control group on the outcome measured.

Evidence tables were completed using templates based on those provided in the NICE methods guidance (NICE 2012). Two reviewers independently conducted data extraction, and the final version was agreed upon to maintain accuracy. Where necessary, a third team member arbitrated in disagreements.

2.4 Data syntheses

To answer our research questions about the extent of community engagement across design, delivery and evaluation in online social media and online social networking interventions and the health issues and populations under study, we undertook a descriptive analysis and framework synthesis. To evaluate the effectiveness of community engagement within the context of online social media and online social network interventions, we undertook a synthesis comprised of three interconnected parts:

1) meta-analyses to pool effect size estimates across the included studies;
2) a statistical moderator analysis, to test identified sub-groups for differential effectiveness, based on predefined intervention elements;
3) a synthesis using qualitative comparative analysis (QCA), aiming to generate theory about the *necessary* and *sufficient* intervention components that are associated with effective interventions.

Each method is described in more detail below.

2.4.1 Descriptive analysis/framework synthesis

These analyses were conducted to answer RQ1: What is the extent of community engagement across design, delivery and evaluation in online social media and online social networking interventions? and RQ2: What health issues and populations have been studied using online social media/social networking? Using the characteristics of studies coded during the data extraction process, a descriptive analysis was undertaken by summarising the frequencies of different study characteristics. A framework synthesis was undertaken of the processes of community engagement and their relationship to health topic, age group, gender, disadvantaged groups and extent of community engagement, utilising an existing conceptual framework (O'Mara-Eves et al. 2013; Brunton et al. 2015b).

2.4.2 Meta-analysis

A series of meta-analyses was conducted to test RQ3: How effective are online social network interventions at improving health and wellbeing and reducing health inequalities?

To explore the effectiveness of social network/social media approaches at improving

health and wellbeing outcomes, random-effects models were fitted using the methods described in Lipsey and Wilson (2001). Separate analyses were conducted for each outcome in the causal pathway, i.e. self-efficacy outcomes, social support outcomes, health behaviour outcomes and clinical/physiological outcomes, and for the primary outcomes. Analyses were conducted separately for standardised mean differences recorded using means at follow-up (final scores), and change from baseline at follow-up (mean changes), given that means and mean changes are not equivalent, often having substantially different standard errors.

2.4.3 Meta-regression

A series of meta-regressions was conducted to test RQ4: Do particular programme features account for heterogeneity in effect size estimates across studies? To explore between-study heterogeneity, meta-regression models were fitted (where data permitted) using the *metareg* command in Stata v.12.1 (Statacorp, College Station, TX). Planned analyses were conducted where there was evidence of heterogeneity. A range of programme features, including extent of community engagement, health target, theoretical basis of the intervention and inclusion of health professionals, was assessed. A minimum of eight studies was considered sufficient for undertaking meta-regression analyses, and for dichotomised constructs, at least three studies were required in each category. For each potential moderator, we reported the pooled effect size and corresponding 95% confidence intervals (CIs), the proportion of between-cluster variability (Adjusted R^2) accounted for by the moderator variable; I^2 - the proportion of residual between-study variation due to heterogeneity (Higgins and Thompson 2002) and Cochran's (1954) *Q* test for heterogeneity, with a *p*-value less than 0.05 taken to indicate evidence of heterogeneity (Borenstein et al. 2009).

2.4.4 Qualitative comparative analysis

Using the programme features identified in the synthesis, we conducted qualitative comparative analysis (QCA) to explore RQ5: What processes are more aligned with effective interventions?

The studies included in the QCA are those that tested a direct comparison of online social networks or social media with and without health professionals as moderators or group leaders, OR a sub-set of studies from the other-moderator analysis, which enables us to explore issues which the first analysis was unable to resolve. This approach has been used to develop theory on the *necessary* and *sufficient* intervention characteristics that are associated with effectiveness.

We then used the outcome of our moderator analyses to initiate a 'dialogue' between the data and the analysis, resulting in additional study characteristics being captured. The output from this process was used to develop new theory to explain why particular outcomes have been observed, based on an iterative examination of study characteristics and their outcomes (Thomas et al. 2014).

2.5 Quality assurance

Two researchers, in consultation with our information scientist, developed search strategies. The nine inclusion criteria were applied to the identified titles and abstracts of all the potentially relevant trials identified. To trial the screening criteria, a pilot round of screening was conducted on a random selection of 30 document titles and abstracts, and modified where necessary. Two reviewers screened the titles and abstracts independently with disagreements reconciled through discussion and moderation by a third researcher where necessary. Where insufficient information was available in the title and abstract to make a decision, the full-text article of the document was retrieved for further inspection. Once the title and abstract screening was complete, the full-text documents were retrieved for those records marked for inclusion. The retrieved documents were then

re-screened independently by two reviewers on the basis of the detail available in the full-text article. Those documents that passed the inclusion criteria on the basis of full-text screening were included in the review. Measures of inter-rater agreement (the percent agreement and Cohen's kappa) were above 0.80.

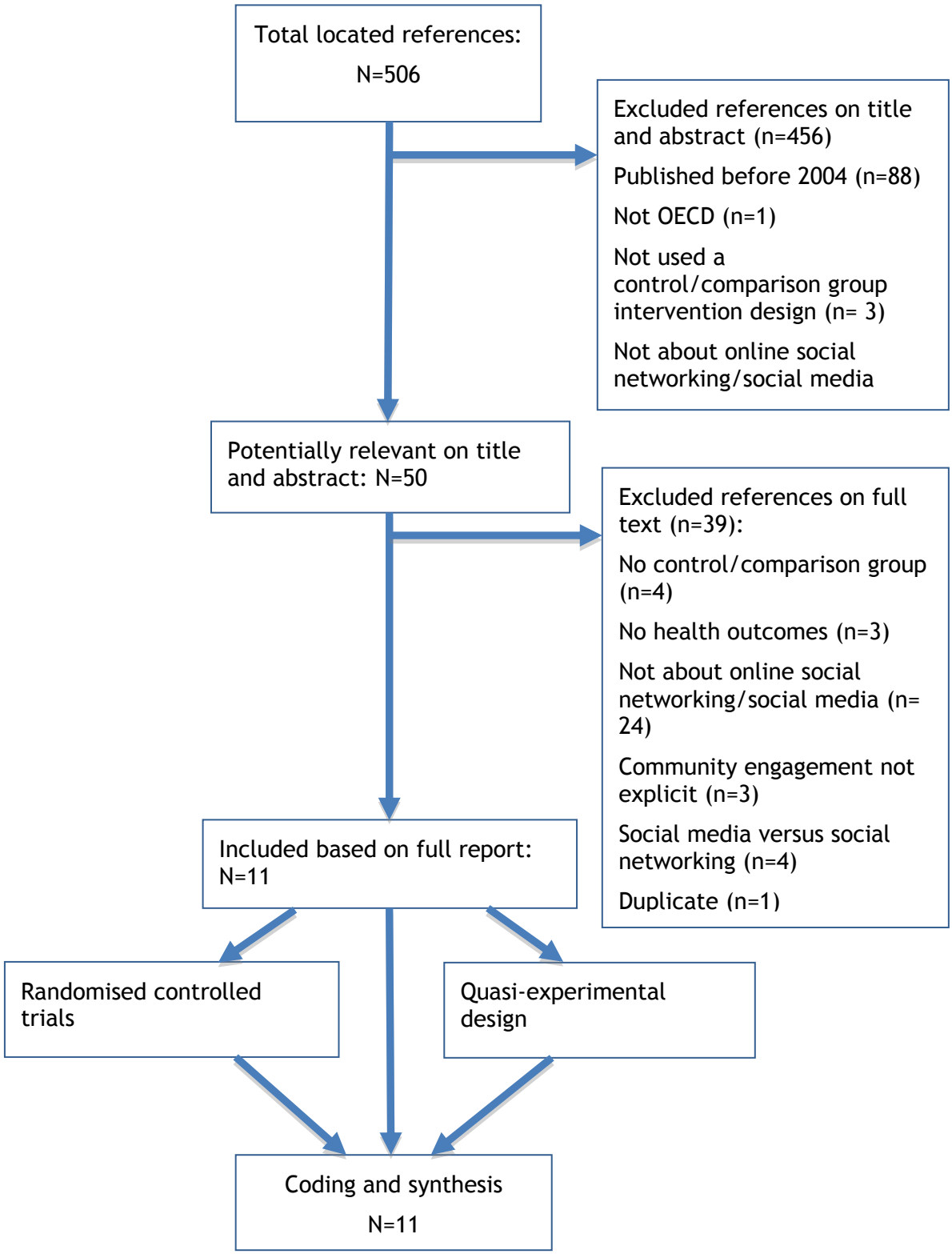
Two reviewers independently conducted data extraction, and the final version was agreed upon to maintain accuracy. Where necessary, a third team member arbitrated in disagreements. Evidence tables were completed using templates based on those provided in the NICE methods guidance (NICE 2012). The records identified by the searches were uploaded to the specialist systematic review software, EPPI-Reviewer 4, for duplicate stripping and screening (Thomas et al. 2010). This software was used to record the bibliographic details of each study considered in the review, where studies were found and how, and the reasons for their inclusion or exclusion. EPPI-Reviewer 4 was also employed to conduct and record the data extraction, coding and quality appraisal stages for the included studies, using the required data fields and appropriate quality checklists detailed in the methods manual (NICE, 2012).

3. Findings: Descriptive analysis

3.1 Study identification

Re-screening of the studies identified in the two previous reviews on community engagement identified 506 potentially relevant references from the 2014 (Brunton et al. 2015a) and the 2013 community engagement review (O'Mara Eves et al. 2013). Prior to embarking on screening, a sample screening of 15 studies was undertaken and yielded an inter-rater agreement of 87%. However, to ensure that no references were missed, it was decided that the studies be double screened. Screening references on titles and abstracts resulted in a total of 50 potentially relevant references. Full-text reports of these were retrieved and re-screened by two reviewers, resulting in a total of eleven included studies. The reasons for exclusion at both title/abstract and full-text screening stages are illustrated in Figure 3.1.

Figure 3.1: Map of included studies



3.2 Characteristics of the included studies

In total, 11 studies were included in this review (Brindal et al 2012; Bull et al. 2012; Carr et al. 2013; Cavallo et al. 2012; Cobb and Poirier 2014; Hanberger et al. 2013; Hansen et al. 2012; Hwang et al. 2013; Lau et al. 2012; Mayer and Harrison 2012; Turner-McGrievy and Tate 2011). The majority of the included studies were published in 2012 (n=6), with the earliest study being published in 2011 (Turner-McGrievy and Tate 2011) and the most recent in 2014 (Cobb and Poirier 2014).

3.2.1 Country of origin

None of the included studies were conducted in the UK. The majority of studies (n=7) were conducted in the USA (Bull et al. 2012; Carr et al. 2013; Cavallo et al. 2012; Cobb and Poirier 2014; Hwang et al. 2013; Mayer and Harrison 2012; Turner-McGrievy and Tate 2011). Two studies were conducted in Australia (Brindal et al. 2012; Lau et al. 2012). The two remaining studies were conducted in Scandinavia, one in Sweden (Hanberger et al. 2013) and the other in Denmark (Hansen et al. 2012).

3.2.2 Study design

All but one of the 11 studies (Mayer and Harrison 2012) were randomised controlled trials (RCTs). Mayer and Harrison (2012) employed a quasi-experimental design for their study into the development and implementation of social media-based interventions for college students to improve students' food safety knowledge, attitudes and practices, in which students from an introductory nutrition course were assigned to either the control or treatment groups.

3.2.3 Type of comparison/control group

The type of control varied, with four of the studies opting for a control group that received no intervention (Hanberger et al. 2013; Hansen et al. 2012; Lau et al. 2012; Mayer and Harrison 2012) and four studies providing the control participant with information only (Brindal et al 2012; Cavallo et al. 2012; Cobb and Poirier 2014; Hwang et al. 2013). The use of existing publically available research was permitted for the control groups in two studies (Bull et al. 2012; Carr et al. 2013) and the remaining study provided the control group with podcast only, as opposed to the podcast plus the enhanced mobile media intervention (Turner-McGrievy and Tate 2011).

3.2.4 Intervention duration/length of time to follow-up

The duration of the studies was varied, ranging from one month (Mayer and Harrison 2012) to one year (Hanberger at al. 2013). Just under half of the studies of the studies (n=5) had a duration of six months (Carr et al. 2013; Hansen et al. 2012; Hwang et al. 2013; Lau et al. 2012; Turner-McGrievy and Tate 2011). Cobb and Poirier (2014) did not specify the study length.

Outcomes were either assessed post-test (n=6) (Brindal et al. 2012; Cavallo et al. 2012; Hanberger et al. 2013; Lau et al. 2012; Mayer and Harrison 2012; Turner-McGrievy and Tate 2011) or via repeated measures during the duration of the study (n=5) (Bull et al. 2012; Carr et al. 2013; Cobb and Poirier 2014; Hansen et al. 2012; Hwang et al. 2013).

3.2.5 Health topic focus

The nature of the primary health care issues that were addressed was varied. Three studies focused on physical activity (Carr et al. 2013; Cavallo et al. 2012; Hansen et al. 2012). Two studies focused on obesity prevention or weight reduction (Brindal et al. 2012; Turner-McGrievy and Tate 2011). The remaining studies were disparate, covering cancer detection and screening (Hwang et al. 2013), diabetes (Hanberger et al. 2013), general wellbeing and lifestyle (Cobb and Poirier 2014), flu immunisation (Lau et al. 2012), sexual health (Bull et al. 2012) and finally food safety (Mayer and Harrison 2012).

Health issues that were incorporated into the interventions were mainly based on physical activity (n=6) (Brindal et al 2012; Carr et al. 2013; Cavallo et al. 2012; Cobb and Poirier 2014; Hansen et al. 2012; Turner-McGrievy and Tate 2011). Three studies incorporated healthy eating or nutritional issues (Brindal et al. 2012; Cobb and Poirier et al. 2014; Turner-McGrievy and Tate 2011). Hanberger et al. (2013) focused on diabetes and aspects related to the condition, with the Diabit Web 2.0 portal that provided diabetes-related information and communication with local practitioners, interaction with peers and access to relevant information and diabetes services. Hwang et al. (2013) focused on cancer screening. In the Cobb and Poirier (2014) study, aspects of mental health were also incorporated.

3.2.6 Type of online platform

The type of online social media or networking platform employed was mainly purpose built, using interfaces designed specifically for the study (n=4) (Carr et al. 2013; Hanberger et al. 2013; Hansen et al. 2012; and Lau et al. 2012). Carr et al. (2013) incorporated an 'Ask the Expert' question-and-answer forum for social support, and updates of peer physical activity. This was to engage participants in their enhanced Internet physical activity programme called Step into Motion, which employed self-monitoring and goal setting, where participants logged their physical activity in terms of minutes into a calendar. In the case of Hanberger et al. (2013) their intervention (Diabit Web 2.0) contained social networking functions that included a storyboard, a simple blog module and also discussion boards. Hansen et al. (2012) provided a forum and discussion page for questions from participants, in conjunction with a personal profile page that provided tailored physical activity advice and a page dedicated to providing training programmes and general recommendations. For their study into the impact of a web-based personally controlled health management system entitled *Healthy.me* on influenza vaccination and health service utilisation rates, Lau et al. (2012) incorporated social forums and messaging to allow consumers to interact with each other and with healthcare professionals.

Two studies employed pre-existing purpose-built platforms (Hwang et al. 2013; Cobb and Poirier 2014). Hwang et al. (2013) in their study focused on colorectal cancer screening used a pre-existing health-specific online platform in the form of 'SparkTeam' a private-study arm of SparkPeople, an online weight-loss community. Via SparkTeam, the participants were able to access the narratives and interact with the narrators and other participants, in order to connected unscreened individuals to positive role models who were also online community members. In the Cobb and Poirier study (2014), participants were encouraged to recruit individuals from their 'real-life' social networks and connect with these individuals within the *Daily Challenge* email, web and mobile-based intervention.

Two studies used Facebook pages (Bull et al. 2012; and Mayer and Harrison 2012). Cavallo et al. (2012) employed a Facebook group in their study into a social media-based physical activity intervention (Internet Support for Healthy Associations Promoting Exercise (INSHAPE)) to encourage participants with an existing Facebook account to exchange social support. Twitter was used by Turner-McGrievy and Tate (2011). Brindal et al. (2012) used a combination of two platforms. To begin, a purpose-built online social networking platform allowed the participants to create a profile page and a blog, either personal or public. From there, the participants could forge online friendships, sending friend requests that, once accepted, allowed participants to access the content on the profile pages of confirmed 'friends'.

3.2.7 Role of online platforms

These platforms were mainly used to share relevant information about the studies' particular health topics (Brindal et al. 2012; Bull et al. 2012; Carr et al. 2013; Cavallo et

al. 2012; Hanberger et al. 2013; Lau et al. 2012; Turner-McGrievy and Tate 2011) and to share experiences (Bull et al. 2012; Cavallo et al. 2012; Cobb and Poirier 2014; Hanberger et al. 2013; Hansen et al. 2012; Hwang et al. 2013; Lau et al. 2012; Turner-McGrievy and Tate 2011). Cobb and Poirier (2014) further used the platform for monitoring the behaviour and self-regulation of participants. Participants were rewarded with points, badges and other virtual rewards for engaging with the Daily Challenge. In the case of Hansen et al. (2012) the platform was used to encourage the use of a training buddy by providing access to search for training partners in a second forum. In two studies (Lau et al. 2012; Mayer and Harrison 2012), the active content of the site was not reported.

3.2.8 Other intervention components

All but two studies (Hwang et al. 2013; Mayer and Harrison 2012) used additional intervention components. In the majority of studies (n=7), this was in the form of purpose-built online platforms with health-specific material. Turner McGrievy and Tate (2011) employed the use of a diet and physical activity monitoring application (app). This app was a version of FatSecret's Calorie Counter app from FatSecret.com. Cobb and Poirier (2014) also used telephone and email in addition to social media. However, the type of additional component was unclear for one study (Bull et al. 2012). These components were employed for a variety of reasons; however, all but one study (Turner-McGrievy and Tate 2011) presented multiple reasons. Seven studies used the additional intervention components to provide information or to educate the participants (Brindal et al. 2012; Carr et al. 2013; Cavallo et al. 2012; Cobb and Poirier 2014; Hanberger et al. 2013; Hansen et al. 2012; Lau et al. 2012). Six studies used additional interventions to encourage self-regulation (Carr et al. 2013; Cavallo et al. 2012; Cobb and Poirier 2014; Hansen et al. 2012; Lau et al. 2012; Turner-McGrievy and Tate 2011). Four studies employed the additional intervention as a platform for interaction with an expert (Carr et al. 2013; Cavallo et al. 2012; Hanberger et al. 2013; Hwang et al. 2013). Other reasons for utilising an additional intervention was to change or monitor social norms (Carr et al. 2013; Hansen et al. 2012). In the case of Carr et al. (2013) this was to increase and improve physical activity behaviour in previously sedentary adults. Hansen et al. (2012) examined whether access to a website with individually tailored feedback and suggestions on how to increase physical activity would improve physical activity, anthropometrics, and health measurements; they provided training programmes and general recommendations. The same two studies also used these additional components to improve the skills of the participants. Two studies (Bull et al. 2012; Carr et al. 2013) used additional interventions to provide devices to help participants, and another (Lau et al. 2012) used additional interventions to provide access to appointment booking.

The duration of the additional interventions matched the duration of the online social media interventions in all studies that employed them, apart from one in which the duration of the additional intervention was not specified (Bull et al. 2012).

In the majority of studies (n=8) the provider of the additional potentially active content was either automated or anonymous (Brindal et al 2012; Carr et al. 2013; Cavallo et al. 2012; Cobb and Poirier 2014; Hanberger et al. 2013; Hansen et al. 2012; Lau et al. 2012; Turner-McGrievy and Tate 2011). Two of the studies (Hanberger et al. 2013; Lau et al. 2012) also had content that was provided by health professional or experts.

3.2.9 Relative importance of the online social media/networking intervention component

In terms of the relative role of online social media/social networking with respect to other intervention components, social media/social networking was the primary intervention in three of the included studies (Bull et al. 2012; Hwang et al. 2013; Mayer and Harrison 2012). For almost half of the studies (n=5) however, the online social media/social networking interventions were considered equal to the other interventions in the studies (Brindal et al. 2012; Cavallo et al. 2012; Cobb and Poirier 2014; Hanberger et al. 2013;

Turner-McGrievy and Tate 2011). For three studies (Carr et al. 2013; Hansen et al. 2012; Lau et al. 2012) the online social media element was considered subsidiary to another intervention.

3.2.10 Use of prompts/reminders

Participants were prompted to access the online social media/social networking intervention in six studies (Brindal et al 2012; Carr et al. 2013; Cavallo et al. 2012; Hansen et al. 2012; Hwang et al. 2013; Turner-McGrievy and Tate 2011). Frequent email and telephone prompts were employed by Brindal et al. (2012) to improve participant retention rates. Carr et al. (2013) also emailed regular prompts to remind participants to access their website; weekly during the first month, biweekly during months 2 and 3, and monthly from month 4 to 6. Intervention participants were encouraged via emails, website instructions and moderator messages to ask for and provide social support related to increasing physical activity through the physical activity–themed Facebook group in the Cavallo et al. (2012) study. In the Hansen et al. (2012) study, participants who did not log on to the website or make a personal profile were sent two email reminders to encourage them to become involved with the intervention. Further reminder emails were sent to participants who had created a personal profile to keep the profile updated after 4, 8, 12 and 16 weeks. In the Hwang et al. study (2013), emails were also used as reminders, with up to three additional reminders being sent within 2 weeks of the initial email to those who had not yet viewed the information. In the Turner-McGrievy and Tate (2011) study, Twitter was used as a method of prompting via automated messages from the study co-ordinator as well as being the method by which participants supported each other during the intervention.

3.13 Extent of community engagement

No studies demonstrated a high level of community engagement, where participants were involved in the three measured elements: design, delivery and evaluation. The community was not explicitly involved in identifying the health need for any of the 11 included studies. Only two studies (Hanberger et al. 2013; Mayer and Harrison 2012) were rated as having a moderate level of community engagement. This indicates that participants were involved in two elements of the study process. For both of these studies, community engagement occurred in the design and delivery element of the process. Generally, the extent of community engagement was low for the majority of studies (n=9) with a score of 1 (Brindal et al 2012; Bull et al. 2012; Carr et al. 2013; Cavallo et al. 2012; Cobb and Poirier 2014; Hansen et al. 2012; Hwang et al. 2013; Lau et al. 2012; Turner-McGrievy and Tate 2011). The score of 1 indicates that participants were only involved in a single element of the study process. No studies demonstrated community engagement in the evaluation process.

3.3 Summary

In summary, the set of studies included in the analysis describes mostly RCT-evaluated interventions of (on average) six months or more conducted in non-UK countries, half of which focused on healthy eating/physical activity topics. The social media/social networking platforms used were mainly purpose built and used to share relevant information about the health topic being addressed; they were an equal or predominant part of a multi-component intervention strategy in most studies. Community members were not involved in identifying the health need or in the design or evaluation of the intervention, instead being involved in intervention delivery by communicating with each other on discussion forums.

4. Findings: Framework synthesis

4.1 Characteristics of included studies

4.1.1 Health topic

Six studies focused broadly on aspects of healthy eating or physical activity (Brindal et al. 2012; Carr et al. 2012; Cavallo et al. 2012; Hansen et al. 2012; Mayer and Harrison 2012; Turner-McGrievy and Tate 2011). The remaining studies focused on diabetes management (Hanberger et al. 2013), influenza immunization (Lau et al. 2012), colorectal cancer screening (Hwang et al. 2013), sexually transmitted infection prevention (Bull et al. 2012), and mental health/wellbeing (Cobb and Poirier 2014).

4.1.2 Age group

Four studies described samples either with a mean age of 26 years or less, or eligibility for inclusion as youth up to age 25 (Bull et al. 2012; Cavallo et al. 2012; Hanberger et al. 2013; Mayer and Harrison 2012). The remaining seven studies either aimed to include participants from an older adult age range or reported a mean age of over 37 years. Four of these studies focused on participants with a mean age of over 40 years (Brindal et al. 2012; Hansen et al. 2012; Hwang et al. 2013; Turner-McGrievy and Tate 2011).

4.1.3 Gender-specific

Only two studies specifically targeted women only (Cavallo et al. 2012; Hwang et al. 2013). Hwang et al. (2013) examined the impact of cancer prevention education and online social support on colorectal cancer screening; Cavallo et al. (2012) targeted female undergraduate students in a physical activity promotion intervention that incorporated discussion forums.

4.1.4 Disadvantaged groups

Only two of the eleven included studies targeted disadvantaged groups. Carr et al. (2013) recruited Latino and Hispanic participants; Bull et al. (2012) recruited African American and Latino men who have sex with men.

4.1.5 Extent of community engagement

All of the 11 included studies employed community members in the delivery of the intervention, in that participants all took part in discussion forums and question and answer sessions. Two studies undertook additional community engagement: Hanberger et al. (2013) and Mayer and Harrison (2012) each developed interventions in collaboration with community members. None of the included studies reported community engagement in the evaluation of the intervention.

4.1.6 Processes of community engagement

Studies were coded according to specific reported processes of community engagement developed from earlier work (Brunton et al. 2015a, b; O'Mara-Eves et al. 2013). All eleven studies reported bidirectional communication through the structure and use of the social media or social networking, where participants in each study had the opportunity to discuss issues and communicate with each other. Only one study described the use of a mandatory five-minute training session on how to use a website (Lau et al. 2012).

One new process of community engagement was identified: the use of online facilitators was described in nine studies (Brindal et al. 2012; Bull et al. 2012; Carr et al. 2013; Cavallo et al. 2012; Hanberger et al. 2013; Hansen et al. 2012; Hwang et al. 2013; Lau et al. 2012; Turner-McGrievy and Tate 2011). Of these, three studies reported using peer facilitators in particular (Bull et al. 2012; Hanberger et al. 2013; Hwang et al. 2013). The remainder utilised health professionals (Hansen et al. 2012; Lau et al. 2012) and

researchers (Brindal et al. 2012; Carr et al. 2013; Cavallo et al. 2012; Turner-McGrievy and Tate 2011). Studies which utilised any type of facilitator in the delivery of the social media/network interventions, and those that used peers in particular, were examined further in comparison to those studies which did not use facilitators. This process was analysed further because variation existed between studies on this particular characteristic. We analysed this process of community engagement in order to determine whether there were differences in the health topics, aspects of age, sex or disadvantaged groups, or the extent of community engagement. These comparisons are discussed below.

4.1.6.1 Use of facilitators across health topics

Of the nine studies using a facilitator, a higher proportion (n=5, 56%) focused on healthy eating/physical activity (Brindal et al. 2012; Carr et al. 2013; Cavallo et al. 2012; Hansen et al. 2012; Turner-McGrievy and Tate 2011). In comparison, only one of the three studies (33%) not using a facilitator was focused on healthy eating (Mayer and Harrison 2012). While a very small number of studies, this suggests that in studies focused on healthy eating/physical activity, facilitators were used more often.

The three studies utilising peer facilitators focused on cancer screening (Hwang et al. 2013), paediatric diabetes management (Hanberger et al. 2013), and prevention of sexually transmitted infections (Bull et al. 2012). These studies differed from those that used a non-peer facilitator in that the latter (i.e. researchers, counsellors, GPs, physiotherapists) focused more on healthy eating/physical activity topics. This indicates that studies utilising peer facilitators are not focused on healthy eating or physical activity. This may be because this type of peer-led role modelling behaviour has been less helpful or simply not considered in healthy eating or physical activity interventions than the use of peers in interventions relating to cancer, diabetes or sexually transmitted infections.

4.1.6.2 Use of facilitators and different age groups

Studies using any type of facilitator were more likely to be directed toward adults. In the nine studies, six (67%) had samples that were predominantly 'adults' (i.e. mean age 30 years and over), compared to three studies (33%) focused on 'youth' (i.e. mean age under 30 years). Two studies did not use facilitators: one each targeted adults and youth. Interventions using peer facilitators were used more often in studies with younger participants than those targeting older participants (67% versus 33% respectively). Studies directed toward adult participants were more often shown to employ professional facilitators than peer facilitators (83% versus 17%).

4.1.6.3 Facilitator use in sex-specific interventions

Both studies focusing on women only employed facilitators to help deliver the intervention (Cavallo et al. 2012; Hwang et al. 2013). The former provided a physical activity intervention to female undergraduate students with professional facilitators, while the latter targeted obese women for cancer screening information provision enlisting the help of peer facilitators. This suggests that studies focused on women only may build in facilitators to aid in the delivery of the intervention.

4.1.6.4 Facilitator use in studies of disadvantaged groups

Two of the nine studies (22%) employing facilitators were focused on disadvantaged groups. Carr et al. (2013) targeted obese Latino and Hispanic Americans, while Bull et al. (2102) focused on STI prevention in African American and Latino youth. The latter study specifically used peer facilitators, while the former study used professionals. None of the studies that focused on non-disadvantaged groups utilised facilitators. This provides some tentative evidence that studies focused on disadvantaged groups more often utilise facilitators as a means of community engagement.

4.1.6.5 Facilitator use and extent of community engagement

Studies with a higher extent of engagement were no more likely to utilise facilitators than studies with a lower extent. Of the two studies that collaborated with community members on intervention design, one utilised facilitators (Hanberger et al. 2013) and one did not (Mayer and Harrison 2012).

4.2 Summary

In summary, the framework analysis indicated that there was little variation within studies in terms of the type of community engagement, in that peer delivery of the intervention was predominant. Further, there was little variation in the extent of community engagement overall: community members led or collaborated on intervention delivery in all eleven included studies; only two involved them in collaboration on the design of the intervention and none involved community members in evaluation. Two processes of community engagement were reported: bidirectional communication (used in all studies) and the use of facilitators (utilised in nine studies), but none of the studies evaluated these processes. These relationships will be tested further in meta-analysis/meta-regression.

Professional facilitators appeared to be used more often in healthy eating/physical activity studies, but peer facilitators were more often seen in studies focusing on other issues. Peer facilitators used more often in youth-focused interventions, and professional facilitators were used more often in interventions targeting older participants. This suggests that different age groups may have different ideas about whom they consider 'expert'.

Studies focused on women only may build in the use of either peer or professional facilitators to aid in the delivery of the intervention, although again the number of studies with these characteristics is very small.

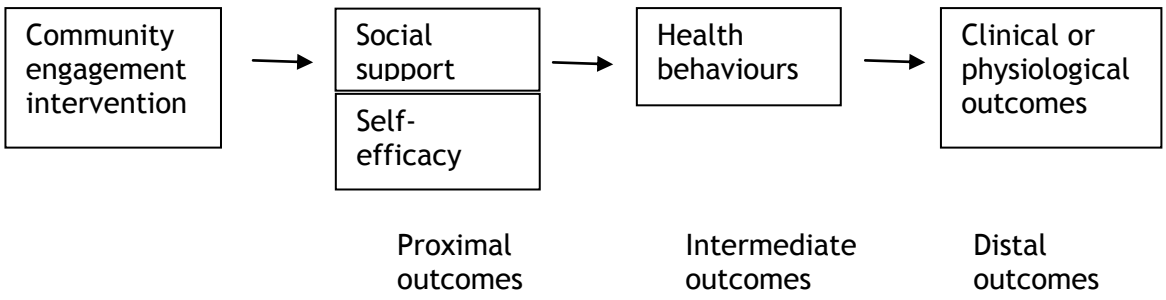
Facilitators were used slightly more consistently in interventions directed toward minority ethnic groups, and the facilitators used could be either peer or professional in these cases. Finally, facilitators (peers or professionals) are not used more often in studies with a higher extent of community engagement, suggesting that in this set of studies, higher engagement is not related to the use of facilitators.

5. Findings: meta-analysis and modelling

5.1 Theoretical framework

A conceptual framework describing a range of dimensions to explore and categorise differences between community engagement approaches was developed by O'Mara et al (2013, p.112). Across studies, a variety of outcomes were used to assess impact. Following the theoretical development based in the original review (O'Mara-Eves et al. 2013), a causal chain was assumed (see Figure 5.1) in which self-efficacy (i.e. belief in capacity to change behaviour) needed to be changed in order for health behaviours (i.e. actions that people do, such as smoking, healthy eating and physical activity) to subsequently have an impact upon physiological or clinical outcomes (such as blood pressure and body mass index). Social support outcomes were also added to the model given their relevance to social network interventions. Social support outcomes were categorised as proximal assessments that precede behaviour following models of behaviour change (reference theory of planned behaviour).

Figure 5.1: Proposed causal pathway from intervention to clinical/physiological outcomes.



5.2 Outcome extraction

Research Question 1: How effective are community engagement approaches at improving health and wellbeing and reducing health inequalities?

To address this first research question, we extracted available data on intervention effectiveness for the following outcomes:

- self-efficacy in relation to health behaviours;
- social support for health behaviours;
- health behaviours (e.g., physical activity, sexual health behaviours);
- physiological or clinical consequences (e.g., body mass index, weight loss).

A total of 17 effect sizes across ten studies were calculated (it was not possible to calculate an effect size for one study). Six studies contributed an effect size estimate for only one domain; of these two studies had a behavioural outcome only, three had a clinical outcome only and one assessed social support only. One study assessed two domains (behaviour and support) and three studies provided an effect size estimate for three domains: two assessed self-efficacy, behaviour and social support and one assessed self-efficacy, behaviour and clinical outcomes. A primary outcome for each of the ten studies was identified.

Table 5.1 highlights the outcomes extracted, the outcome category that they were allocated to, and which of the outcomes were identified as primary. Separate meta-analyses were conducted for outcomes from different points in the causal pathway, i.e. self-efficacy, social support, health, behaviour and clinical outcomes, and additionally for the primary outcomes identified for each study. Table 5.2 summarises the number of

studies contributing to separate meta-analysis by outcome domain, and type of standardised mean difference (final or change score)

Table 5.1: Outcomes, outcome categories and primary outcomes for each of the studies

Author	**Outcome measure(s)**	**Outcome category**	**Primary Outcome**
Brindal et al. (2012)	Weight loss	Clinical	yes
Bull et al. (2012)	Proportion of protected sex acts	Behaviour	yes
Bull et al. (2012)	Condom Self-efficacy	Efficacy	no
Bull et al. (2012)	Condom norms	Support	no
Carr et al. (2013)	Physical activity	Behaviour	yes
Cavallo et al. (2012)	Physical activity	Behaviour	no
Cavallo et al. (2012)	Social support	Support	yes
Cobb and Poirier (2014)	Social support	Support	yes
Hanberger et al. (2013)	HbAc1	Clinical	yes
Hansen et al. (2012)	BMI	Clinical	yes
Hwang et al. (2013)	Screening (faecal occult blood test, sigmoidoscopy or colonoscopy)	Behaviour	yes
Hwang et al. (2013)	Social support	Support	no
Hwang et al. (2013)	Self-efficacy to undergo colorectal cancer screening	Efficacy	no
Lau et al. (2012)	Immunisation	Behaviour	yes
Turner-McGrievy and Tate (2011)	Physical activity	Behaviour	no
Turner-McGrievy and Tate(2011)	Weight loss	Clinical	yes
Turner-McGrievy and Tate (2011)	Weight loss self-efficacy	Efficacy	no

Note: Data for Mayer and Harrison (2012) were not extracted as effect size estimates could not be extracted or obtained from the study authors.

Table 5.2: Number of studies contributing to separate meta-analyses by outcome domain, and mean change outcome type

Outcomes	**Standardised mean difference**	**Number of studies included**
Behavioural	Final	4
Behavioural	change	2
Clinical	Final	3
Clinical	Change	1
Self-efficacy	Final	1
Self-efficacy	Change	2
Social support	Final	3
Social support	Change	1
Primary	Final	8
Primary	Change	2

5.3 Results of the meta-analysis

Figures 5.2 to 5.5 display the effect sizes for the studies assessing final scores. Only one study assessed self-efficacy (Bull et al. 2012), so a summary effect could not be produced.

There was no evidence of beneficial effects on any outcomes: social support (*d* =0.030ns, 95%CI -0.105 to 0.166); behavioural (*d* = 0.140, 95%CI -0.121 to 0.402); clinical *(d* = 0.04, 95%CI -0.055 to 0.137) and primary (*d* = 0.055ns,[2] 95%CI = -0.030 to 0.141).

[2] ns=not significant

Figure 5.2: Forest plot of effect size estimates and standard errors of studies reporting final score social support outcomes (n =3)

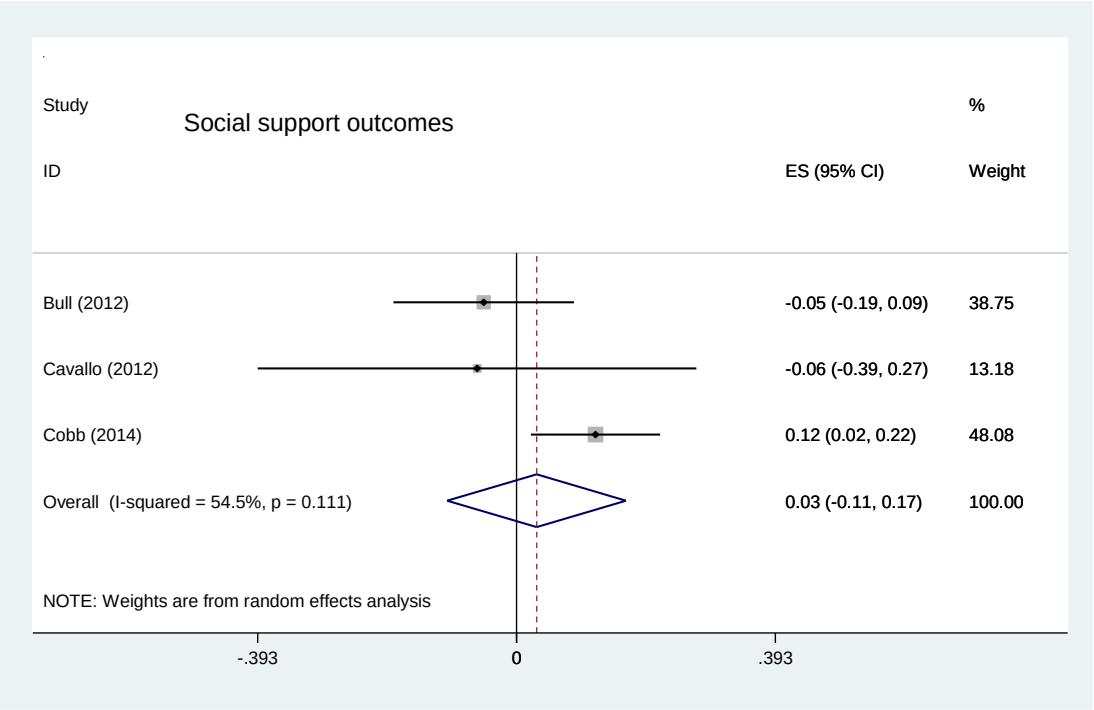


Figure 5.3: Forest plot of effect size estimates and standard errors of studies reporting final score health behaviour outcomes (n = 4)

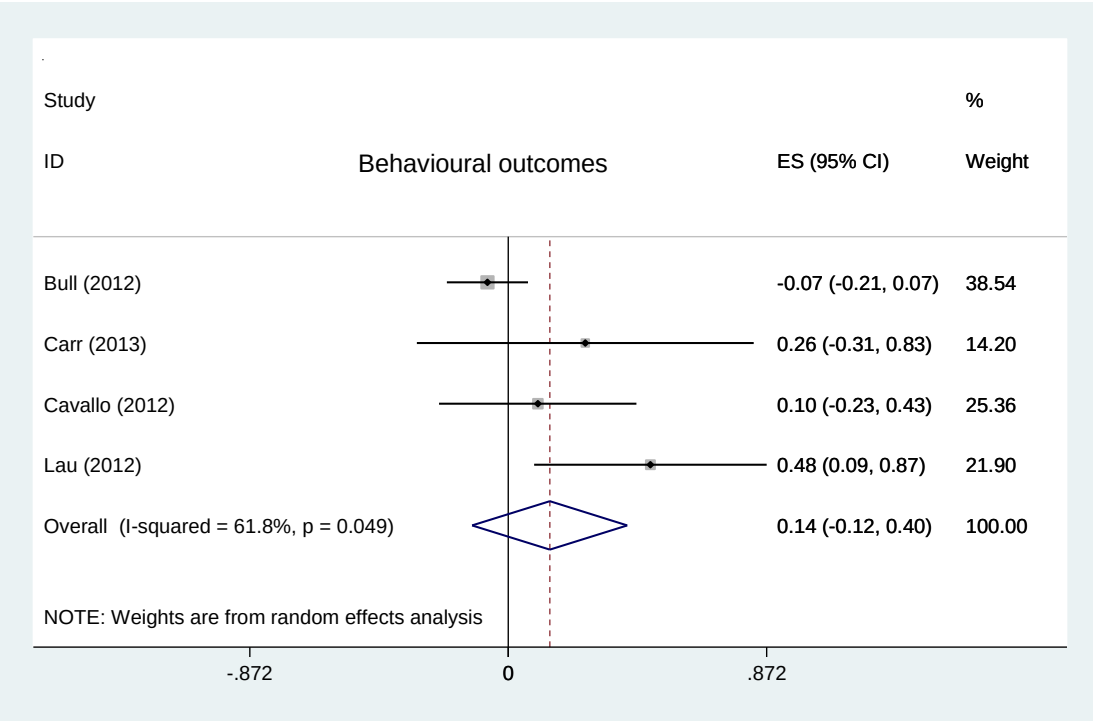


Figure 5.4: Forest plot of effect size estimates and standard errors of studies reporting final score clinical outcomes (n = 3)

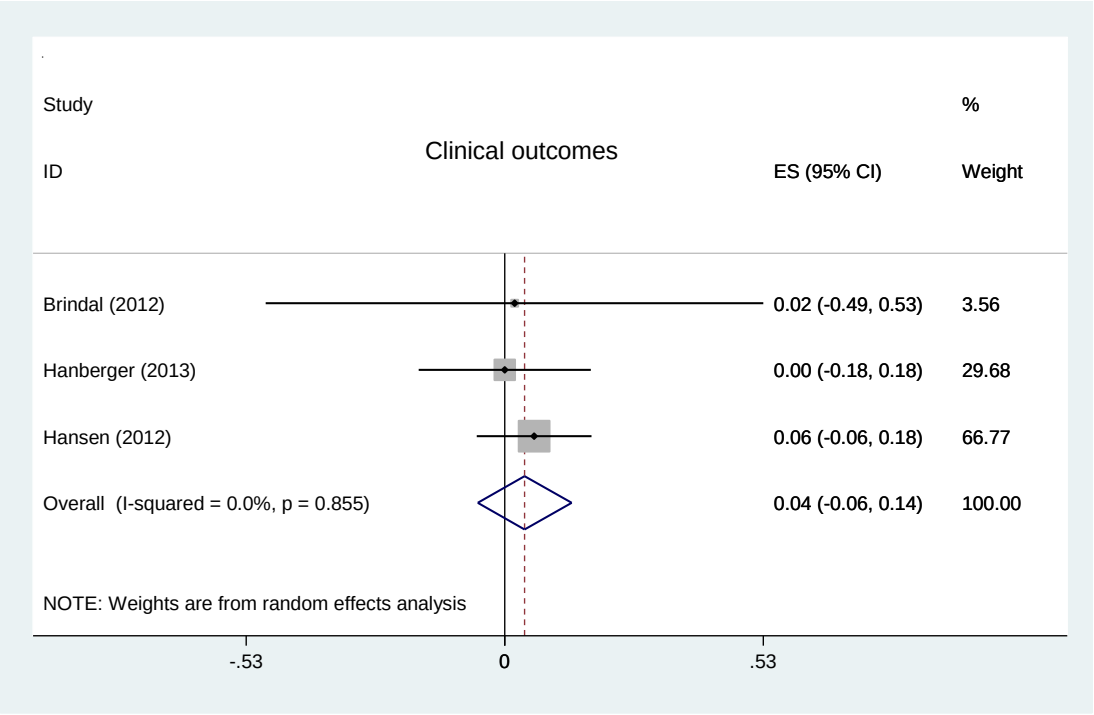
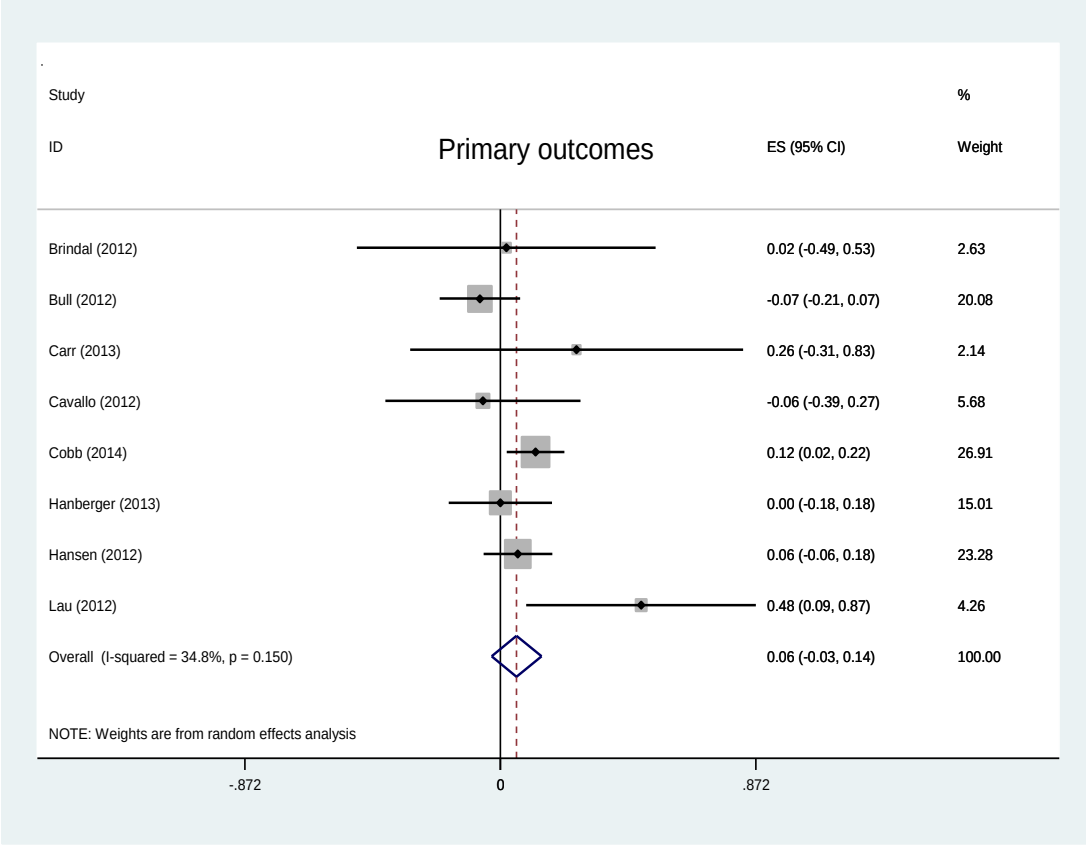


Figure 5.5: Forest plot of effect size estimates and standard errors of studies reporting final score primary outcomes (n = 8)



Figures 5.6 to 5.7 display the effect sizes for the studies examining change at post-test in the behavioural and self-efficacy domains. Only one study each assessed social support (Hwang et al. 2013) and clinical outcomes (Turner-McGrievy and Tate 2011), so a summary effect for these outcomes could not be calculated.

There was no evidence of beneficial effects on self-efficacy (d= -0.107, 95%CI -0.309 to 0.094), behavioural (*d*= 0.072, 95%CI -0.182 to 0.326) and primary outcomes (*d*= 0.093, 95%CI -0.161 to 0.347).

Figure 5.6: Forest plot of effect size estimates and standard errors of studies reporting change in self-efficacy outcomes (n = 2)

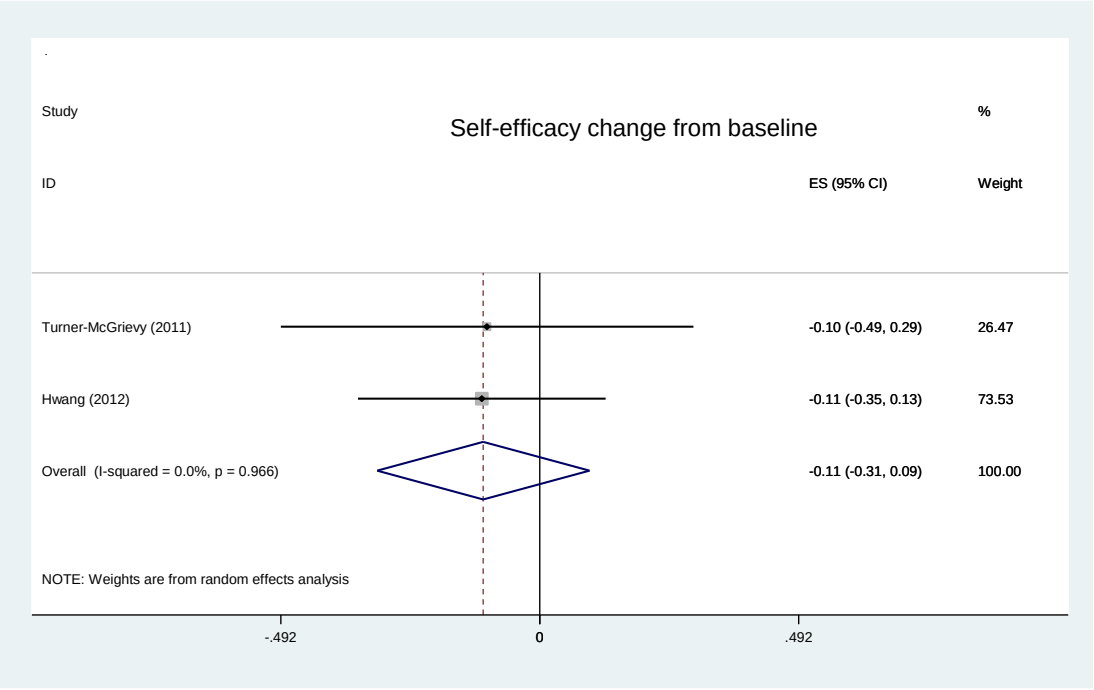
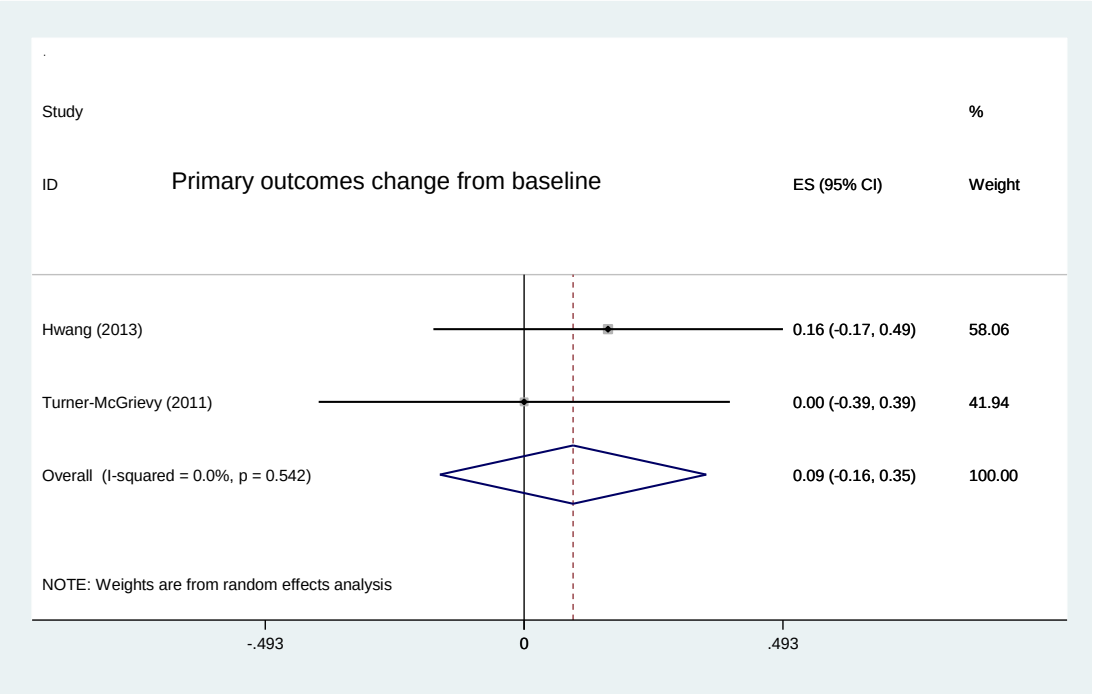


Figure 5.7: Forest plot of effect size estimates and standard errors of studies reporting change in primary outcomes (n = 3)



5.4 Publication bias

We were unable to properly assess funnel plots or use more advanced regression-based assessments to assess publication bias due to the inadequate numbers of included trials (Ahmed et al. 2012).

5.5 Results of the meta-regression

RQ4. Do particular programme features (e.g. health topic, extent of community engagement) account for heterogeneity in effect size estimates across studies?

To test this research question, in our next set of analyses we explored the extent of between-study heterogeneity in effect sizes across studies for each of the meta-analytic models tested (i.e., pooled estimates of final and change scores for self-efficacy, social support, health behaviour, clinical and primary outcomes). Table 5.3 reports the pooled effect size estimate and corresponding 95% confidence intervals (CIs), Cochran's (1954) Q test for heterogeneity and I^2.

Table 5.3: Heterogeneity across studies within separate meta-analyses

Outcome type	Change data	Number of studies included	Pooled effect estimate (Cohen's *d*)	95% Confidence Interval of effect estimate	Q-statistic[a]	I^2 (%)[b]
Self-efficacy	No	1	n/a	n/a	n/a	n/a
Self-efficacy	Yes	2	-0.107ns	-0.309 to 0.094	0.00	0.0%
Social support	No	3	0.030ns	-0.105 to 0.166	4.40	54.5%
Social support	Yes	1	n/a	n/a	n/a	n/a

Behavioural	No	4	0.140ns	-0.121 to 0.402	7.84	61.8%
Behavioural	Yes	2	0.072ns	-0.182 to 0.326	0.64	0.0%
Clinical	No	3	0.041ns	-0.055 to 0.137	0.31	0.0%
Clinical	Yes	1	n/a	n/a	n/a	n/a
Primary	No	8	0.055ns	-0.030 to 0.141	10.74	34.8
Primary	Yes	2	0.093ns	-0.161 to 0.347	0.37	0.0%

Notes: ns=not significant

[a]Q = Cochran's (1954) test of heterogeneity

[b]I^2 = Higgins and Thompson's (2002) measure of heterogeneity

Heterogeneity was moderate (I^2 =25 to <50) to high (I^2 ≥50) for three subsets of studies including final scores for behavioural, social support and primary outcomes, though too few studies limit the reliability of these findings.

The results indicate that the studies within these groups are statistically significantly different from each other, although, as noted previously, the evidence suggests that the pooled effect sizes did not differ from zero. However, where there is variation in the magnitude of effects, we can focus on explaining the variability between the observed effect size estimates using meta-regression (where data permit). A minimum of eight studies was considered sufficient for undertaking meta-regression analyses, so moderator analyses were conducted for the final score primary outcomes; only these met the required threshold of studies.

In our next set of analyses, we explored the extent to which the average effect size differed by a number of study-level characteristics (where data permitted) for the primary outcomes. As noted in Chapter 2 for dichotomised constructs, at least three studies were required in each category.

All potential moderators of heterogeneity are based on groups identified a priori in our research questions. These include studies with differences in various intervention elements categorised as health focus/topic, content of social network/social media intervention, function of facilitator, intervention length, additional intervention components, level of community engagement and explicit use of theory. There were insufficient data to examine the other a priori study elements that might influence effectiveness (including participant age, gender and socio-economic disadvantage).

Table 5.4 lists the moderators tested and the results of the meta-regressions. None of the heterogeneity in effect sizes for the pooled primary outcomes was explained by: health focus/topic (physical activity); elements of social network/social media intervention (sharing Information and experiences); function of facilitator (provide response to questions; post discussion questions; provide information); intervention length (six months or longer); additional intervention components (self-regulation, interaction with expert, prompt to use website, prominence of social media/network); level of community engagement (design and planning, delivery) or explicit use of theory. These results suggest that none of the characteristics assessed had an impact on intervention effectiveness for the primary outcomes.

Table 5.4: Moderator analyses for primary outcomes

Potential modifier	N	Meta-regression results			I^2 (%)[b]	Adj. R^2 [c]
		Coefficient[a]	95 CI%	*p* value		
Primary topic domain						
Physical activity: present (n = 3) vs absent (reference)	8	-0.008	-0.278 to 0.262	0.944	0.441	0.000
Elements of social network/social media intervention						
Sharing information and experiences: both present (n = 4) vs one only (reference)	8	-0.108	-0.285 to 0.069	0.186	0.234	1.000
Function of facilitator						
Provide response to questions: present (n = 5) vs absent (reference)	8	0.077	-0.167 to 0.320	0.472	42.440	0.000
Post discussion questions: present (n = 3) vs absent (reference)	8	-0.095	-0.309 to 0.120	0.321	0.317	0.892
Provide information: present (n = 3) vs absent (reference)	8	-0.095	-0.309 to 0.120	0.321	0.317	0.892
Intervention length						
6 months or longer: yes (n = 4) vs no (reference)	7	0.136	-0.074 to 0.346	0.158	0.070	1.000
Additional intervention components						
Self-regulation: present (n=5) vs absent (reference)	8	0.145	-0.015 to 0.304	0.069	0.000	1.000
Interaction with expert: present (n =4) vs absent (reference)	8	0.047	-0.222 to 0.316	0.684	0.440	0.000
Prompt to use website: present (n=5) vs absent (reference)	8	0.047	-0.222 to 0.316	0.684	0.440	0.000
Prominence of social media/ network: equal/primary (n = 5) vs subsidiary (reference)	8	-0.138	-0.410 to 0.135	0.263	0.396	0.000
Level of community engagement						
Design and planning: community members present (n=4) vs absent (reference)	8	-0.115	-0.288 to 0.058	0.156	0.174	0.842
Delivery: Leading (n = 5) vs collaborating (reference)	8	-0.261	-0.626 to 0.104	0.131	0.214	0.119
Explicit use of theory						
Use of theory: yes (n = 4) vs no (reference)	8	-0.015	-0.285 to 0.254	0.896	-0.724	0.441

a. how primary outcomes change with a unit increase in the potential modifier
b. I^2 = The proportion of residual between-study variation due to heterogeneity
c. Adj. R^2 = proportion of variance accounted for by potential modifier
d. Reference = variable coded as zero (vs 1) in the meta-regression to denote direction of effect

5.6 Summary

- A series of meta-analyses examining final and change outcomes showed no evidence of beneficial effects on self-efficacy, social support, behaviour, clinical or primary health outcomes. Effect sizes in general were very small, implying ineffective interventions.
- When we focus on the primary outcomes assessed using final scores, moderate heterogeneity between studies was observed, suggesting the existence of potential moderators. None of the tested study characteristics, however, explained the variation in effect size estimates across studies.
- There was insufficient evidence to test the operation of moderators for particular outcome constructs, namely self-efficacy, social support, behaviour and clinical.
- There was insufficient evidence to determine whether direct comparisons of social media/networks (i.e. social media/network intervention versus the same intervention without social media/network elements) differed in health outcome effects from indirect comparisons of community engagement.
- It was not possible, using the evidence available, to determine whether or not the effectiveness of social media/social network interventions was influenced by participant characteristics such as age groups, gender or low income.

6. Findings: Qualitative comparative analysis (QCA)

Using the programme features identified in the synthesis, we conducted qualitative comparative analysis (QCA) to explore further our fifth research question: D*o* particular programme features account for heterogeneity in effect size estimates across studies? Studies were coded to denote either the presence or absence of characteristics of interest (a 'crisp set' analysis).

The crisp set data table is shown in Table 6.1. This contains the study conditions that were considered to be most likely to influence study effectiveness, based on the findings from previous research, Review 2 findings (Brunton et al. 2015b) and the framework synthesis and meta-analysis described above. QCA allowed us to look at the influence of direct community engagement comparisons and the use of theory; it has been identified in previous literature that meta-regression does not have sufficient power to analyse these rigorously.

Table 6.1: Data table

Author/year	Healthy eating/ physical activity topic	Theory	Direct test of community engagement	Higher extent of community engagement	Any facilitator	Peer facilitator	Higher effect size
Brindal et al. 2012	1	0	1	0	1	0	0
Bull et al. 2012	0	1	0	0	1	1	0
Carr et al. 2013	1	1	0	0	1	0	1
Cavallo et al. 2012	1	0	0	0	1	0	0
Cobb and Poirier 2014	1	1	0	0	0	1	0
Hanberger et al. 2013	1	0	0	1	1	1	0
Hansen et al. 2012	1	1	0	0	1	0	0
Hwang et al. 2013	0	0	1	0	1	1	1
Lau et al. 2012	0	0	0	0	1	0	1
Mayer and Harrison 2012	1	1	1	1	0	1	0
Turner-McGrievy and Tate 2011	1	1	0	0	1	0	0

All possible combinations of conditions were calculated, and the number of studies ('cases') containing similar combinations of conditions were grouped together in a truth

table, shown in Table 6.2. For ease of reference, the combinations of conditions that did not have cases have not been shown.

Table 6.2: Truth table

Healthy eating/ physical activity topic	Stated use of theory	Direct test of CE	Higher extent of CE	Any facilitator	Number of studies with this combination of conditions	Higher effect size	Consistency+
0	0	1	0	1	1	1	1.0
0	0	0	0	1	1	1	1.0
1	1	0	0	1	3	0	0.33
1	1	1	1	0	1	0	0
1	1	0	0	0	1	0	0
1	0	1	0	1	1	0	0
1	0	0	1	1	1	0	0
1	0	0	0	1	1	0	0
0	1	0	0	1	1	0	0
1	1	1	1	1	0		
1	1	1	0	1	0		
1	1	1	0	0	0		
1	1	0	1	1	0		
1	1	0	1	0	0		
1	0	1	1	1	0		
1	0	1	1	0	0		
1	0	1	0	0	0		
1	0	0	1	0	0		
1	0	0	0	0	0		
0	1	1	1	1	0		
0	1	1	1	0	0		
0	1	1	0	1	0		
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0	1	0	1	0	0		
0	1	0	0	0	0		
0	0	1	1	1	0		
0	0	1	1	0	0		
0	0	1	0	0	0		
0	0	0	1	1	0		
0	0	0	1	0	0		
0	0	0	0	0	0		

Notes: All possible combinations of conditions are shown (but not all combinations occurred in this dataset of studies)

+ The proportion of cases with outcome of interest (i.e. higher effect sizes); as specified a priori, cases with a consistency of less than 0.75 were considered too inconsistent to rate a 'higher effect size' and were coded '0' for this combination of conditions.

One combination of conditions shown in the table above was found in three studies (Carr et al. 2013; Hansen et al. 2012; Turner-McGrievy and Tate 2011). However, only the effect sizes reported in Carr were considered higher (*d*=0.26); the other two rated lower effectiveness (*d*=0.06 and *d*=0.00 respectively). To resolve this contradiction in combinations, the three studies were further examined. All three studies focused on healthy eating/physical activity. The study by Carr et al. (2013) comprised a slightly younger sample than the other two studies (mean ages 37.6 years compared to 43.0 and 50.0 respectively). The study by Carr et al. was judged to be at low risk of bias compared to Hansen et al. (2012), which rated a high risk, and Turner-McGrievy and Tate (2011), which rated a moderate risk. Carr et al. targeted Hispanic and Latino participants, while the other two studies did not target any specific ethnicity. The interventions across all three studies were similar in type, provider and duration. However in Carr et al. (2013) the primary outcome under consideration was physical activity, which may have been more likely to change in response to an intervention in comparison to BMI or weight loss, the primary outcomes reported respectively by Hansen et al. (2012) and Turner-McGrievy and Tate (2011). It is possible that Carr et al. (2013) overestimated the effects seen due to an outcome that was relatively easier to change in comparison to the other two study outcomes. For these reasons, and because its consistency was under the 0.75 level as specified a priori, this combination of conditions was coded as '0' for 'higher effect sizes'.

Boolean minimisation of the combinations of conditions revealed only one condition that was consistently seen in more effective studies (i.e. studies with an effect size above 0.15): the presence of a facilitator. The studies that employed any type of facilitator (n=9) more often showed higher effect sizes, but only in those studies that were not about healthy eating/physical activity, those that did not utilise particular theory and those that had a lower extent of engagement (i.e. did not collaborate with community members on design). All three studies reporting effect sizes over *d*=0.15 (i.e. 'higher effect size' studies) described the use of a facilitator (Carr et al. 2013; Hwang et al. 2013; Lau et al. 2012). Two of these studies were not about healthy eating/physical activity topics and did not describe the use of theory in the development of their interventions (Hwang et al. 2013; Lau et al. 2012).

6.1 Summary

In summary, although the effect sizes are very small overall, QCA demonstrated that including a facilitator in the delivery of social media/social networking interventions demonstrated higher effect sizes for studies not focused on healthy eating and physical activity and which did not employ the use of theory in intervention development. Non-healthy eating/physical activity topics focused on sexually transmitted infection prevention, cancer screening/prevention, influenza immunization and mental health promotion. The use of this combination of conditions is conceptually well supported, lending confidence to its findings. However, it must be considered that these findings are exploratory in nature and should be evaluated robustly in future intervention development and evaluation.

7. Discussion

7.1 Main findings/strengths of the evidence

The findings from this analysis suggest that despite being a growing area, online social media and online social networks have not been utilised greatly in terms of community engagement in health topics. The dataset that proved eligible for this review was very small (n=11) and there were no UK studies. This lack might not be significant, as the studies take place in a virtual environment. However, it does reflect the proportionate difference in published studies across countries.

The use of online social media and online social networks to share health-related information and to connect with other individuals with common healthcare issues is a rapidly expanding field (Chapman et al. 2014; Loss et al. 2014; Neiger et al. 2013). However, it has been suggested that public health organisations and practitioners are employing online social media purely for information dissemination rather than engaging the public in 'true multi-way conversations and interactions' (Heldman et al. 2013). As online social media and social networks rely on high levels of user interaction and user-generated discourse, it is suggested that providers of healthcare information know how to use this platform successfully in order to meet the needs of the online public (Chapman et al. 2014). Not only this, but growth is not restricted to children and adolescents, but extends across all age groups, so it is important to examine whether community engagement, as described in the previously established theories, is actually present within online social media and online social network interventions.

Across the studies included in this review, it was found that researchers are using online social media and social networks as an 'add-on' tool, rather than as a community engagement initiative in its own right. Therefore there is a lack of understanding about the direct effects of online social media and social networks on health outcome changes, since their use cannot be separated from other intervention components employed in the studies.

The QCA indicated that direct comparisons of community engagement (versus none) did not occur more often in studies with higher effects sizes. This might be a reflection of the minimal amount of community engagement occurring in these studies rather than a lack of effect.

It was noted that the length of time after which the evaluation of the online social media or social network occurred varied across the studies. It is recognised that mobile consumption practices such as use of online social media have transformed the spatiality and temporality of news media and information sharing. Information such as new articles is not only constantly accessed 'on demand' from miniature mobile devices, but can also be tagged, organised, aggregated and easily redistributed (Sheller, 2014). Understanding the instantaneous nature of online social media, however, does not give insight into how much time is needed for a health-care intervention to have impact on the public and ultimately an effect on the health outcome. Therefore, while Twitter, for example, is immediate, its impact is perhaps not sustained. In contrast, we note that online social networking could potentially be a 'slow burn' process in terms of making an impact. Considering these potential differences in the nature of online social media and social networks, we suggest that it is necessary to understand better how much time is needed to detect change in these different interventions and whether the timings of the evaluations were appropriate.

In Review 1, it was suggested that a higher extent of community engagement was related to more beneficial effects and positive trends across outcomes (Brunton et al. 2015a). For

Review 3, we found a lower overall extent of community engagement, particularly involvement in design and evaluation than in the coalitions/ collaborations/ partnerships synthesis of Review 2 (Brunton et al. 2015b) and lower than the original CERI review (O'Mara et al. 2013). Potentially, these might not be showing positive effects because there is so little 'true' community engagement in them (i.e. involving people in designing or evaluating the intervention). Currently, online social media and social networks appear to be used as a social support mechanism, but it is not evaluated well enough yet to be able to know whether these platforms are achieving this or not.

Most of the processes of community engagement identified in the reviews on coalitions (Reviews 1 and 2) were not demonstrated in these studies. However, bidirectional communication and the use of facilitators were identified as consistent processes in this set of studies. The use of facilitators, although described across the majority of studies, was not evaluated, making it difficult to comment on the nature of facilitator involvement or make recommendations for their involvement in online social media and social networking. However the type of person who facilitated groups varied (peer versus professional). Although facilitator type varied across health topics and age groups, this did not appear to make a difference to the effects (based on QCA).

Across the studies, we found no evidence of effectiveness for any outcomes, neither for our categories nor for stated primary outcomes.

Moderate heterogeneity suggested that potential moderators were present, but none of the hypothesised characteristics (including the use of facilitators or direct versus indirect comparisons of community engagement) explained variation in effect sizes with respect to primary outcomes; it was not possible to test for moderators of self-efficacy, social support, behavioural or clinical outcomes (because there were not enough studies). Likewise, it was not possible to test for age, gender or low income as moderators of effectiveness.

The QCA indicated that studies that used online facilitators tended to show slightly higher effect sizes, but only in interventions that were not related to healthy eating/physical activity and that were not based on theory. The small effect sizes noted in our synthesis resonate with those found in other reviews of online interventions for healthy eating and physical activity (Williams et al. 2014). It is interesting to note that these overall effect sizes are considerably smaller than those that have been demonstrated in reviews of face-to-face healthy eating/physical activity interventions (Bhattarai et al. 2014; Johns et al. 2014). This could suggest that face-to-face interventions for weight management/obesity prevention are more effective than online strategies and suggests a need for future research to evaluate this.

The studies included in this review do not provide strong evidence of positive effect for any of the online social media or social networking interventions studied. It was also observed that community engagement was limited, not stretching beyond participants occasionally being consulted on what should go into the intervention or discussing topics via the studies that incorporated online social networking sites into their study design. It can thus be argued that these studies show no evidence that participants are really co-creating knowledge or building social capital.

7.2 Gaps in the evidence

Some gaps in the evidence emerged from this synthesis. Firstly, none of the studies identified in this review were undertaken in the UK, which could suggest a need for UK-developed interventions. However it could also be argued that in view of a combination of the 'virtual' nature of online interventions, the topics under study and no evidence of cross-country differences in participant outcomes, a lack of UK-specific interventions may be less important than in 'real-world' interventions.

The studies identified for this synthesis targeted people on average aged 16 to 25 or in their 40s. We thus identified a gap in studies aimed specifically at children younger than 16 years of age, 30 to 40 year olds, or older than 60.

Assessment of the studies identified for this analysis revealed that almost all studies were at either high or moderate risk of bias. This necessitates caution in the interpretation of authors' findings and in the application of these interventions to policy and practice.

Most of the identified studies utilised some form of multi-component interventions in addition to social media/social networking. This creates challenges in identifying the 'active' component of an intervention, as has been highlighted by others (Laranjo et al. 2015). A dataset of studies directly comparing the effects of community engagement is slowly being identified through these reviews; it is anticipated that future research will be able to rigorously evaluate a direct effect of community engagement on health outcomes.

7.3 Strengths of the review

The review represents the first attempt we are aware of to collate and evaluate community engagement in online social media and/or online social networking in the context of health research. Although there are reviews that look at the effectiveness of online interventions or electronic peer-to-peer contact in relation to health education (e.g. Eysenbach et al. 2004), no one has looked at the impact of community engagement itself on these outcomes. The work presented here is a rigorous evaluation based on the conceptual framework from our previous reviews (O'Mara Eves et al. 2013; Brunton et al. 2015a, b). The report provides a basis to explore how community engagement is being considered and employed in this growing and increasingly important method of communication.

7.4 Limitations of the review

The review has some limitations that should be taken into account. First, the search strategy was to use previously run searches used for Reviews 1 and 2 (Brunton et al. 2015a, b; O'Mara Eves et al. 2013). In the original searches, the review team were looking to find studies about community engagement, not online social media or social networks. If the searches had been rerun including additional search terms, this might have picked up more relevant studies but due to time limitations, this was not possible for this review. This also has implications for the representativeness of the studies, in that we cannot be sure that the studies represented in the review are representative of online social media or social networking interventions.

The dataset of included studies was very small, making it difficult to draw conclusions or to do meta-analysis. This is to be expected from an emerging field.

There was also limited description of the extent and nature of community engagement within the set of included studies. This is possibly due to the nature of online social media and social networks as media that require interaction or engagement as part of their mechanism of operation, i.e. people have to engage with them to use them. But this finding may also have come about because interventions that utilise social networking/social media for social justice, social capital or empowerment are not being planned or reported.

7.5 Applicability of the evidence to relevant UK populations

It is important to note that none of the 11 included studies were conducted in the UK, and only two of the studies were focused on disadvantaged populations. These were both conducted in the USA and targeted African-American, Latino and Hispanic populations. Caution is required in the interpretation of the findings in terms of their applicability to the UK context for UK communities.

8. Conclusions

The results from this study suggest that community engagement is not utilised across the design or evaluation of health interventions, and that the type of engagement undertaken within intervention delivery focuses on peer interactions alone. This suggests that very little co-creation of knowledge or building of social capital takes place (or is simply not reported) in evaluated health interventions. As in the synthesis of coalitions, collaborations and partnership interventions undertaken in Review 2, this review has noted that healthy eating/physical activity interventions were most often undertaken, followed by a variety of other health topics. In general, studies of community engagement in social media/social networking interventions focused on young people aged 16 to 25 or those aged in their 40s, illustrating a gap in interventions in children, those aged 30 to 40 years, and older people. Very few studies were identified targeting women only or disadvantaged groups. Meta-analyses suggest evidence of very small mixed effects across studies, and a limited meta-regression indicated that effectiveness could not be ascribed to any programme features. Qualitative comparative analysis found that interventions utilising online facilitators tended to occur in effective outcome studies, but only in studies that did not focus on healthy eating or physical activity interventions. This, combined with the very small mixed effects, found particularly in relation to face-to-face healthy eating/physical activity interventions, suggest a need to compare the effects of online versus face-to-face interventions on this topic. Future research to evaluate the direct effect of community engagement in changing outcomes is needed.

8.1 Evidence statements

RQ1. What is the extent of community engagement across design, delivery and evaluation in online social media and online social networking interventions?

There is evidence from all eleven studies of community engagement in the delivery of a variety of health interventions; however only two studies additionally involved community members in design consultation or collaboration[6,10] and no studies described community member involvement in intervention evaluation. This is 'weak' evidence due to the unclear theoretical mechanisms underpinning the use of community members, the lack of evaluations of community engagement, and based on the high to moderate risk of bias across studies. RQ2. What health issues and populations have been studied using online social media/social networking?

There is evidence of health issues focused on healthy eating/physical activity,[1,3,4,7,11] cancer detection and screening[8], diabetes[6], general wellbeing and lifestyle,[5] sexual health,[2] flu immunisation,[9] food safety.[10] This is inconsistent due to the low number of studies for each health topic and population. There is evidence of studies focused on populations under 25 years of age[2,4,6,10] or on those over 40,[1,7,8,11] but gaps in evaluated interventions in those aged under 16, 30 to 40 and over 60. There is inconsistent evidence of studies targeting women only[4,8] and no evidence of studies targeting men specifically. There is inconsistent evidence of social media/social networking interventions directed to minority ethnic groups.[2,3]

RQ3. How effective are online social networks in improving health and wellbeing and reducing health inequalities?

There is no evidence of effectiveness from ten RCTs[1-9,11] and one quasi-experimental study[10] that online social networks or social media are effective in improving health and wellbeing or reducing health inequalities. Studies showed very small mixed effects; further the methodological quality of almost all the studies indicated a moderate or high risk of bias.

RQ4. Do particular programme features (e.g. health topic, extent of engagement, population type) account for heterogeneity in effect size estimates across studies?

Based on the eleven included studies, there is no evidence that any programme features account for heterogeneity in the effect size estimates across studies. This is in part because so little variation in effect sizes occurred, and also because too few studies provided data amenable to regression analyses.

RQ5. Which processes of community engagement are more aligned with effective interventions?

There is weak evidence from nine studies[1-4,6-9,11] that employing either peers or professionals to facilitate online discussion forums is seen more often to have effective outcomes. This evidence is weak because of the high to moderate risk of bias across studies, the limited number of studies showing effective outcomes in comparison to those showing no effect, and the very small effect sizes between studies.

1. Brindal et al 2012 (-)
2. Bull et al. 2012 (-)
3. Carr et al. 2013 (++)
4. Cavallo et al. 2012 (+)
5. Cobb and Poirier 2014 (+)
6. Hanberger et al. 2013 (+)
7. Hansen et al. 2012 (-)
8. Hwang et al. 2013 (-)
9. Lau et al. 2012 (++)
10. Mayer and Harrison 2012 (-)
11. Turner-McGrievy and Tate 2011) (+)

8.2 Recommendations

One recommendation for social media/social networking interventions emerged:

- In social media/social networking interventions involving 'communities' those developing interventions need to give careful consideration and explanation of the reasons why communities are being utilised. This will make clear the theoretical mechanism underpinning a social media/social networking intervention, i.e. whether community engagement is being undertaken to build communities, co-create knowledge or build social capital, or simply to provide another means of intervention delivery.

Two recommendations for future research arose from our synthesis:

- The fact that the use of facilitator was aligned with effective interventions, combined with the very small mixed effects found, particularly in relation to face-to-face healthy eating/physical activity interventions, suggest a need to compare the effects of online versus face-to-face interventions on this topic.
- Future research to evaluate the direct effect of community engagement in changing outcomes is needed.

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Appendices

Appendix 1: Bibliography of included and excluded studies

Included studies

Brindal E, Freyne J, Saunders I, Berkovsky S, Smith G, Noakes M (2012) Features predicting weight loss in overweight or obese participants in a web-based intervention: Randomized trial. *Journal of Medical Internet Research,* 14(6): e173.

Bull SS, Levine DK, Black SR, Schmiege SJ, Santelli J (2012) Social media-delivered sexual health intervention: a cluster randomized controlled trial. *American Journal of Preventive Medicine,* 43(5): 467-474.

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Studies excluded at the full-text stage

Study title	**Reason for exclusion**
An LC, Klatt C, Perry CL, Lein EB, Hennrikus DJ, Pallonen UE, Bliss RL, Lando HA, Farley DM, Ahluwalia JS, Ehlinger EP (2008) The RealU online cessation intervention for college smokers: a randomized controlled trial. *Preventive Medicine: An International Journal Devoted to Practice and Theory*, 47(2): 194-199.	Not about online social networking/ social media
Atlas SJ, Grant RW, Lester WT, Ashburner JM, Chang Y, Barry MJ, Chueh HC (2011) A cluster-randomized trial of a primary care informatics-based system for breast cancer screening. *Journal of General Internal Medicine*, 26(2): 154-161.	Not about online social networking/ social media
Bendtsen P, McCambridge J, Bendtsen M, Karlsson N, Nilsen P (2012) Effectiveness of a proactive mail-based alcohol internet intervention for university students: dismantling the assessment and feedback components in a randomized controlled trial. *Journal of Medical Internet Research*, 14: 130-141.	Not about online social networking/ social media
Blitstein JL, Evans WD, Davis KC, Kamyab K (2012) Repeated exposure to media messages encouraging parent-child communication about sex: Differential trajectories for mothers and fathers. *American Journal of Health Promotion*, 27(1): 43-51.	Not about online social networking/ social media
Bravender T, Tulsky JA, Farrell D, Alexander SC, Østbye Truls LP, Dolor RJ, Coffman CJ, Bilheimer A, Lin P-H, Pollak KI (2013) Teen CHAT: development and utilization of a web-based intervention to improve physician communication with adolescents about healthy weight. *Patient Education and Counseling*, 93: 525-531.	Not about online social networking/ social media
Brown PC, Dunn ME, Budney AJ (2014) Development and initial evaluation of a web-based program to increase parental awareness and monitoring of underage alcohol use: a brief report. *Journal of Child and Adolescent Substance Abuse*, 23: 109-115.	Not about online social networking/ social media
Burrus B, Leeks KD, Sipe TA, Dolina S, Soler R, Elder R, Barrios L, Greenspan A, Fishbein D, Lindegren ML, Achrekar A, Dittus P (2012) Person-to-person interventions targeted to parents and other caregivers to improve adolescent health: a community guide systematic review. *American Journal of Preventive Medicine*, 42(3): 316-326.	Not about online social networking/ social media
Centola D (2011) An experimental study of homophily in the adoption of health behavior. Science. 334: 1269-1272.	Social media compared with social media
Centola D (2010) The Spread of Behavior in an Online Social Network Experiment. Science. 1194-1197.	Social media compared with social media
Coley HL, Sadasivam RS, Williams JH, Volkman JE, Schoenberger YM, Kohler CL, Sobko H, Ray MN, Allison JJ, Ford	No health outcomes

Study title	**Reason for exclusion**
DE, Gilbert GH, Houston TK (2014) Crowdsourced peer - versus expert - written smoking-cessation messages. *American Journal of Preventive Medicine*, 45(5): 543-550.	
Colleran HL, Lovelady CA (2012) Use of MyPyramid Menu Planner for Moms in a weight-loss intervention during lactation. *Journal of the Academy of Nutrition and Dietetics*, 112(4): 553-558.	Not about online social networking/ social media
Collins CE, Morgan PJ, Jones P, Fletcher K, Martin J, Aguiar EJ, Lucas A, Neve MJ, Callister R (2012) A 12-week commercial web-based weight-loss program for overweight and obese adults: randomized controlled trial comparing basic versus enhanced features. *Journal of Medical Internet Research*, 14: 128-143.	Community engagement not explicit
Croker H, Lucas R, Wardle J (2012) Cluster-randomised trial to evaluate the 'Change for Life' mass media/social marketing campaign in the UK. *BMC Public Health*, 12: 404.	Not about online social networking/ social media
DeBar LL, Dickerson J, Clarke G (2009) Using a website to build community and enhance outcomes in a group, multi-component intervention promoting healthy diet and exercise in adolescents. *Journal of Pediatric Psychology*, 34(5): 539-550.	Community engagement not explicit
De Cocker K, Spittaels H, Cardon G, De Bourdeaudhuij I, Vandelanotte C (2012) Web-based, computer-tailored, pedometer-based physical activity advice: development, dissemination through general practice, acceptability, and preliminary efficacy in a randomized controlled trial. *Journal of Medical Internet Research*, 14: 115-127.	Not about online social networking/ social media
Donovan E, Wood M, Frayjo K, Black RA, Surette DA (2012) A randomized, controlled trial to test the efficacy of an online, parent-based intervention for reducing the risks associated with college-student alcohol use. *Addictive Behaviors*, 37(1): 25-35.	Not about online social networking/ social media
Ezendam NP, Brug J, Oenema A (2012) Evaluation of the web-based computer-tailored FATaintPHAT intervention to promote energy balance among adolescents: results from a school cluster randomized trial. *Archives of Pediatrics and Adolescent Medicine*, 166: 248-255.	Not about online social networking/ social media
Fehring RJ, Schneider M, Raviele K, Rodriguez D, Pruszynski J (2013) Randomized comparison of two Internet-supported fertility-awareness-based methods of family planning. *Contraception*, 88: 24-30.	Not about online social networking/ social media
Foster D, Linehan C, Kirman B (2010) Motivating physical activity at work: using persuasive social media for competitive step counting. ACM, 111-16.	No control/comparison group
Gala S, Pesek F, Murray J, Kavanagh C, Graham S, Walsh M (2008) Design and pilot evaluation of an Internet spit tobacco cessation program. *Journal of Dental Hygiene*, 82(1): 11.	No control/comparison group
Graham AL, Cobb NK, Papandonatos GD, Moreno JL, Kang H,	Not about online

Study title	**Reason for exclusion**
Tinkelman DG, Bock BC, Niaura RS, Abrams DB (2011) A randomized trial of Internet and telephone treatment for smoking cessation.. JAMA internal Medicine. 171(1): 46-53.	social networking/ social media
Han C, Voils CI, Williams JW (2013) Uptake of web-based clinical resources from the MacArthur Initiative on Depression and Primary Care. *Community Mental Health Journal*, 49(2): 166-171.	Not about online social networking/ social media
Hersey JC, Khavjou O, Strange LB, Atkinson RL, Blair SN, Campbell S, Hobbs CL, Kelly B, Fitzgerald TM, Kish-Doto J, Koch MA, Munoz B, Peele E, Stockdale J, Augustine C, Mitchell G, Arday D, Kugler J, Dorn P, Ellzy J, Julian R, Grissom J, Britt M (2012) The efficacy and cost-effectiveness of a community weight management intervention: a randomized controlled trial of the health weight management demonstration. *Preventive Medicine*, 54(1): 42-49.	Not about online social networking/ social media
Hightow-Weidman LB, Pike E, Fowler B, Matthews DM, Kibe J, McCoy R, Adimora AA (2012) HealthMpowerment.org: feasibility and acceptability of delivering an internet intervention to young Black men who have sex with men. *AIDS Care*, 24(7): 910-920.	Not about online social networking/ social media
Imanaka M, Ando M, Kitamura T, Kawamura T (2013) Effectiveness of web-based self-disclosure peer-to-peer support for weight loss: randomized controlled trial. *Journal of Medical Internet Research*, 15: e136.	Not about online social networking/ social media
Latkin C, Donnell D, Liu T-Y, Davey-Rothwell M, Celentano D, Metzger D (2013) The dynamic relationship between social norms and behaviors: the results of an HIV prevention network intervention for injection drug users. *Addiction*, 108: 934-943.	Not about online social networking/ social media
Napolitano M A; Hayes S, Bennet G G; (2013) Using Facebook and text messaging to deliver a weight loss program to college students. Obesity. 21(1): 25-31.	Social media compared with social media
Neighbors C, Lee CM, Atkins DC, Lewis MA, Kaysen D, Mittmann A, Fossos N, Geisner IM, Zheng C, Larimer ME (2012) A randomized controlled trial of event-specific prevention strategies for reducing problematic drinking associated with 21st birthday celebrations. *Journal of Consulting and Clinical Psychology*, 80(5): 850-862.	Not about online social networking/ social media
Patrick K, Marshall SJ, Davila EP, Kolodziejczyk JK, Fowler JH, Calfas KJ, Huang JS, Rock CL, Griswold WG, Gupta A, Merchant G, Norman GJ, Raab F, Donohue MC, Fogg BJ, Robinson TN (2014) Design and implementation of a randomized controlled social and mobile weight loss trial for young adults (project SMART). *Contemporary Clinical Trials*, 37: 10-18.	No health outcomes
Rabius V, Pike KJ, Wiatrek D, McAlister AL (2008) Comparing internet assistance for smoking cessation: 13-month followup of a six-arm randomized controlled trial. *Journal of Medical Internet Research*, 10(5): e45.	Not about online social networking/ social media
Rooke S, Copeland J, Norberg M, Hine D, McCambridge J	Not about online

Study title	**Reason for exclusion**
(2013) Effectiveness of a self-guided web-based cannabis treatment program: randomized controlled trial. *Journal of Medical Internet Research*, 15: e26.	social networking/ social media
Salonen AH, Kaunonen M, Åstedt-Kurki, P, Järvenpää AL, Isoaho H, Tarkka MT (2011) Effectiveness of an internet-based intervention enhancing Finnish parents' parenting satisfaction and parenting self-efficacy during the postpartum period. Midwifery, 27, 832–841.	No health outcomes
Terry PE, Fowles JB, Xi M, Harvey L (2011) The ACTIVATE study: results from a group-randomized controlled trial comparing a traditional worksite health promotion program with an activated consumer program. *American Journal of Health Promotion*, 26(2): e64-73.	Not about online social networking/ social media
Turner-McGrievy GM, Tate DF (2013) Weight loss social support in 140 characters or less: use of an online social network in a remotely delivered weight loss intervention. *Translational Behavioral Medicine*, 3: 287-294.	No control/ comparison group
Turner-McGrievy GM, Tate DF (2014) Are we sure that Mobile Health is really mobile? An examination of mobile device use during two remotely-delivered weight loss interventions. *International Journal of Medical Informatics*, 83: 313-319.	No control/ comparison group
Valle CG, Tate DF, Mayer DK, Allicock M, Cai J (2013) A randomized trial of a Facebook-based physical activity intervention for young adult cancer survivors. Journal of Cancer Survivorship. 7(3): 355-68.	Social media compared with social media
van Osch L, Lechner L, Reubsaet A, Steenstra M, Wigger S, de Vries H (2009) Optimizing the efficacy of smoking cessation contests: an exploration of determinants of successful quitting. *Health Education Research*, 24(1): 54-63.	Not about online social networking/ social media
Young SD, Cumberland WG, Lee SJ, Jaganath D, Szekeres G, Coates T (2013) Social networking technologies as an emerging tool for HIV prevention: a cluster randomized trial. *Annals of Internal Medicine*, 159: 318-324.	Community engagement not explicit

Appendix 2: Evidence tables

Study details	Population and setting	Method of allocation to intervention/control	Outcomes and methods of analysis	Results	Notes by review team
Brindal et al. (2012) **Country of study:** Australia **Aim of study:** To determine whether supportive features and personalisation in a 12-week web-based lifestyle intervention with no in-person professional contact affect retention and weight loss Study design: Randomised trial **Quality score: (++,+ or -):** - **External validity score: (++, + or -):** ++	**Setting:** Web based weight loss programmes. (online diet study) Sample characteristics: • Australian adults (18 years and over) with a BMI >25kg/m^2) • Regular access to the Internet **Eligible population:** Participants living in Australia Selected population: • Same as eligible. • Following screening, 8,112 people were successfully registered. **Excluded**	**Method of allocation:** • Eligible respondents (n = 8,112) were randomly allocated to one of 3 functional groups: **information -based** (n = 183), **supportive** (n =3,994), or **personalized-supportive** (n= 3,935). • Randomisation balanced by age, sex and BMI. **Intervention/comparison description:** Three groups: 1) Information-based: a static non-interactive version of the weight loss programme 2) Supportive: a Social interactive website	**Outcomes:** % weight loss. **Follow-up periods:** 12 weeks post baseline. **Method of analysis:** • A multiple imputation (MI) method using the MICE package in the R statistical package was used to impute missing weight loss values for the purposes of intention to treat analyses. • Final weight loss values for starters who did not complete were imputed using the initial weight, the weight loss calculated from the last online	**Total sample:** % weight loss at 12 weeks: • Intervention group (supportive group) (mean= 4.22 (SD=4.34) • Control group (information-based) mean= 4.15 (SD=4.26) **Attrition details:** Across all 3 groups, attrition was high at around 40% in the first week and 20% of the remaining participants each week.	**Limitations identified by author:** • Poor retention, and uptake of the site was low. • Interaction data suggested that many of the features provided in the interactive sites were not heavily utilised. • Despite the presence of interactive features, participants' average scores for liking of the site were low, and this may have reduced their interaction with the portal. **Limitations identified by review**

Study details	Population and setting	Method of allocation to intervention/control	Outcomes and methods of analysis	Results	Notes by review team
	population/s: Participants with any serious medical conditions that would prohibit them from dieting (e.g., cancer, bowel disease)	that provided dietary information as provided in the information-based site, in addition to interactive tools such as real-time dietary compliance visualisations, an interactive meal planner and social support through a social networking platform (i.e. personal profiles, friend networks, blogs, discussion forums, and news feeds) 3) Personalised-supportive: identical to the supportive version with the addition of a personalised meal planner. This offered 3 breakfast, lunch and dinner suggestions personalised to user preferences through a purpose-built algorithm	entered weight (taken from the weight tracker), and the date of the last online weight entry as predictive variables. • Predictive mean matching was used for the MI. • 100 datasets with imputed values of final weight were generated, and the results of analysing each of these were combined using the pooling approach, thus allowing for the uncertainty in the imputed values		**team:** As above. **Evidence gaps/and or recommendations for future research noted by study author:** • Other behavioural strategies (such as implementation intentions) could be used in future studies to encourage interested participants to translate their initial motivation into action. • More intelligent system designs may also be able to improve uptake of features and improve user engagement with web-based systems.

Study details	Population and setting	Method of allocation to intervention/control	Outcomes and methods of analysis	Results	Notes by review team
		that collated data on user preference ratings of a collection of recipes and previous planning (for this review, we extracted data for information-based as control vs supportive only). **Sample sizes at baseline:** Total N=2,648. **Baseline comparisons:** Not reported. **Study sufficiently powered:** Post-hoc calculations suggested that there was over 90% power to detect a 3% difference in weight loss between the groups.			**Source of funding:** This research was jointly funded by the Australian Commonwealth Government and the Government of Tasmania through the Intelligent Island Program, the CSIRO Preventative Health National Research Flagship and the CSIRO Division of Food and Nutritional Sciences.

Study details	Population and setting	Method of allocation to intervention/control	Outcomes and methods of analysis	Results	Notes by review team
Bull et al. (2012) **Country of study:** US **Aim of study:** To determine whether STI prevention messages delivered via Facebook are efficacious in preventing increases in sexual risk behaviour at 2 and 6 months. **Study design:** Cluster RCT **Quality score (++,+ or -):** - **External validity score (++, + or -):** ++	**Setting:** Community setting in Denver CO metropolitan area and in a college community in Louisiana. **Sample characteristics:** • 14% Latino • 35% African-American • 39% Southern US • 35% Western US **Eligible population:** • Aged 16–25 years • US resident • Owner of a Facebook page • Willing to complete study behavioural risk assessments • Able to read and write in English. **Selected population:** Of the	**Method of allocation:** Random allocation at individual level **Intervention description:** • Assigned to network unit – intervention page called ' Just/Us' on Facebook. • Developed in concert with all members of the study team. Implementation was led by ISIS, Internet Sexuality Information Services in Oakland CA. • Content was based on two fundamental ideas: sexual health is a human right and function of social justice; and that	**Relevant outcomes:** • Proportion of protected sex acts • Condom self-efficacy • Condom norms. **Follow-up periods:** 2 months and 6 months **Method of analysis:** • All outcomes were modelled in terms of the main effect of changes over time, the main effect of treatment, and the interaction between treatment and time. • Full information maximum likelihood estimation was used in model estimation, which makes use of all	**Total sample:** • An interaction was observed for proportion of protected sex acts (F=3.63, p= <0.027). Simple effects analysis did not show condition differences at any individual time point (changes over time within conditions were therefore examined, see below). • There were no statistically significant interactions for condom self-efficacy and condom norms. • Moderator analyses were conducted that examined the effect of the	**Limitations identified by author:** • Reliance on self-report for primary outcomes • Rapid decay in intervention effects long term (6 months) • High participant attrition **Limitations identified by review team:** As above **Evidence gaps and/or recommendations for future research noted by study author:** Link Facebook or other social media based intervention to sexual health services to validate self-reported sexual risk behaviours with clinical

Study details	Population and setting	Method of allocation to intervention/control	Outcomes and methods of analysis	Results	Notes by review team
	828 eligible, 652 (79%) agreed to participate. **Excluded population/s:** • Those not eligible were outside the age range • Didn't have a Facebook page • Didn't agree to 'like' the Just/Us or 18-24 News Facebook page.	youth need a space to share ideas and concepts with their peers, as well as professional experts. • Content for the intervention page included eight broad topics: (e.g., communication regarding sexual history; expectations for a healthy relationship; skills building for condom negotiation and condom use; and how to access STI testing). • One week was devoted to each topic. The top-ics provided a frame-work for interactions between youth	available follow-up data (i.e., participants who completed just one of the follow-ups were still included in the repeated measures analyses) and performs well when data are missing at random.	interaction between each demographic variable and condition on each outcome; these were non-significant. **Intervention group(s)/ control group(s):** Proportion of protected acts significantly decreased from baseline to 2 months in the control group (and the subsequent increase at 6 months was not significant), whereas the proportion of protected acts remained stable from baseline to 2 months in the intervention group and decreased by the 6-month follow-up. **Attrition details:**	outcomes **Source of funding:** National Institute for Nursing Research (NINR)

Study details	Population and setting	Method of allocation to intervention/control	Outcomes and methods of analysis	Results	Notes by review team
		facilitators employed by ISIS and participants **Control/comparison/s description:** • Assigned to network unit – control page called '18-24' News • Concept: sharing what was happening between 6pm – until midnight on the 24-hour clock. • What was interesting in the news to those aged 18-24 • Intent of page as a control – to specifically avoid sexual health content. **Total sample:** • 1,017 screened,		• Just under 70% of the sample completed a 2-month follow-up (439 controls, 69% and 653 intervention, 69%), and retention declined to 59% for controls at 6 months (n=377) and 45% for intervention participants (n=427). A total of 75% of participants completed any follow-up (484 control participants and 711 intervention participants). • Of concern is the attrition among higher-risk youth from the study. Although this type of attrition has	

Study details	Population and setting	Method of allocation to intervention/control	Outcomes and methods of analysis	Results	Notes by review team
		828 eligible for participation. • Of the 828 eligible, 652 (79%) agreed to participate **Intervention group:** 340 **Control group:** 312 (Intervention and control groups recruited additional participants) **Baseline comparisons:** • Statistically significant baseline differences in age, ethnicity (Hispanic, African-American and Asian); Geographic region (Mid-Atlantic and Midwest, West) and sexual history at baseline (ever had sex). No statistically		been documented in other online STI-related research, it underscores the need to redouble efforts to attract and engage higher-risk youth in prevention efforts using social media. Future work should explore approaches to keep audiences engaged in social media content related to sexual health.	

Study details	Population and setting	Method of allocation to intervention/control	Outcomes and methods of analysis	Results	Notes by review team
		significant differences in ethnicity (American Indian, Pacific Islander, White, and other); geographic region (New England, South and Southwest); sexual history (age at 1st sex, mean number of lifetime partners, and experienced coercion). **Study sufficiently powered:** Sample size estimates of 1,156 with 578 per study arm were based on assumptions of baseline condom use of 55% with 90% power to detect differences of 10% between intervention at control groups with a CI of 99%			

Study details	Population and setting	Method of allocation to intervention/control	Outcomes and methods of analysis	Results	Notes by review team
		(alpha=0.01), and intra-class correlations (ICC's) for network members of 0.15.			
Carr et al. (2013) **Country of study:** US **Aim of study:** Test an internet physical activity (PA) intervention for sedentary adults. **Study design:** Randomised Controlled trial **Quality score (++,+ or -):** ++ **External validity score (++, + or -):** ++	**Setting:** US States: Rhode Island, Massachusetts and Connecticut. Sample characteristics: • Mostly non-Hispanic, white, women. • Half of all participants were college educated, • Enhanced internet arm: 80.0% women; mean age = 38.5 (sd=13.1) years; mean BMI 31.4 (sd=1.1) • Standard internet arm: 71.4% women;	**Method of allocation:** Blocked randomized into EI (enhance internet) or SI (standard internet) **Intervention/s description:** • Participants in the EI arm completed monthly Internet questionnaires assessing self-efficacy and outcome expectations for exercise • $10 incentive for completing monthly questionnaires and $25 incentives for completing the 3-month and 6-month assessments	**Outcomes:** Physical activity as assessed by the 7-day physical activity recall (PAR) **Follow-up periods:** 3 and 6 months. **Method of analysis:** To assess potential between-groups differences, a repeated-measures regression model implemented with generalized estimated equations (GEE) with robust standard errors was conducted.	**Total sample:** The treatment effect was significant at 3 months, $c^2(1, 53) = 4.78$, $p = 0.03$, but not at 6 months, $c^2(1,53) = 0.61$, $p = 0.44$. **Intervention group(s)/ control group(s):** Within-group changes from 3 to 6 months were not significant for EI participants ($Z = 0.11$, $p = 0.91$) but were significant for SI participants ($Z = 2.38$, $p = 0.02$). **Attrition details:** • A total of 23 EI participants and 22 SI participants completed 3	**Limitations identified by author:** • Small sample size • Generalisability limited because of the primarily female, middle-aged, and non-Hispanic White population adults included • Self-reported PA data. **Limitations identified by review team:** As above **Evidence gaps/and or recommendations for future research noted by study author:** • Whether

Study details	Population and setting	Method of allocation to intervention/control	Outcomes and methods of analysis	Results	Notes by review team
	mean age = 36.8 (SD=11.1) years; BMI 31.0 (SD=0.7) **Eligible population:** • Healthy • Sedentary (achieving less than 60 minutes of moderate-to-vigorous physical activity per week) • Men and women between the ages of 18 and 65 years • Access to an Internet-connected computer • States: Rhode Island, Massachusetts and Connecticut. **Selected**	• Long-term goal of accumulating a minimum of 150 minutes of moderately intensity physical activity each week in continuous bouts of at least 10 minutes in duration. • Access to newly developed website • Received immediate, individually tailored, motivational physical activity messages generated by a computerised expert system after completing monthly online questionnaires • Regular email reminders to access		months assessment • A total of 22 EI participants and 26 SI participants completed 6 months assessment.	participant use of theory-guided Internet features impacts on the targeted theoretical constructs and whether this relates to change in PA behaviour • Whether the programme can sustain behaviours long term (e.g., 12 months post-treatment) • Which internet features predict long-term behaviour. **Source of funding:** Not reported.

Study details	Population and setting	Method of allocation to intervention/control	Outcomes and methods of analysis	Results	Notes by review team
	population: • As above • 527 responded to advertisements. **Excluded population/s:** • 461 deemed ineligible • Ambulatory/ exercise limitations • Any overt, complicated, or acute cardiovascular, metabolic, respiratory or neurological diseases as assessed by medical history • Current or planned pregnancy • Hospitalisation from any	the website. **Control/comparison/s description:** • SI arm completed monthly questionnaires focused on non-PA-related health topics (e.g., nutrition, health screens) to control for the number of contacts between the participants and the research staff between the two conditions. • $10 incentive for completing monthly questionnaires and $25 incentives for completing the 3-month and 6-month assessments. • Access to a list of six reputable, publicly available			

Study details	Population and setting	Method of allocation to intervention/control	Outcomes and methods of analysis	Results	Notes by review team
	physical or mental disorder in the past 6 months • Taking medication that may impair PA tolerance or performance (e.g., beta blockers) • Participation in any of the researchers' previous PA trials • Lack of access to an Internet connected computer.	PA-promoting websites that have been demonstrated to increase PA • Asked to log on to the study homepage • Regular email prompts same as EI arm. **Total sample:** 53 **Intervention group:** 25 **Control group:** 28 **Baseline comparisons:** There were no significant differences at baseline. Measures assessed included: • Age, years • Percentage women • Body mass index • Non-Hispanic White • College graduate • Household income • Married			

Study details	Population and setting	Method of allocation to intervention/control	Outcomes and methods of analysis	Results	Notes by review team
		• Baseline PA (minutes/week) **Study sufficiently powered:** Not reported			
Cavallo et al. (2012) **Country of study:** USA **Aim of study:** To test the efficacy and feasibility of a 12-week physical activity social support intervention partly administered through Facebook. **Study design:** Randomised control trial **Quality score (++,+ or -):** ++ **External validity score (++, + or -):** +	**Setting:** A large South Eastern public university Sample characteristics: • Predominately White (73%) • Non-Hispanic (92%) • Had parents who had attained college of higher-level education (79%) **Eligible population:** • Women undergraduates at large Southeastern public university • Aged <25	**Method of allocation:** Participants (n=134) were randomly assigned to either the intervention group or the control group. **Intervention description:** • Access to website with physical activity self-monitoring and enrolment in a Facebook group. • Access to the Internet Support for Healthy Associations Promoting Exercise (INSHAPE) website • Provided with educational	**Relevant outcomes:** • Perceived companion social support for physical activity was measured using an adapted version of the positive subscales (informational, esteem and companionship) • Physical activity was measured using a version of the Paffenbarger activity questionnaire adapted for online use. **Follow-up periods:** Perceived social	**Total sample:** • There were no group by time interactions for perceived companionship support $F(1, 127.28) = 1.57$, $p=0.21$ or physical activity $F(1,127.75) = 0.42$, $p=0.52$. • There were main effects of time for physical activity $F(1,127.75) = 23.59$, $p<0.00$ and companionship social support $F(1, 127.28) = 12.13$, $p<0.00$), as these variables increased over the course of	**Limitations identified by author:** • Use of a self-reported physical activity measure. • The current study does not isolate • the effects of Facebook from self-monitoring. • Including men and broadening the demographic characteristics of participants would improve the generalisability of the current findings. **Limitations identified by review**

Study details	Population and setting	Method of allocation to intervention/control	Outcomes and methods of analysis	Results	Notes by review team
	• Reported <30 minutes of daily physical activity • Reported 30 minutes of daily use of Facebook. Selected population: • 134 women Same as eligible; see also sample characteristics **Excluded population/s:** • Excluded if they answered yes to three or more questions on the SCOFF disordered eating questionnaire. • Were required to submit physician approval if they answered yes to one or more	information • Physical activity and a self-monitoring tool allowed participants to set goals, track their daily physical activity and view a chart depicting their progress relative to their goal • National recommendations for physical activity. **Control/comparison/s description:** • Education-only controls received access to a physical activity focused website • Received access to a limited version of the INSHAPE	support for physical activity was assessed at baseline and 10 weeks. Physical activity was assessed at baseline and 12 weeks. **Method of analysis:** Using intention-to-treat analysis, differences in perceived social support and physical activity were assessed with linear mixed models including group, time, and group by time interaction as factors and a random intercept to account for missing data.	the intervention. **Intervention group(s)/ Control group(s):** Not reported. **Attrition details:** • Attrition was different between the intervention group (16%, n=11) and the control group (4%, n=3) at 12 weeks (p=0.02). • The only difference between the baseline characteristics of participants who completed all study measures versus those who did not was Facebook Intensity, with completers having a higher score than non-completers, $t(132)=-2.43$, p=0.02.	**team:** As above. **Evidence gaps and/or recommendations for future research noted by study author:** • Use of objective data-collection measures • Larger sample sizes • Use automated prompts and tools to facilitate recruitment. **Source of funding:** Lineberger Comprehensive Cancer Center Cancer Control education program

Study details	Population and setting	Method of allocation to intervention/control	Outcomes and methods of analysis	Results	Notes by review team
	ques- tions on the Physical Activity Readiness Questionnaire.	website, which *excluded* self-monitoring • Received emails throughout the study with links to the same news stories related to physical activity that were provided to the Facebook group. **Total sample:** 134 Intervention group: 67 Control group: 67 **Baseline comparisons:** • No differences were found at baseline between groups with the exception of the Facebook Intensity Scale, $t(132) = -2.03$, $p=0.04$, where those in the control group			

Study details	Population and setting	Method of allocation to intervention/control	Outcomes and methods of analysis	Results	Notes by review team
		showed higher scores than those in the intervention group. • Participants were predominately white (73%),non-Hispanic (92%), and had parents who had attained college or higher-level education (79%). **Study sufficiently powered:** it was estimated that 110 participants were necessary to give 80% power to detect a significant difference between groups assuming 20% attrition and *A* =0.05.			

Study details	Population and setting	Method of allocation to intervention/control	Outcomes and methods of analysis	Results	Notes by review team
Cobb and Poirier (2014) **Country of study:** US **Aim of study:** To evaluate effectiveness of an online well-being intervention **Study design:** Randomised controlled trial. **Quality score (++,+ or -):** + **External validity score (++, + or -):** +	**Setting:** US. Sample characteristics: • The mean age was 46.7 years • Mean median income was estimated at $75,227 (inflation-adjusted to 2012); 29.8% of the sample was estimated to have reached college or higher education levels. **Eligible population:** Adults living in the US. **Selected population:** See eligible population. **Excluded population/s:**	**Method of allocation:** Eligible candidates were randomised; randomisation was automated and gender-stratified (permutation within strata). **Intervention description:** • Daily Challenge is a freely accessible email-, web- and mobile-based intervention. • Participants receive a daily email and/or text message suggesting a small health-related action (a 'challenge') that they can usually complete in a few minutes, along with information about how to complete the challenge and	**Outcomes:** Social support was assessed using the Interpersonal Support Evaluation List (ISEL, 12-item version). **Follow-up periods:** Participants were contacted over a 7-day window at 30 and 90 days post-enrolment. **Method of analysis:** Wellbeing and social support scores were analysed in mixed model regressions with maximum-likelihood estimation. Response variables were modelled with time, group, and their interaction as predictors. Participants' age, gender, income, and education level were included as controlling variables. The model was first fitted to all	**Total sample:** Across groups, social support scores did not appear to be affected by condition assignment (change for treatment and control groups, respectively: 0.92 vs 0.77 at 30 days; 1.81 vs 1.16 at 90 days), as no significant time-by-group interactions were noted for social support scores in any model ($p > 0.05$). **Intervention group(s)/ control group(s):** See above. **Attrition details:** Across groups, 74.9% (n=1126) of participants were reached for at least one follow-up, and 56.3% (n=846) were reached at both follow-ups. At 30 days, 68.7% (n=1032) of the	**Limitations identified by author:** • Measure of social support possibly not sensitive enough to capture social support that might occur online • High attrition rate. **Limitations identified by review team:** As above **Evidence gaps and/or recommendations for future research noted by study author:** Validate findings using more distal time points. **Source of funding:** MeYou Health LLC, a wholly owned subsidiary of Healthways Inc.

Study details	Population and setting	Method of allocation to intervention/control	Outcomes and methods of analysis	Results	Notes by review team
	• Did not provide a valid email address • Failed to provide consent • Did not complete enrolment in the allotted time • Had a Facebook friend in the trial.	its relationship to wellbeing • The challenges cover topics such as healthy eating, physical activity, stress management, financial matters, relationships, life satisfaction and sleep, among others. By default, a participant receives challenges covering all domains of well-being; at any point, they may opt to focus on an area of their choice. • Members report having completed the challenge (by email, text message, or on the website) and collect virtual	available data, excluding 14 participants for whom no estimate of income and education level could be computed. Multiple imputation methods were used to create 40 replicates of the data set with all participant data (including income and education) made complete, using Rubin's rules to combine the results.	sample completed follow-up; 62.6% (n=940) of participants did so at 90 days. No evidence of differential study retention between groups was found at either time point (p > 0.05).	

Study details	Population and setting	Method of allocation to intervention/control	Outcomes and methods of analysis	Results	Notes by review team
		rewards. • Members are encouraged to recruit individuals from their real-life social network and connect with them within Daily Challenge. • Additionally, members may interact and establish 'friend' connections with people they meet through the intervention site. These connections are explicit and must be acknowledged (reciprocated) to be activated • Members can form pacts to complete challenges together, encourage one			

Study details	Population and setting	Method of allocation to intervention/control	Outcomes and methods of analysis	Results	Notes by review team
		another, cheer each other on via 'smiles' and comment on each other's challenge completion stories • Engagement is rewarded with points, badges, gradual revealing of graphic-level images, and other virtual elements drawn from game design work. **Control/comparison/s description:** • Placebo-controlled, parallel group • Control participants received a generic health newsletter by email once a week (no social interactivity or calls to action) and otherwise had no			

Study details	Population and setting	Method of allocation to intervention/control	Outcomes and methods of analysis	Results	Notes by review team
		access to the Daily Challenge system. **Number of participants:** • **Total** N=1503 • Intervention n=752 • Control n=751. **Baseline comparisons:** There was no association between group allocation and gender, age, ethnicity, race, income, education level, baseline wellbeing or baseline social support. **Study sufficiently powered:** Power calculations and sample size were based on an expected 2-point change in wellbeing score coupled with evidence indicating that a 1-point change is correlated with			

Study details	Population and setting	Method of allocation to intervention/control	Outcomes and methods of analysis	Results	Notes by review team
		significant economic outcomes. Budgetary constraints set an upper limit on recruitment at 1,500 participants, which allowed the detection of a 2.2-point effect in a two-tailed *t*-test with 80% power, at a 5% significance level with a 20% dropout rate (alpha Bonferroni corrected to 0.025; estimated SD=16.7).			
Hanberger et al. (2013) **Country of study:** Sweden **Aim of study:** To develop a web portal designed to facilitate self-management, including diabetes-related information and	**Setting:** Paediatric clinics in Linköping and Jönköping (Sweden). **Sample characteristics:** Mostly women **Eligible population:** • Families living in catchment area of Linköping and	**Method of allocation:** The patients and their families were randomised (stratified for clinic) to either the intervention group or the control group **Intervention description:** Intervention group: • Offered self-	**Relevant outcomes:** HbA1c values. **Follow-up periods:** 1 and 2 years **Method of analysis:** • Most recent HbA1c values for each patient at baseline, at the end of study year 1 and at the end of study year 2	There were no significant differences between intervention and control groups at one year (both means = 6.7, SD = 1.2, *p*=0.72). **Intervention group(s)/ Control group(s):** Not reported. **Attrition details:**	**Limitations identified by author:** • Overall usage rate of intervention portal low • The effect on patients' and parents' knowledge of diabetes was not evaluated. **Limitations**

Study details	Population and setting	Method of allocation to intervention/control	Outcomes and methods of analysis	Results	Notes by review team
social networking functions, and to study its use and effects in paediatric patients with diabetes **Study design:** Randomised controlled trial. **Quality score (++,+ or -):** + **External validity score (++, + or -):** +	Jönköping • 0-18 years and their families • Clinically diagnosed type 1 diabetes children • Registered in the Swedish paediatric diabetes quality registry. **Selected population**: Same as eligible **Excluded population/s:** Not reported.	directed communication with health professionals, interaction with peers and access to information. • The portal provided services for medical prescription renewal, appointments, and open questions and other general information about the local diabetes teams and their services. **Control/comparison description:** • No access to the portal until year 2 • Then in year 2, the control group had the same access to portal and facilities as intervention	• For comparisons, Mann-Whitney U test and Wilcoxon signed rank test were used and when data were normally distributed, Student's *t* test, paired and unpaired was used.	• Year 1 No consent (n=11) • Year 1 Transfer to other diabetes centre (n=5) • Year 2 Transfer to other diabetes centre (n=3) • Year 2 No consent (n=7).	**identified by review team:** As above. **Evidence gaps/ and or recommendations for future research noted by study author:** Not reported **Source of funding:** Not reported.

Study details	Population and setting	Method of allocation to intervention/control	Outcomes and methods of analysis	Results	Notes by review team
		group. **Sample:** • Total: 474, of which adolescents 295 • Intervention group: 244 (adolescents 151) • Control group: 230 (adolescents 144) • Study year 1: 233 patients and their parents (adolescents n=142) • Second study year, an additional 254 patients and their parents (adolescents n=147) from the previous control group accepted as well. **Baseline comparisons:** The groups were equal regarding baseline clinical characteristics (age at diagnosis,			

Study details	Population and setting	Method of allocation to intervention/control	Outcomes and methods of analysis	Results	Notes by review team
		Duration, HbA1c baseline and insulin dose). **Study sufficiently powered:** Not reported.			
Hansen et al. (2012) **Country of study:** Denmark **Aim of study:** To examine whether an automated web-based intervention would lead to increased physical activity (PA) among inactive persons. **Study design:** Population-based randomised controlled trial. **Quality score**	**Setting:** A nationwide health study in Denmark carried out in 13 municipalities. **Sample characteristics:** • Mean age was 50 (SD 13.6) years • 64.82% (3,925) were women • 18.95% (2,329/12,287) were mostly sedentary and the rest reported light PA in their leisure time.	**Method of allocation:** Participants were randomly assigned by the registration programme to either an intervention (website) or a no-intervention control group. Intervention description: • Website programme/group individual tailored advice • Training programme: general recommendations • Forum and	**Relevant outcomes:** Body mass index (BMI) **Follow-up periods:** 3 months and 6 months. **Method of analysis:** Independent *t* test for difference between groups.	**Total sample:** • There were no significant differences in body mass index (BMI) at 3 months between the intervention group, mean = 25.3 (SE=0.2) and control group, mean 25.0 (SE=0.2); p = 0.12 • Note BMI was *not* measured at six months. **Intervention group(s)/ Control group(s):** Not reported. **Attrition details:**	**Limitations identified by author:** • Due to technical error, only half the participants were invited to answer the 3-month follow-up questionnaire. • A fundamental methodological problem in eHealth trials is that a proportion of the people in the intervention group will not use the intervention or will use it only sparingly • In this study, 7%

Study details	Population and setting	Method of allocation to intervention/control	Outcomes and methods of analysis	Results	Notes by review team
(++,+ or -): - **External validity score (++, + or -):** +	**Eligible population:** • Aged 18+ • Physically inactive • Living in one of 13 Danish municipalities **Selected population:** • Same as eligible population • 11 out of 13 municipalities selected. **Excluded population/s:** • People engaging in moderate to vigorous PA. • People with serious heart problems. • People not being able to perform everyday activities, or	discussion page for questions from participants • Participants aged 60+ given extra advice. **Control/ comparison/s description:** Control group received no intervention. **Total sample:** 12,287 participants. **Intervention group:** 6,055 participants. **Control group:** 6,232 participants. **Baseline comparisons:** There were no significant differences between the website and control groups on the measures tested: age, sex, education, physical activity and health.		• The response rates in the 3-month questionnaire were 57.55% in the intervention group and 66.41% in the control group. • The response rates in the 6-month questionnaire were 59% in the intervention group and 67% in the control group. • 37.2% participated in the follow-up health examination, with 215 in the intervention group and 219 in the control group.	logged on more than once and only 2% used the website as intended in the website group. • Intervention embedded within a survey could have caused confusion and influenced usage. **Limitations identified by review team:** As above. **Evidence gaps and/or recommendations for future research noted by study author:** Not reported. **Source of funding:** TrygFonden, Denmark.

Study details	Population and setting	Method of allocation to intervention/control	Outcomes and methods of analysis	Results	Notes by review team
	missing values in the PA screening questionnaire.	**Study sufficiently powered:** With a power of 80% probability of detecting a 12% versus 5% difference as statistically significant at the 5% level, the minimum sample size was calculated to be 250 in each group. We expected that approximately 50% of the participants in DANHES were sedentary. Assuming that 80% accepted participation and 25% were lost to follow-up, the power to detect effects was sufficient.			
Hwang et al. (2013) **Country of study:** US **Aim of study:** To evaluate user	**Setting:** Members of an online weight-loss community who were not up-to-date with CRC screening were enrolled in the	**Method of allocation:** participants were randomly allocated in a 1:1 ratio to the basic or enhanced intervention with a computer-generated	**Relevant outcomes:** • Self-efficacy to undergo CRC screening • Social support • Screening status	**Total sample:** • For social support (social influence of SparkPeople members), the basic group	**Limitations identified by author:** • Fewer than 60% of participants in the enhanced intervention

Study details	Population and setting	Method of allocation to intervention/control	Outcomes and methods of analysis	Results	Notes by review team
engagement and the impact of narratives and peer support for promoting colorectal cancer screening (CRC) in an online weight-loss community. **Study design:** Pilot randomised controlled trial. **Quality score (++,+ or -):** - **External validity score (++, + or -):** +	study in 2011. Sample characteristics: • Mean age 56 years (SD=5.3) • Mean BMI was 32.1 (SD=7.8) • Most participants were female, white, married, employed and had health insurance). **Eligible population:** • Aged 50-75 • residing in the US • having no prior diagnosis of CRC or history of inflammatory bowel disease • Not up-to-date with CRC screening (i.e.,	randomisation sequence. Block randomisation was used to achieve balanced groups. **Intervention description:** Enhanced intervention: • received narratives and peer support for CRC screening in online forums • Most narratives in health interventions were delivered in clinical or local community settings. • Invited to join the private, study-specific online 'SparkTeam' to access the narratives and interact with the narrators and other enhanced group	(faecal occult blood test, sigmoidoscopy or colonoscopy). **Follow-up periods:** 1 month then 6 months. **Method of analysis:** Comparisons were conducted with the *t*-test, chi-square, or Fisher's exact test.	reported a mean change of 0.26 (SD 0.59) at 6 months (vs 3.33, SD 0.56) in the enhanced group), $p = 0.17$. • For self-efficacy, the basic group reported a mean change of 0.15 (SD 0.60) at 6 months (vs 0.09, SD 0.54 in the enhanced group) $p = 0.42$ • For screening, 25 participants (16%) in the basic group vs. 29 participants (19%) in the enhanced group reported attendance. Adjusted odds ratio (95%CI) = 1.33 (0.73, 2.42). **Attrition details:** Participants at 6	accessed the narrative and peer support components • Only 56% (306 of 550) of eligible and initially interested members were randomised, suggesting that the study may have enrolled a subset with more motivation to learn about CRC screening • Participants were predominately white women, reflecting the membership of the SparkPeople community and other online health-related communities • Despite the reach

Study details	Population and setting	Method of allocation to intervention/control	Outcomes and methods of analysis	Results	Notes by review team
	having had no faecal occult blood test within the past year, sigmoidoscopy within the past 5 years, or colonoscopy within the past 10 years). **Selected population:** Same as eligible population **Excluded population/s:** Out of the initial n=4,127: • 1,505 up to date with CRC • 546 declined participation • 463 lived outside US • 440 up to date with sigmoidoscopy • 323 up to date with faecal	participants. • Unscreened individuals were connected to positive role models who were members of the same online community. • Educational information about CRC adapted from the 'Screen for Life' National Colorectal Cancer Action Campaign by the CDC. **Control/ comparison description:** • Email link inviting them to view educational information about CRC adapted from the 'Screen for Life' National Colorectal Cancer		months, self-report measures: • 122 in basic group • 136 enhanced group • Outcomes available for 306 participants.	of online social media, most members of online communities passively view the content without posting their own messages. **Limitations identified by review team:** As above. **Evidence gaps and/or recommendations for future research noted by study author:** Modifications are needed to improve user engagements with the narrative and peer support components of the enhanced intervention. Source of funding: NIH grant.

Study details	Population and setting	Method of allocation to intervention/control	Outcomes and methods of analysis	Results	Notes by review team
	occult blood test • 165 aged <50 or >75 years • 100 had inflammatory bowel disease • 35 had colorectal cancer. • 244 gave an invalid email address or did not respond to confirm email address).	Action Campaign by the CDC. • Up to three additional reminders were sent within 2 weeks of the initial email to those who had not yet viewed the information. **Total sample:** 306 **Intervention group:** 153 **Control group:** 153 **Baseline comparisons**: • There were significant differences between intervention and control groups (age, gender ethnicity, marital status, education BMI, working status, health			

Study details	Population and setting	Method of allocation to intervention/control	Outcomes and methods of analysis	Results	Notes by review team
		insurance, knowledge of screening, motivation for screening and attitudes towards screening) • The participants in the basic group were more likely to report a visit to their primary care provider in the past year compared to the enhanced group (86% vs. 72%). **Study sufficiently powered:** Not reported.			
Lau et al. (2012) **Country of study:** Australia **Aim of study:** To assess the impact of a web-based personally	**Setting:** Australian university, students and staff Sample characteristics: • Mean (SD) age: 26.26 (9.07)	**Method of allocation:** Eligible participants were randomly assigned to the PCHMS (personally controlled health management system) or waitlist control by a random	**Relevant outcome measures:** Proportion of participants obtaining influenza vaccinations during the study. **Follow-up periods: End of study (**6	**Total sample:** In absolute terms, participants assigned to the PCHMS were 6.7% (95% CI 1.5 to 12.3) more likely than waitlist recipients to receive an influenza	**Limitations identified by author:** • The study relied on self-reported outcome by participants • It is possible that in a more severe

Study details	Population and setting	Method of allocation to intervention/control	Outcomes and methods of analysis	Results	Notes by review team
controlled health management system (PCHMS) on the uptake of seasonal influenza vaccine and primary care service utilisation among university students and staff. **Study design:** Randomised controlled trial. **Quality score (++,+ or -):** ++ **External validity score (++, + or -):** ++	• Female: 57.0% • Student: 80% • Non-medicine faculty: 80%. Eligible population: • Initial recruitment of 855 students and staff • Aged 18 or above • University staff and students • Access to the internet and email at least on a monthly basis. **Selected population:** Same as sample and eligible population. **Excluded population/s:** Self-reported having obtained an influenza	number sequence, pre-generated externally to the research team with a computerised random-number generator with randomly assigned blocks (block sizes 2, 4, and 8) and an intervention allocation ratio of 1:1. **Intervention/s description:** • Online appointment bookings whereby participants could click a Book now button on the journey page, thus sending an email to the University Health Service (UHS, the university primary care service) to book an appointment for influenza	months). **Method of analysis:** Primary analysis examined differences in the proportion of participants obtaining influenza vaccination during the study in the waitlist and PCHMS groups using the c2 test, including participants who had the opportunity to use the PCHMS but did not do so.	vaccine: x^2 (1, n=470)=7.1, p=0.008; waitlist: 4.9% (12/246, 95% CI 2.8 to 8.3) vs PCHMS: 1.6%(26/224, 95% CI 8.0 to 16.5). **Attrition details:** • 604 participants were followed up at end of intervention occurring between May and October 2010. • Primary and secondary analyses were conducted on 470 of the participants who met the eligibility criteria and had complete data.	season of influenza, the impact of PCHMS on vaccination rates and health service utilisation could be higher than observed in the study. **Limitations identified by review team:** As above. **Evidence gaps/ and or recommendations for future research noted by study author:** Future studies should employ more theoretical approaches to designing e-health services, recognising that uptake and outcome changes may be highly dependent on population, disease group and socio-economic

Study details	Population and setting	Method of allocation to intervention/control	Outcomes and methods of analysis	Results	Notes by review team
	vaccination in 2010 prior to enrolment in the study (excluded from analysis at post-study).	vaccination or other medical issues. A dedicated UHS administrative staff member would telephone participants by the next working day to confirm appointments. • The influenza vaccine journey in Healthy.me contained three elements: 1) A consumer vaccination care pathway which described the types of influenza vaccine currently available; 2) steps to obtain vaccination at the UHS or elsewhere; and 3) vaccine costs, adverse effects and contraindications.			factors. **Source of funding:** National Health and Medical Research Council (NHMRC) Centre for Research Excellence (1032664), and the HCF Health and Medical Research Foundation.

Study details	Population and setting	Method of allocation to intervention/control	Outcomes and methods of analysis	Results	Notes by review team
		Control/comparison/s description: Waitlist control. **Total sample:** 742 **Intervention group:** 370 **Control group:** 372. **Baseline comparisons:** • There were no baseline differences between pre-study characteristics across the waitlist and PCHMS groups ($p > 0.05$). Characteristics tested were: age, gender, university student, non-medicine faculty, patient at the university heath service, use of social networking sites, use of the			

Study details	Population and setting	Method of allocation to intervention/control	Outcomes and methods of analysis	Results	Notes by review team
		internet to find health-related information, use of public transport for work, experience of cold symptoms, work face-to-face with patients, medications used, visited healthcare professionals during last six months. **Study sufficiently powered:** 600 participants with 300 in each arm were needed to detect a 10% difference in vaccination rate between the waitlist control and the PCHMS groups, calculated at 5% level of significance, 80% power (two-sided test), with an anticipated participant dropout rate of 10%.			

Study details	Population and setting	Method of allocation to intervention/control	Outcomes and methods of analysis	Results	Notes by review team
Mayer and Harrison (2012) **Country of study:** US. **Aim of study:** To develop and evaluate a social media-based intervention for young adults to improve food safety attitudes, practices, and knowledge. **Study design:** Quasi-experimental **Quality score (++,+ or -):** - **External validity score (++, + or -):** +	**Setting:** University of Georgia **Eligible population:** • Undergraduate students studying at University of Georgia • Studying introductory food and nutrition classes or an introductory housing and consumer economics course **Selected population:** As above. **Excluded population/s:** not reported.	**Method of allocation:** Quasi-experimental design in which students from the introductory nutrition course were assigned to either a control or one of three treatment groups. **Intervention description:** The project was conducted in two phases: • Phase 1: two sections of the course were assigned to the control or treatment groups. • Phase 2: students from an additional two sections from the introductory course were assigned to the	**Relevant outcomes measured:** Practices related to safe food handling. **Follow-up periods:** No specific dates; just states spring and summer. **Method of analysis:** Paired *t* tests were used to compare pre-test and post-test scores within groups.	**Total sample:** the Lecture and Facebook (Phase 1 intervention) group had significantly greater improvement in practice scores than did the other groups (data not reported). **Intervention group(s)/ control group(s)** • There was a significant difference in food practices between the Phase 1 intervention (Lecture Facebook >15 minutes) at pre-test (mean = 3.90) and post-test (mean = 4.30) (p = 0.0001) (standard deviations not reported) • There was a significant difference in food	**Limitations identified by author:** • The population may not be representative of the youth population • The use of self-reported data. **Limitations identified by review team:** As above **Evidence gaps/ and or recommendations for future research noted by study author:** Future research should explore the relationship between informal communications on social media sites and food safety outcomes. **Source of funding:**

Study details	Population and setting	Method of allocation to intervention/control	Outcomes and methods of analysis	Results	Notes by review team
		control or treatment group. Phase descriptions: • Phase 1 group: access to the 'safe eats' Facebook page and a standardised food safety lecture. • Phase 2 group: only access to the 'safe eats' Facebook page. **Control/comparison/s description:** • Phase 1 group: only the standardised food safety lecture • Phase 2 group: no food safety instruction. **Total sample:** 710 Intervention group: • Phase 1 (n=274)		practices between the control group at pre-test (mean = 3.91) and post-test (mean = 4.17) (p = 0.0001) (standard deviations not reported. **Attrition details:** Not reported.	Not reported.

Study details	Population and setting	Method of allocation to intervention/control	Outcomes and methods of analysis	Results	Notes by review team
		• Phase 2 (n= 278) Control group: • Phase 1 (n =75) • Phase 2 (n= 83) **Baseline comparisons** • Analysis of pre-test scores revealed that all treatment and control groups were similar in terms of food safety attitude, practice and knowledge scores at the beginning of the study • Females had significantly higher practice pre-test scores than did males. **Study sufficiently powered:** Not reported.			

Study details	Population and setting	Method of allocation to intervention/control	Outcomes and methods of analysis	Results	Notes by review team
Authors: Turner-McGrievy and Tate (2011) **Country of study:** US. **Aim of study:** To examine whether a combination of podcasting, mobile support communication, and mobile diet monitoring can assist people in weight loss. **Study design:** Randomised controlled trial **Quality score (++,+ or -):** + **External validity score (++, + or -):** ++	**Setting:** Participants were recruited through television advertisements and email listservs in the Raleigh-Durham, North Carolina, USA, metropolitan area for this 6-month randomised trial. Of the 494 volunteers who inquired about the study, 359 (72.7%) were ineligible and 135 were invited to an orientation, of whom 96 enrolled in the study. **Sample characteristics:** Participants were mostly: • female • white • married • educated (higher	**Method of allocation:** • Participants were randomly assigned using a computerised random numbers generator. • Neither study participants nor investigators were blind to treatment assignment. **Intervention description:** Participants were randomly assigned to one of two conditions: podcast only vs podcast plus enhanced mobile media intervention (Podcast+Mobile). Both groups received 2 podcasts per week for 3 months (approx. 15 minutes each) and 2 minipodcasts per week for months 3–6	**Outcomes:** • Physical activity (Paffenbarger Physical Activity Questionnaire) • Weight loss (a face-to-face group visit was conducted to obtain height and weight (Tanita scales and Stadiometer) • Weight loss self-efficacy (Weight Efficacy Life-Style Questionnaire). **Follow-up periods:** 3 and 6 months (this review assessed at 6 months only). **Method of analysis:** • All data collection and analyses were conducted using intention-to-treat by using imputation	**Total sample:** The group-by-time interaction was not significant for any of the variables including physical activity, weight loss and weight lost self-efficacy. **Intervention group(s)/ control group(s):** • The podcast+mobile group lost a mean of 2.4 kg (SD 3.4) at 3 months (vs 2.3 kg, SD 3.3 in the podcast group) and an additional 0.2 kg (SD 3.0) from months 3 to 6 (vs 0.3 kg, SD 1.8 in the podcast group) • The podcast+mobile group increased intentional physical activity change by	**Limitations identified by author:** • Participants completed the 3-month follow-up a week prior to the Thanksgiving holiday (United States). Months 3–6 occurred over the holiday season, including Thanksgiving, Christmas, Hanukkah and New Year, which may have been a barrier to behaviour change • The self-monitoring app and Twitter were poorly used by participants • A short intervention period • The study

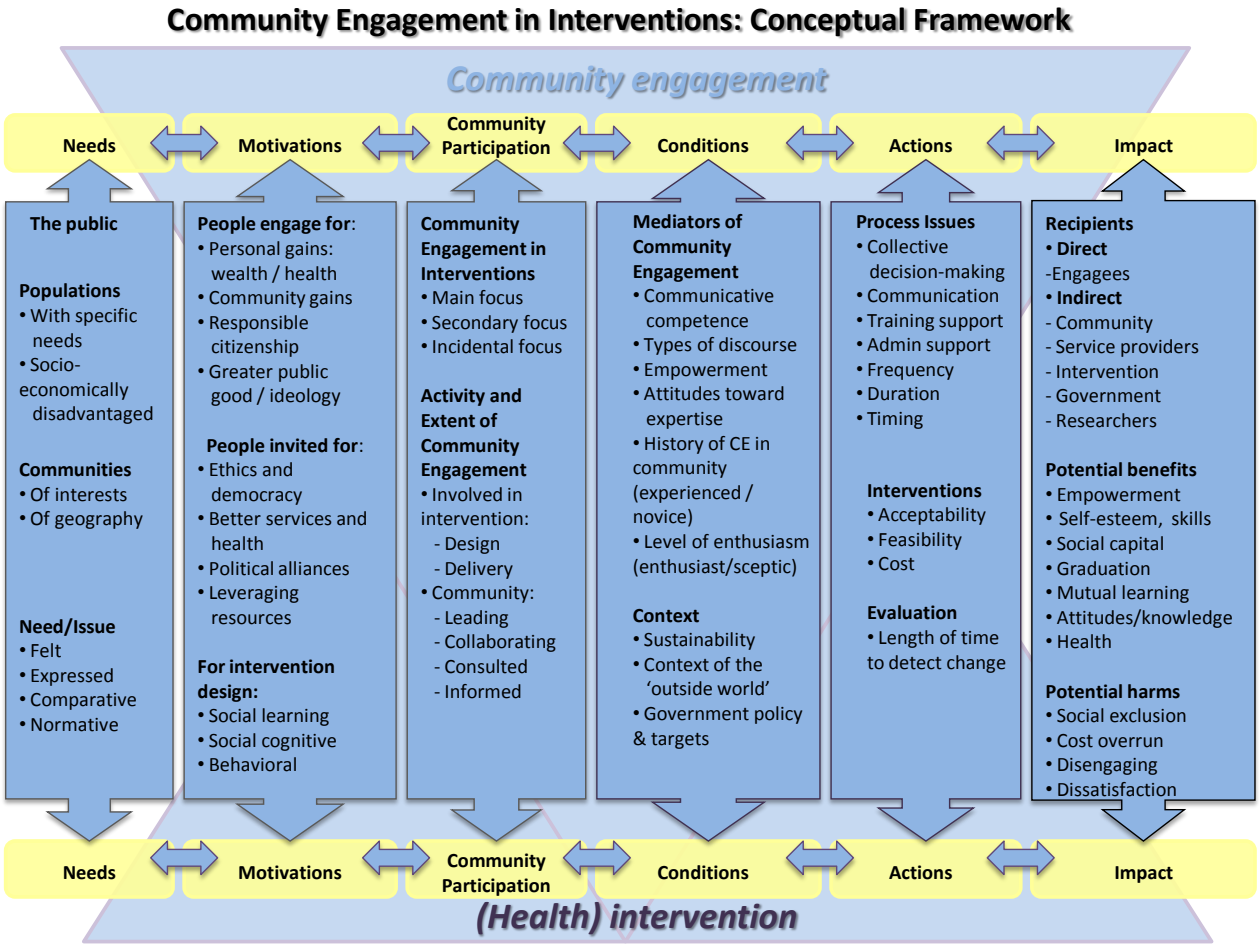
Study details	Population and setting	Method of allocation to intervention/control	Outcomes and methods of analysis	Results	Notes by review team
	degree) **Eligible population:** • Overweight and obese men and women (BMI 25–45) • 18–60 years old • Had to own one of four types of Internet-capable mobile devices: iPhone, iPod Touch, BlackBerry, or an Android-based phone. • Have access to the Internet and be comfortable using a computer. • Have access to a body weight scale for self-monitoring weight. **Selected**	(approx. 5 minutes each). For both groups: • Access was to a group-specific podcast site • They had to subscribe to the podcast using their mobile device or listen to the podcast on a PC. • Podcasts were designed using constructs from social cognitive theory • For the first 3 months, podcasts covered nutrition and physical activity information; there was an audio blog of a man or woman trying to lose weight; and there was a soap opera, and a goal-setting	(baseline observation carried forward) • Between-subjects *T* tests were calculated for differences between continuous variables, paired-samples *T* tests were used to examine differences within groups. • Analysis of variance was used to examine mean differences within 3 or more groupings, and repeated-measures analysis of variance was used to assess changes over time among the continuous variables.	94.5 kcal (SD 130.2) at 3 months (vs 82.7 kcal, SD 153.2) in the podcast group) and by 86.8 kcal (SD 182.1) from months 0 to 6 (vs 96.7 kcal, SD 185.5 in the podcast group) • The podcast+mobile showed a mean weight loss self-efficacy change of 12.5 (SD 29.0) kg at 3 months (vs 12.5, SD 24.4 in the podcast group) and 17.6 (SD 25.3) from months 0 to 6 (vs 20.1, SD 26.0 in the podcast group).	population was mostly female and white **Limitations identified by review team:** As above. **Evidence gaps and/or recommendations for future research noted by study author:** Combine podcasts with tailored feedback for participant to enhance compliance with health behaviour change interventions. **Source of funding:** Not reported.

Study details	Population and setting	Method of allocation to intervention/control	Outcomes and methods of analysis	Results	Notes by review team
	population: As above. **Excluded population/s:** Participants were excluded if they smoked, had an unstable medical status or uncontrolled thyroid condition, were unable to attend the 3 monitoring visits or increase walking as a form of exercise, had a psychiatric illness, were in treatment for alcohol or drug dependency, had an eating disorder, were currently participating in a weight-loss programme, or were pregnant, breastfeeding, or planning on	activity • Months 3–6: only the nutrition and exercise podcast – the focus was on overcoming barriers and problem-solving issues. **Only the podcast+mobile group received the following:** • Instruction to download a diet and physical activity monitoring application (app: 2010 version of FatSecret's Calorie Counter app, FatSecret.com) and a social networking site (Twitter) app to their mobile device (both free for download). • A user account on			

Study details	Population and setting	Method of allocation to intervention/control	Outcomes and methods of analysis	Results	Notes by review team
	becoming pregnant within the next 6 months.	Twitter and advice to read messages posted from the study co-ordinator once a day. • Encouragement to post at least daily to Twitter. **Control/ comparison/s description:** See above. **Sample sizes at baseline:** • Intervention: 47 podcast + mobile media group) • Control: 49 podcast-only group. **Baseline comparisons:** There were no significant differences in baseline demographics (age, gender, ethnicity, marital status, education) between			

Study details	Population and setting	Method of allocation to intervention/control	Outcomes and methods of analysis	Results	Notes by review team
		the two groups. More people in the Podcast+Mobile group than in the Podcast group reported previously downloading a health-related podcast (p = 0.04) or installing a healthy diet-related app to their mobile device (p = 0.04). **Study sufficiently powered:** Sample size per intervention arm for 2-sided tests of significance at alpha = 0.05 and power 1 – beta = 80% would be 43 per group (86 total required). To account for attrition, an attempt was made to recruit 95–105 total participants.			

Appendix 3: Conceptual framework



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