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Published paper

Everson-Hock, E.S., Johnson, M., Jones, R., Woods, H.B., Goyder, E., Payne, N. and Chilcott, J. (2013) *Community-based dietary and physical activity interventions in low socioeconomic groups in the UK: a mixed methods systematic review*. Preventive Medicine. ISSN 0091-7435 (In Press)

<http://dx.doi.org/10.1016/j.ypmed.2013.02.023>

Community-based dietary and physical activity interventions in low socioeconomic groups in the UK: a mixed methods systematic review

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Running head: Community dietary and physical activity interventions in low-SES groups

Keywords: diet, physical activity, low-SES, community, review, mixed methods

Word count (excluding in-text citations and references): 4011

Date of resubmission: 31 January 2013

Highlights

- We review community dietary and physical activity interventions in low-SES groups
- Quantitative data are inconclusive as to the effectiveness of interventions
- Qualitative evidence suggests a range of barriers and facilitators to participation
- Some barriers and facilitators were addressed by interventions, but many were not

Abstract

Objective: Low socioeconomic status (SES) is a risk factor for type 2 diabetes and changes in diet and physical activity can prevent diabetes. We assessed the effectiveness and acceptability of community-based dietary and physical activity interventions among low-SES groups in the UK.

Method: We searched relevant databases and web resources from 1990 to November 2009 to identify relevant published and grey literature using an iterative approach, focusing on UK studies.

Results: Thirty-five relevant papers (nine quantitative, 23 qualitative and three mixed methods studies) were data extracted, quality assessed and synthesised using narrative synthesis and thematic analysis. The relationship between interventions and barriers and facilitators was also examined. Dietary/nutritional, food retail, physical activity and multi-component interventions demonstrated mixed effectiveness. Qualitative studies indicated a range of barriers and facilitators, which spanned pragmatic, social and psychological issues. The more effective interventions used a range of techniques to address some surface-level psychological and pragmatic concerns, however many deeper-level social, psychological and pragmatic concerns were not addressed.

Conclusion: Evidence on the effectiveness of community-based dietary and physical activity interventions is inconclusive. A range of barriers and facilitators exist, some of which were addressed by interventions but some of which require consideration in future research.

1. Introduction

Low socioeconomic status (SES) is a significant risk factor for chronic conditions such as type 2 diabetes and precursory conditions such as impaired glucose tolerance and impaired fasting glucose, together known as 'pre-diabetes' (Department of Health, 2002). Type 2 diabetes prevalence in the UK is rising, from 2.8% in 1996 to 4.3% in 2005 (González et al., 2009) and 100,000 people are diagnosed with type 2 diabetes every year in the UK (Diabetes UK, 2006). In England, people who are most socioeconomically deprived are 40% more likely than those least deprived to have type 2 diabetes (The NHS Information Centre, 2010). Around 10% of the English population lived in the most deprived areas in 2008 (Department for Communities and Local Government, 2011) and 3.6 million adults fell below the minimum income adequate for healthy living in 2010 (Morris et al., 2010). Therefore, interventions targeted at low-SES groups have the potential for major public health impact. Qualitative research can provide contextual insight into the appropriateness and acceptability of interventions aimed at low-SES groups.

Dietary and physical activity interventions have the potential to influence health outcomes, including type 2 diabetes and pre-diabetes (Harding et al., 2006). Those in low-SES groups are more likely to have higher levels of obesity, an unhealthy diet and be physically inactive, putting them more at risk of developing diabetes and pre-diabetes (Cleland et al., 2012a; Diabetes UK, 2006; National Institute for Health and Clinical Excellence, 2011) and other chronic conditions. Intervention participants, however, tend to be from less deprived backgrounds than non-participants (Chinn et al., 2006; Waters et al., 2011), suggesting that interventions aimed specifically at low-SES groups might be useful for reaching these people.

Community-based interventions provide a feasible and cost-effective way of reaching large numbers of people using limited resources, for health gain (Bopp & Fallon, 2008; Brownson et al., 1996; Garrett et al., 2011; Harding et al., 2006). Such interventions are typically multi-dimensional and take a broad and inclusive approach (Carson et al., 2011). Specific strategies include mass media campaigns, mass communication (e.g. posters, flyers, websites), counselling by health professionals, collaboration with community-based organisations, use of specific community-based settings, changes to the environment, community member delivery and social networks (Bopp & Fallon, 2008; Brownson et al., 1996; Merzel & Afflitti, 2003; Mummery & Brown, 2009) and can involve engagement of the community concerned (King et al., 2011). This approach is appropriate for diet and physical activity, which are likely to be influenced by a range of environmental, physical, social and economic factors (Ganann et al., 2012), and for low-SES groups, who may have specific needs and barriers (Cleland et al., 2012a).

Therefore, as part of a series of reviews of evidence to inform national public health guidance regarding community-based prevention of diabetes, we assessed the effectiveness and acceptability of community-based dietary and physical activity preventive interventions among low-SES groups in the UK.

2. Methods

2.1. Search strategy

We searched electronic databases Medline, Embase, CINAHL, British Nursing Index, Cochrane Library, Science Citation Index via Web of Knowledge, Social Science Index via Web of Knowledge and PsycINFO from 1990 to November 2009 using terms relating to low SES and community dietary and physical activity interventions (Supplementary Table 1). Additional web searches were also undertaken to identify relevant grey literature. An emergent and iterative approach to identifying key literature was adopted to maximise specificity of searches (Booth, 2008). More general mapping searches were conducted initially, with papers identified informing subsequent targeted searches. Key phrases, words and authors identified through each iteration were searched in each subsequent iteration. Citation searches and hand searches of reference lists of included papers were also undertaken.

2.2. Inclusion criteria

Quantitative intervention studies examining community-based physical activity and dietary interventions relative to a usual care, placebo/attention or no comparison involving adults (aged 18-74) from a low-SES group within the UK were included in the review. Intervention studies that did not report numerical outcome data for at least one time point were excluded. Also included were qualitative evaluations of interventions and stand-alone qualitative studies assessing beliefs and perceptions of physical activity and diet among adults from a low-SES group or health professionals/workers working with adults from a low-SES group, within the UK. A UK focus was maintained as the purpose of the review was to inform national guidance and we wanted to be confident we were considering the evidence most relevant to a national policy context. For practical reasons, included papers were restricted to those published in the English language and from 1990. Titles, abstracts and full papers of retrieved records were sequentially screened (Figure 1).

2.3. Data extraction and synthesis

Two reviewers (EEH and RJ for intervention studies and EEH and MJ for qualitative studies) extracted data on the sampling, aims, intervention, measurements and outcomes/themes using standardised forms. Heterogeneity in intervention type, population and outcomes precluded

meta-analysis of quantitative data, thus narrative synthesis was undertaken. Thematic analysis was conducted on the qualitative data. All themes were derived from the data. We juxtaposed qualitative and quantitative data in a matrix assessing the extent to which the interventions incorporated the barriers and facilitators identified in the qualitative synthesis (Thomas et al., 2004).

2.4 *Quality assessment*

Quality assessment of quantitative and qualitative studies was undertaken using the appropriate National Institute for Health and Clinical Excellence (NICE) quality assessment checklists (NICE, 2009). Each study was rated as ++, + or – on the basis of characteristics such as sampling, measurement, analysis and internal and external validity of findings (Supplementary Tables 2 and 3). No study was excluded on the basis of quality. Study quality was assessed by two reviewers and there was no disagreement on the grading of studies.

3. Results

3.1. *Included studies*

Initial mapping searches and targeted searches produced 3416 and 237 hits respectively, excluding duplicates (Figure 1). Thirty-five articles were included in this review; 12 reporting quantitative intervention studies (three of which also reported qualitative studies) and 23 reporting qualitative studies (Supplementary Tables 4 and 5).

Three quantitative intervention studies were randomised controlled trials (RCTs), six were non-randomised controlled trials (nRCTs), one was a prospective cohort study and two were non-comparative studies (case series). Fifteen qualitative studies were evaluations of interventions (including seven evaluations of included interventions) and 11 were stand-alone qualitative studies investigating beliefs, attitudes and practice relating to dietary and physical activity behaviours.

3.2. *Quality of included studies*

Two quantitative intervention studies were rated ++, eight were rated + and two were rated -. The main limitations to quality were poor description of the source population, lack of sufficient power or power calculations and lack of reported effect sizes (Supplementary Table 2). Eight qualitative studies were rated ++, 18 were rated + and none were rated -. The main quality limitations were reporting of participant characteristics and researcher/participant interaction, as well as data collection and analysis methods (Supplementary Table 3).

3.3. *Quantitative data synthesis*

Quantitative intervention studies were categorised as: dietary/nutritional; food retail; physical activity and multi-component interventions. The most common duration for an intervention was one year (Ashfield-Watt et al., 2007+; Bremner et al., 2006+; Cochrane & Davey, 2008+; Cummins et al., 2005+). Other interventions lasted between two weeks (Steptoe et al., 2003++) and six months (Lindsay et al., 2008+). One intervention lasted four years (Baxter et al., 1997+). Intervention duration varied across different types of intervention.

Two dietary/nutritional community-level interventions aimed to increase fruit and vegetable intake in deprived communities (Ashfield-Watt et al., 2007+; Bremner et al., 2006+) and four interventions involved enabling people to choose and cook healthy food (Kennedy et al., 1998-; McKellar et al., 2007+; Steptoe et al., 2003++; Wrieden et al., 2007+), one of which focused on promoting a Mediterranean-type diet (McKellar et al., 2007+). Overall, findings demonstrated mixed effectiveness (Supplementary Table 6). There was evidence of mixed effectiveness on **fruit and vegetable intake, consumption of high fat food, physiological measurements and nutrition knowledge**. Evidence suggested no significant impact on **weight control or other eating habits**, such as intake of starchy foods, fish or fibre.

Two interventions involved the introduction of a large-scale food retailing outlet in the intervention area (Cummins et al., 2005+; Wrigley et al., 2003-), and findings were mixed in terms of effectiveness (Supplementary Table 6). One study found a positive effect on **psychosocial variables**. Both studies indicated mixed effectiveness on **fruit and vegetable intake**, and evidence suggested no significant impact on **health outcomes**. Neither study identified a negative impact on any outcome.

Both studies examining physical activity interventions adopted different approaches: an environment-focused community awareness campaign promoting physical activity in the local community (Cochrane & Davey, 2008+); and two interventions tested together using a fitness assessment to tailor an exercise plan and an exercise consultation focused on behaviour change principles, both with vouchers for local facilities (Lowther et al., 2002++). Overall, physical activity interventions showed mixed effectiveness (Supplementary Table 6). One study demonstrated a positive effect on **health** and mixed effectiveness was found on **physical activity** behaviour, with one study finding a positive effect and another finding a mixed effect. No studies identified a negative impact on any outcome.

One multi-component intervention incorporated a combination of behaviour change, educational, empowerment and medical approaches to lifestyle change (Baxter et al., 1997+) and the other involved providing access to an Internet portal aimed at helping people with

heart disease to lead a healthier lifestyle (Lindsay et al., 2008+). Evidence of mixed effectiveness was found on **consumption of high fat foods**, with one study reporting a positive effect on consumption of low-fat milk but no effect on consumption of low-fat spread, and one study reporting no significant impact (Supplementary Table 6). Evidence suggested no significant impact on **physical activity, weight control, physiological measurements, psychosocial variables and other eating habits**. Neither study identified a negative impact on any outcome.

We examined the characteristics of studies that were and were not successful across a range of outcomes (sample size, study design, intervention, duration of intervention and duration of longest follow-up point). The only difference found was in studies assessing **consumption of high fat foods**, where the positive effect (for similar interventions) was associated with a shorter follow-up time (McKellar et al., 2007+). One study that did not find evidence of a positive effect on any outcome was the only study to assess access to a health promotion portal (Lindsay et al., 2008+).

3.4. *Qualitative synthesis: main themes*

Barriers to and facilitators of lifestyle change identified in included qualitative studies were grouped into several categories, each with one or more themes attached (Supplementary Table 7).

3.4.1. *Barriers and facilitators to intervention implementation/participation*

Having sufficient **available resources** was raised as being important in implementing dietary and physical activity interventions (Bremner et al., 2006+; Dobson et al., 2000+; Kennedy et al., 1998+). Specific barriers included a lack of funding, time and labour for running interventions and a lack of available facilities for preparing, storing and transporting food. Continuous funding from a large award was identified as a facilitator, as was developing a focused action plan to target the funding and labour effectively.

Generating **awareness of interventions** was also reported to be instrumental. Although a range of strategies were typically used, the most successful method appeared to be word of mouth (Dobson et al., 2000+; Withall et al., 2009+).

A number of studies reported the **acceptability of interventions**, in terms of the *attributes of health workers, the delivery and content of interventions, social inclusion and the associated image* formed by health behaviours in interventions (Dobson et al., 2000+; Gray et al., 2009+; Kennedy et al., 1998+; Kennedy et al., 1999+; Peerbhoy et al., 2008+; Spence & van Teijlingen, 2005+; Wormald et al., 2006+). Positive attributes of health workers included

knowledge of the community, facilitating empowerment, engaging participants in the subject matter, communicating information in a meaningful way, empathy and trustworthiness.

Certain aspects of intervention delivery and content were facilitative (Dobson et al., 2000+; Gray et al., 2009+; Kennedy et al., 1998+; Peerbhoy et al., 2008+; Rankin et al., 2006++; Spence & van Teijlingen, 2005+; Stead et al., 2004+; Wormald et al., 2006+), including practical demonstrations, progressive small steps towards change, male-only classes and orientation to weight management, delivering content according to participants' needs, incentives such as free food, using familiar and affordable food and using community members to deliver the intervention. Acceptability could be enhanced by women-only classes, activities at the weekend, free sessions, child-care and food, tailored recipes and enjoyable activities. Social inclusion was important in enhancing intervention acceptability (Dobson et al., 2000; Gray et al., 2009+; Lindsay et al., 2008+; Peerbhoy et al., 2008+; Rankin et al., 2006++; Rankin et al., 2009++; Thomson et al., 2003+). The image associated with certain health promotion activities could be a barrier to participation (Coleman et al., 2008++; Rankin et al., 2006++; Stead et al., 2004+), for example negative connotations with exercise clothing and the term 'healthy eating'.

Views and experiences of health professionals and health workers reported in one study suggested that a deeper knowledge of target groups' circumstances could be a facilitator and correspondingly that lack of knowledge could be a barrier (Rankin et al., 2009++).

3.4.2. *Barriers and facilitators to behaviour change*

Barriers and facilitators regarding **information** on health behaviours were identified in a number of studies, and related to *available information* and *understanding messages*. Available information was obtained from many sources including health professionals and the mass media (Daborn et al., 2005+; Dibsdall et al., 2002++; Gough & Conner 2006++; Wood et al., 2010+). Television was seen as a facilitator, when used positively to improve knowledge of food and nutrition. However, people felt bombarded by information, often confusing and contradictory, and distrust was common.

Many barriers impeded the understanding of health messages (Gray et al., 2009+; Lawrence et al., 2009+; Stead et al., 2004+; Wardle et al., 2001+; Wood et al., 2010+). These included a lack of clear information, misunderstanding of food messages and the perception of healthy eating messages as complex, especially sugar content and the classification of fats, a balanced diet (misinterpreted as a balance of 'good' and 'bad' foods) and the '5-a-day' message (misinterpreted as five portions of fruit).

Existing **attitudes to health** were also found to be important in behaviour change (Dibsdall et al., 2002++; Lawrence et al., 2009+; Nic Gabhainn et al., 1999+; Whelan et al., 2002+; Withall et al., 2009+; Wood et al., 2010+), and in particular there seemed to be contradicting attitudes depending on how in control people felt over their health. Some deliberately sought a healthy lifestyle and cheap healthy foods, whereas others were not concerned with their health or healthy food. Other barriers were lack of perceived control over weight, no clear perceived links between lack of exercise and chronic conditions, and food and health, with some people believing it was not good to be ‘too healthy’.

Perceived capabilities could also constitute a barrier or facilitator of change (Coleman et al., 2008++; Lawrence et al., 2009+; Peerbhoy et al., 2008+; Stead et al., 2004+). Barriers included a poor initial level of fitness and perceptions of a lack of sporting capability, cooking skills and confidence in cooking meals from scratch and being able to eat ‘5-a-day’, although the latter could be overcome by enhancing skills in a non-threatening way and using peer and family support. Some people, however, expressed confidence in cooking and experimenting with food.

Barriers related to people’s **current lifestyle** (Gough & Conner 2006++; Lawrence et al., 2009+; Nic Gabhainn et al., 1999+; Price, 2007+; Whelan et al., 2002+; Withall et al., 2009+) included commitments and responsibilities, stress, comfort eating, being stuck in a rut, embarrassment, the belief that activity around the home is sufficient and lack of time. Conversely, boredom was cited as a reason for unhealthy eating, with some people aware of the apparent contradiction. Health professionals suggested that mental health problems such as depression could have an impact.

Many barriers centred around **affordability** (Dibsdall et al., 2002++; Kennedy et al., 1998+; Lawrence et al., 2009+; Parry et al., 2007+; Peerbhoy et al., 2008+; Price 2007+; Whelan et al., 2002+; Withall et al., 2009+), including the cost of buying healthy food, perceived lack of affordable food locally, public transport costs, the cost of cooking different meals to suit different preferences, marketing strategies promoting unhealthy foods and wasting money buying food that the family would not eat. Health professionals felt that healthy food could be prioritised when shopping, and budgeting could be covered in nutritional education programmes. The costs of physical activity, including transport and facilities, were perceived as prohibitive, although these could be overcome by referral schemes.

Certain **environmental factors** warrant consideration (Cavill & Watkins, 2007++; Lawrence et al., 2009+; Parry et al., 2007+; Peerbhoy et al., 2008+). Perceived lack of local shopping amenities and accessing shops with children could be prohibitive to healthy eating. Fear of

crime, intimidation and attack, dark evenings and poor weather were barriers to outdoor physical activity.

Social norms, preferences, habitual behaviours and lifestyle were also found to be influential (Daborn et al., 2005++; Dibsall et al., 2002++; Gough & Conner, 2006++; Gray et al., 2009+; Kennedy et al., 1998+; Lawrence et al., 2009+; Peerbhoy et al., 2008+; Stead et al., 2004+; Whelan et al., 2002+; Withall et al., 2009+; Wood et al., 2010+; Wormald et al., 2006+). Barriers to healthy eating included perceiving ‘bad’ foods as a treat and ‘good’ foods as boring and unsatisfying, prioritising traditional food and family preferences over healthy choices, perceived lack of family support in childhood, parental influence, habit in unhealthy shopping and eating and living alone. Women’s eating practices were often influenced by a perceived lack of personal control and importance. Men’s barriers centred around personal preferences (to be overweight rather than ‘thin’), personal choice and good current health. Facilitators included women’s motivation to cook healthy food for their children and men’s motivation to engage in ‘masculine’ physical activity to compensate for an unhealthy diet.

3.5. *Mixed methods synthesis*

To better understand the relationship between interventions and barriers and facilitators, we juxtaposed quantitative and qualitative data. Specifically, we examined which barriers and facilitators were addressed in any intervention and in effective interventions specifically (Table 1; Supplementary Table 8). Fifteen facilitators and 24 barriers were covered by the interventions and 17 facilitators and 24 barriers were not, suggesting that while the interventions reviewed should have a moderate degree of acceptability, there is scope for interventions to be more sensitive to the needs of low-SES groups.

The five studies to find at least one positive effect of the intervention addressed some of the barriers and facilitators identified in the qualitative studies (of the 15 facilitators and 24 barriers covered by interventions, six facilitators and 11 barriers were covered by ‘effective’ interventions; Supplementary Table 8). The barriers and facilitators covered by ‘effective’ interventions encompassed a range of psychological and pragmatic considerations, although some more deeply-ingrained psychological and pragmatic considerations, such as attitudes and perceptions relating to health behaviour and weight and fear of crime were not addressed by the interventions reviewed.

4. Discussion

Overall, some dietary and physical activity interventions appeared to be effective and acceptable among low SES groups in the UK, although others demonstrated little or no

impact. There was mixed evidence of effectiveness across all categories of intervention. While no intervention demonstrated a clear positive effect on all outcome measures considered, some studies showed positive impacts on some outcomes and no intervention had a negative impact on any outcome. We could not identify systematic differences in the characteristics of interventions that were effective at changing at least one outcome and those that were not, but this may be due to the relatively small number of interventions and the large numbers of different outcomes examined, which makes direct comparisons across studies more difficult. Study quality was variable, with only two intervention studies being rated as high quality, one of which was only two weeks in duration.

Our finding of overall limited evidence seems consistent with the broader context. A recent review of reviews found insufficient good-quality evidence to draw any conclusions about the effectiveness of dietary and physical activity interventions among low-SES populations worldwide, however there was weak evidence that dietary interventions decreased fat intake (O'Mara et al., 2010). A recent review found a small effect of community-wide physical activity interventions on physical activity levels in low-SES groups, however again the evidence base was limited (Cleland et al., 2012b). Similarly, a recent evaluation of the 'Change for Life' public health campaign in the UK found little benefit of the intervention on physical activity and dietary behaviours, although engaging with the intervention had a positive impact on low-SES families and a negative impact on high-SES families (Croker et al., 2012).

Our qualitative review indicated a range of barriers to and facilitators of both participation in dietary and physical activity interventions and health behaviour change more generally, which spanned pragmatic, social and psychological concerns. Although some intervention programmes used qualitative research as a means of evaluation, none used qualitative research to inform the content and delivery of the intervention. The research reviewed here provides relevant insights into the needs, expectations and beliefs of people from a range of social and cultural groups who share the characteristic of socioeconomic deprivation.

Our qualitative review findings have practical implications for community-based dietary and physical activity interventions targeting low-SES groups and also for policy makers. Sufficient resources are needed to deliver meaningful interventions. Key workers delivering interventions need knowledge and understanding of the community; possibly be a community member. Interventions can increase acceptability by using enjoyable, creative and innovative activities and enhancing (and harnessing) social inclusion. Negative or misunderstood beliefs and connotations surrounding healthy eating and physical activity need to be addressed. Clear and consistent information on healthy eating and physical activity is needed, encompassing

advice provided by the government, on TV and in interventions. Interventions could enhance people's control beliefs and self-confidence in their ability to cook and eat healthily and be physically active, and correspondingly address the role of the whole family in lifestyle choices. The affordability and perceived affordability of healthy lifestyle choices needs to be improved, and this could be complemented with education on budgeting. Existing motivators could be harnessed within interventions, such as cooking healthy food to improve children's health or exercising to bolster masculinity.

Our qualitative findings appear to be broadly consistent with previous research. Issues surrounding information, family and work commitments, costs, social influences and understanding health information were also identified in a recent review examining barriers and facilitators to the implementation of community-based lifestyle interventions among black and minority ethnic groups in the UK (Johnson et al., 2011). Lack of information and financial and neighbourhood resources, and group exercise and affordable and accessible facilities have been identified respectively as barriers and facilitators of physical activity among low-SES pregnant African-American women (Krans & Chang, 2011). Another recent review found insufficient information, perceptions of control over health and concerns over personal safety to be barriers to physical activity in South Asian older adults (Horne & Tierney, 2012). Recent research suggests young adults view health promotion messages as unpopular and lack concern for future health (Poobalan et al., 2012). An evaluation of the UK-based 'Change for Life' public health intervention revealed a common perception among people from all SES backgrounds that their existing eating and physical activity behaviours were satisfactory, with the cost of healthier eating seen as a barrier among low-SES families (Croker et al., 2012). Awareness of the impact of financial status on family food choices has also been documented among primary school children (Fairbrother et al., 2012).

When assessed against the interventions reviewed, many of the barriers and facilitators raised in the qualitative review were addressed by interventions, however many were not. The more effective and acceptable interventions used a range of techniques to address some (mainly surface level) psychological and pragmatic concerns, however many (deeper-level) social, psychological and pragmatic concerns such as the role of the family, attitudes and perceptions relating to health behaviour and weight and fear of crime were not addressed by any intervention. Future research would benefit from considering such barriers and facilitators in planning dietary and physical activity interventions for low-SES groups.

4.1 Strengths and limitations

Behavioural outcomes of interventions were mainly self-reported, therefore some caution is required in interpreting our quantitative review findings. Since no study reported longer-term

health outcomes, it is impossible to directly assess the impact of the interventions on the health of those in low-SES groups. Substantial numbers of eligible people did not participate in the interventions, however those who are eligible but do not volunteer, or who volunteer but do not provide data may be different from those who participate. Trial participants are less likely to be male, current smokers or within the lowest quartile of SES than non-participants or defaulters (Chinn et al., 2006; Waters et al., 2011). Thus, our quantitative review findings may not necessarily be representative of the hardest-to-reach low-SES groups.

Some of the methodological challenges in conducting mixed methods reviews would also apply here, including conflicting data produced by different methods, the resource-intensive nature of this method and dependence on authors' descriptions of interventions (Harden & Thomas, 2007; Kavanagh et al., 2012). Contextual or cultural differences between data sources may also be a challenge (Campbell et al., 2011).

A strength of this review was the inclusion of many types of evidence, which allowed us to explore effectiveness findings in contextual detail and create explicit links between quantitative and qualitative evidence, using methods appropriate for the data (Harden & Thomas, 2007; Kavanagh et al., 2012). This enabled us to identify gaps in the intervention evidence base and thus directions for future research (Harden & Thomas, 2007).

5. Conclusion

There remains limited evidence for the effectiveness of specific dietary and physical activity interventions implemented in low-SES communities and many specific barriers to and facilitators of behaviour change exist, which warrant consideration when developing interventions for low-SES populations. While some of these factors appear to have been addressed in the interventions reviewed here, the published evidence suggests that others have not been addressed to date. Overall, evidence on the effectiveness of community-based dietary and physical activity interventions is inconclusive. A range of barriers and facilitators exist, some of which were addressed by interventions and some of which require consideration in future research.

Acknowledgements

This review was funded by the National Institute for Health and Clinical Excellence (NICE) for the purpose of informing public health development. The project was initiated by the funder and developed as a result of a scoping exercise undertaken by the funder and the authors. The interpretation, analysis and views expressed are those of the authors and not necessarily those of NICE.

Conflict of interest statement

The authors declare that they have no conflicts of interest. Data was collected, analysed and written up by the authors and the funder had no involvement in the analysis, writing up or decision to submit the article for publication.

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Figure 1: Flow diagram of paper selection

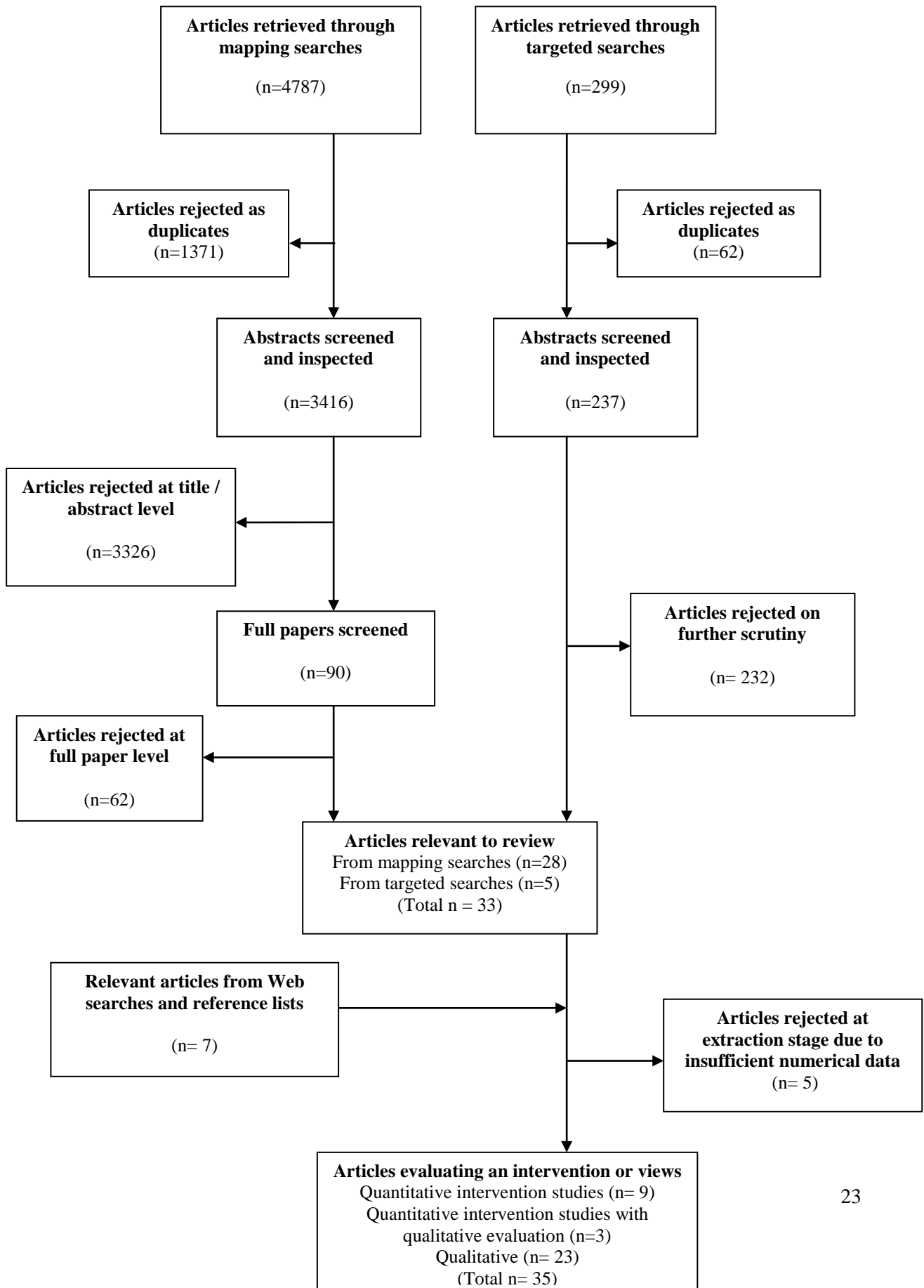


Table 1: Presence of themes identified in qualitative review in community-based dietary and physical activity interventions for low-SES groups in the UK, 1990-2009 (shaded columns indicate studies finding effectiveness on one or more outcome/s)

Category	Theme (where relevant)	Ashfield-Watt +	Baxter +	Bremner +	Cochrane +	Cummins +	Kennedy -	Lindsay +	Lowther ++	McKellar +	Steptoe ++	Wrieden +	Wrigley -
Available resources													
Awareness of interventions													
Acceptability of interventions	Attributes of health workers												
	Delivery and content			✓			✓		✓	✓		✓	
	Social inclusion						✓			✓		✓	
Views and experiences of health professionals and health workers	Knowledge												
Information	Available information	✓		✓									
Attitudes to health				✓	✓		✓		✓	✓		✓	
Perceived capabilities													
Affordability					✓								
Social norms, preferences, habitual behaviours and lifestyle													
Acceptability of interventions	Associated image												
Information	Available information						✓			✓		✓	
	Understanding messages	✓		✓			✓						
Attitudes to health													
Perceived capabilities	Existing attitudes	✓		✓			✓		✓	✓		✓	

Lifestyle (current)				✓			
Affordability	✓	✓	✓		✓	✓	✓
Environmental factors	✓	✓	✓		✓	✓	✓
Social norms, preferences, habitual behaviours and lifestyle	✓			✓	✓		

✓ = theme addressed by intervention