Research

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Effectiveness of physical activity and dietary interventions in South Asian populations:

a systematic review

Abstract

Background
Physical activity and dietary change interventions can prevent or delay a range of chronic disease. Little is known in primary care about their effectiveness in South Asian populations, who are often at higher risk of developing such diseases.

Aim
To assess evidence for effectiveness of primary care based physical activity and dietary interventions in South Asian populations, and identify methods to inform future intervention development.

Design
Systematic review.

Method
Intervention studies conducted in developed countries that reported data for South Asian adults were sought by searching electronic databases, trial registries, and conference proceedings. Following wider screening of titles and abstracts, 119 full articles were reviewed.

Results
Of the 119 articles, four studies met the inclusion criteria and evaluated community-based interventions with South Asian individuals. Methodological quality was poor overall. Interventions appeared generally effective in promoting a decrease in weight, with some positive changes in blood pressure and biochemical outcomes, such as cholesterol. There was limited evidence for effects on behaviour. Theoretical frameworks were not identified and evidence on attitudinal or knowledge-based outcomes was sparse. The inclusion of individual feedback and community workers in communities of deprivation appeared important to the acceptability of the interventions. Information distinguishable for South Asian individuals within intervention studies of general populations was lacking.

Conclusion
Physical activity and dietary interventions with South Asian populations show modest promise but, given the paucity of controlled evaluations or use of objective measures, outcomes are difficult to interpret. Potential insights may be missed if experience concerning South Asian groups within studies is not reported. Further development of culturally appropriate interventions that are theoretically informed and assessed in experimental designs are required.

Keywords
community; dietary change, physical activity; primary care; South Asian; systematic review.

INTRODUCTION

In developed countries, people of South Asian origin who are historically immigrant (including those of Indian, Pakistani, Bangladeshi, and Sri Lankan ancestral origins) have markedly higher and earlier mortality and morbidity from coronary heart disease (CHD) and type 2 diabetes, as well as their complications, than the general population.[1–3] These contribute to extensive disability and suffering, as well as significant societal costs. For primary care, the greatest opportunity to address the personal and societal burden of such chronic disease is to prevent development of the disease or delay its onset in those, often socially disadvantaged, communities that are at highest risk and need.[4]

Although genetic factors contribute, lifestyle features strongly in the development of a range of chronic diseases.[5] Well-documented risk factors for cardiovascular disease, diabetes, and cancer include physical inactivity, a diet that is high in fat and sugar, and obesity.[3,6,7] A significant association is found between cardiovascular-protective behaviours and lower risk of all-cause and cardiovascular mortality on a national scale.[8] Large international trials of intensive physical activity and dietary interventions have demonstrated long-term reductions in the development of type 2 diabetes for adults at higher risk.[9,10] Several reviews on the effects of diet and exercise on the incidence of CHD and type 2 diabetes have emphasised their importance in the primary and secondary prevention of disease.[11–13]

With South Asian populations identified as less physically active than the general population,[14,15] alongside growing concern about child and adult obesity,[16] culturally appropriate and effective interventions in this high-risk group are urgently needed.[17] However, little is known about relevant experience of such interventions with South Asian populations. This study aimed to systematically review current evidence to address two research questions:

- Can community or primary care based interventions targeting physical activity and/or dietary change improve health outcomes in people of South Asian origin in developed countries?
- Can culturally appropriate methods and theoretical models be identified from eligible studies to inform the development and delivery of future interventions?

METHOD

Study eligibility criteria were any community or primary care based intervention study conducted in a developed country that quantitatively evaluated the effectiveness of a physical activity and/or dietary change intervention in adult South Asian communities of people who were historically immigrant, or described inclusion of the latter in their samples and reported data identifiable for South Asian individuals. The search aimed to identify both randomised and non-randomised controlled studies, the latter including before and after, between-group designs. The search was limited to the English language.

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How this fits in

Evidence for the impact of interventions promoting dietary change and physical activity is strong, particularly for diabetes, but less is known about their effectiveness in South Asian populations at high risk of developing chronic diseases. This systematic review suggests there is modest evidence that interventions with people of South Asian origin may improve weight loss, blood pressure, and blood lipid profiles, although there is little evidence for facilitating change in behaviour or knowledge. Community-based interventions involving bilingual link workers and using individual feedback, appear promising, especially within South Asian communities that are socio-educationally disadvantaged. The development of culturally appropriate interventions that are theoretically based and evaluated in high-quality experimental research is still needed to achieve effective health promotion in this high-risk group.

The following databases were searched from inception to January 2011: MEDLINE®, embase, CINAHL®, PsycINFO, Cochrane Database of Systematic Reviews, and DARE. Search strategies were designed for each database. The MEDLINE search strategy was developed using existing Cochrane search strategies and peer-reviewed by an information scientist (Box 1). Supplementary searches of online trial registries and conference proceedings were also conducted. Two reviewers independently inspected titles and abstracts of identified papers. The data extraction form was developed by two individuals, who independently reviewed the full-text articles of eligible studies; data extraction was undertaken by a third reviewer and the details were cross-checked by the first two individuals. Any disagreement on inclusion or data entry was resolved by consensus discussion.

From eligible studies, all effects of physical activity and dietary interventions were categorised into primary clinical outcomes and secondary outcomes of behaviour and psychological/knowledge-based change, which are meaningful in explaining clinical endpoints.[18] Data were extracted in terms of the percentage of change from baseline to follow-up, and presented with the actual baseline value and level of statistical significance where available. Qualitative data on intervention acceptability were also extracted where available. The methodological quality of the studies was assessed using a validated quality index,[19] based on the reporting of findings, validity, the extent of bias in measurement and outcome, and selection bias.

RESULTS

Study characteristics and quality assessment

The flow of studies through the stages of the systematic review is shown in Figure 1. Data distinguishable for South Asian individuals who were historically immigrant and were, or may have been, included in the samples of many studies was lacking. In total, only four studies were included in the final review.

Details of the study characteristics and interventions are described in Table 1. Due to the small number of studies and considerable heterogeneity in intervention type, assessment, and outcome measures, meta-analyses were not feasible and a narrative synthesis was performed.[20] The four studies included physical activity and/or dietary change as part of one-to-one and/or group educational interventions for CHD risk and/or diabetes, involving health visitors, bilingual link workers, or dietitians in community settings.[21–24]

All studies were uncontrolled before-and-after designs, except one randomised controlled trial.[24] No studies reported using theoretical models to inform interventions, though one study[21] measured participants' stage of change.[25] Reported methodological quality was generally poor, with total scores ranging from 41% to 56%[19] (full data available from authors). The number of participants varied from 13[23] to 201,[24] involving people who were largely from South Asian communities; however, detailed descriptors beyond ethnicity or, in one study, education, were lacking. For reporting quality, higher scores were gained for adequately describing study aims, interventions, and participants, but only three of the four studies clearly described the main findings.[21–23] Two studies reported exact significance levels for the main outcomes[21,22] and one reported a sample-size calculation.[24] External and internal validity and bias scores were low, with only one study reporting reliable compliance with the intervention.[24] One study failed to score on the use of accurate, valid, and reliable main-outcome measures[24] and reliability of secondary measures was poor. No studies adjusted for confounding in analyses, or reported on potential adverse effects, and only one provided a comparison group.[24]
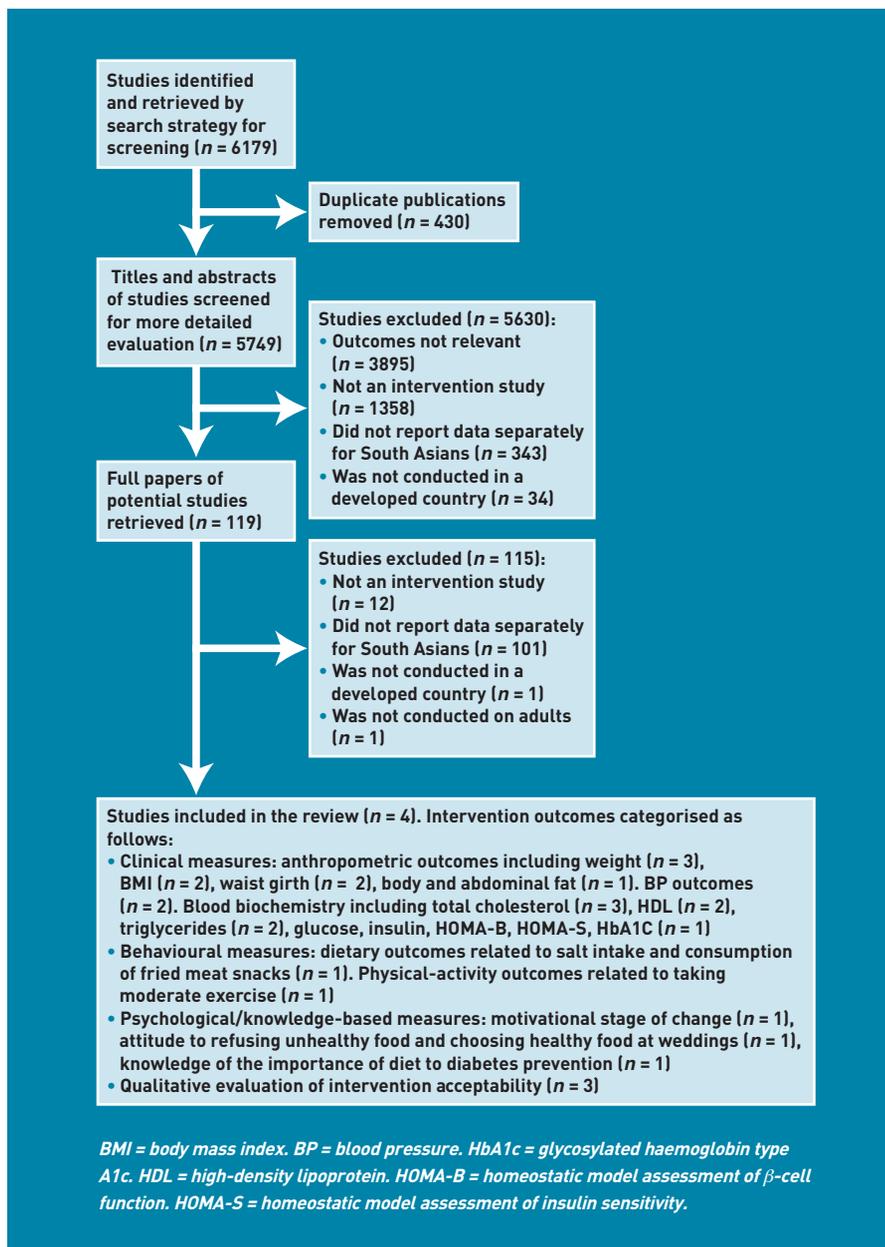
Figure 1. Flow chart for studies through stages of systematic review.

Studies identified and retrieved by search strategy for screening (n = 6179)

Duplicate publications removed (n = 430)

Titles and abstracts of studies screened for more detailed evaluation (n = 5749)

Studies excluded (n = 5630):
- **Outcomes not relevant (n = 3895)**
- **Not an intervention study (n = 1358)**
- **Did not report data separately for South Asians (n = 343)**
- **Was not conducted in a developed country (n = 34)**

Full papers of potential studies retrieved (n = 119)

Studies excluded (n = 115):
- **Not an intervention study (n = 12)**
- **Did not report data separately for South Asians (n = 101)**
- **Was not conducted in a developed country (n = 1)**
- **Was not conducted on adults (n = 1)**

Studies included in the review (n = 4). Intervention outcomes categorised as follows:
- **Clinical measures: anthropometric outcomes including weight (n = 3), BMI (n = 2), waist girth (n = 2), body and abdominal fat (n = 1). BP outcomes (n = 2). Blood biochemistry including total cholesterol (n = 3), HDL (n = 2), triglycerides (n = 2), glucose, insulin, HOMA-B, HOMA-S, HbA1C (n = 1)**
- **Behavioural measures: dietary outcomes related to salt intake and consumption of fried meat snacks (n = 1). Physical-activity outcomes related to taking moderate exercise (n = 1)**
- **Psychological/knowledge-based measures: motivational stage of change (n = 1), attitude to refusing unhealthy food and choosing healthy food at weddings (n = 1), knowledge of the importance of diet to diabetes prevention (n = 1)**
- **Qualitative evaluation of intervention acceptability (n = 3)**

BMI = body mass index. BP = blood pressure. HbA1c = glycosylated haemoglobin type A1c. HDL = high-density lipoprotein. HOMA-B = homeostatic model assessment of β-cell function. HOMA-S = homeostatic model assessment of insulin sensitivity.

Intervention effects

Clinical outcomes. The clinical impacts of the interventions are summarised in Table 2. All four studies reported clinical outcomes, including changes to anthropometric measures, blood pressure, and/or blood biochemistry. All studies measuring changes in weight demonstrated a reduction in kilogrammes from baseline to follow-up, ranging from a 0.9% reduction over 6–12 months[21] to 3.4% at 17 months.[23] Waist girth in centimetres showed small percentage decreases of 0.6[21] and 2.1,[22] and reductions in body and abdominal fat were also found.[22] However, all reductions in weight, waist girth, and body and abdominal fat were significant

for males only in one community-based, group-education intervention.[22]

One study reported significant reductions in systolic blood pressure of 2.8%[21] and two studies reported reductions in mean diastolic blood pressure of 3.9%[21] and 3.9%[22] (females only). Measures of blood biochemistry showed mixed results. Significant positive impacts on cholesterol (–3.7% over 6–12 months)[21] were reported in one of three studies; increases in high-density lipoprotein were reported in another (9.5% females only, increases in males also approaching significance),[22] and significant decreases in triglyceride levels (13.3%)[21] were found in one of two studies. No significant changes were reported in glucose, insulin, homeostatic model assessment of β-cell function (HOMA-B), homeostatic model assessment of insulin sensitivity (HOMA-S), or glycosylated haemoglobin type A1c (HbA1c).

Behavioural outcomes. Self-reported changes to dietary behaviour and physical activity were measured in one study[21] (Table 3). Males and females reported significant improvements in salt intake and consumption of fried meat snacks following a CHD-prevention service.[21] In relation to physical activity, an average of 49% of participants reported taking more moderate exercise (defined as 'physical activity that makes one out of breath but not sweaty') 6–12 months after intervention.[21] Another study discussed specific dietary changes, such as increases in fish intake and cereal, following group activity and dietary-education sessions, but no data were reported from these measures.[22]

Psychological and knowledge-based outcomes. Table 4 shows the psychological and knowledge-based impacts of the interventions. In total, 50% of participants in one study showed an increase in the stage of change relating to motivation to address lifestyle behaviours after 6–12 months, in comparison with a decrease of 21% and 29% who stayed the same.[21] With regard to attitude change, a single item about 'finding it hard to refuse food at social events' increased, and 'choosing correct food at weddings' showed a modest increase, but no significance data were reported.[24]

Little evidence was demonstrated for knowledge-based changes following the interventions. Single items asking if the participant 'agrees the importance of diet to diabetes prevention' and the percentage of people 'correctly identifying different food values' showed small increases after 6

Table 1. Characteristics of included studies

Study	n (attrition rate)	Sample	Setting/ referral method	Intervention design and content	Delivery	Duration of follow-up	All outcome measures		
							Clinical	Psychological/ Behavioural	Knowledge based
Mathews et al[21]	140 (54%, n = 304)	Inclusion South Asian origin: Bangladeshi 21%, Indian 23%, Pakistani 48%, other South Asian origin 8% Age: 13–81 years (mean = 44.5 ± 13.6) 66% female; 48.8% with family history of diabetes	Health clinic/ community-based CHD prevention and control service Referral [1] self [2] voluntary organisations [3] GP/other health workers	Uncontrolled before-and-after study [1] 30-minute screening clinic to identify and address CHD risk factors; [2] 30-minute consultation to discuss individual tests, heart-health profile and goal setting; printout of heart profile with personal levels of risk; [3] dietetic clinic to provide one-to-one nutritional support [4] optional practical activities including cookery workshops, exercise classes and CHD/diabetes-awareness sessions	Delivered at project base and community venues by [1] health visitors [2] South Asian community workers [3] interpreter and translator service from local council and South Asian health workers	Clinic follow-up 6–12 months from baseline	Anthropometric [1] weight [2] BMI [3] waist girth Blood pressure [1] systolic [2] diastolic Blood biochemistry [1] cholesterol [2] HDL [3] triglycerides Mean collective CHD risk score/100	Lifestyle assessment self-reported: [1] salt intake [2] consumption of fried meat snacks [3] takes moderate exercise	Psychological motivational stage of change in relation to CHD and diabetes control (precontemplation/ contemplation/ preparation/action/ maintenance)
Rush et al[22]	41 (not reported)	Inclusion migrant Asian Indian origin >50 years Exclusion [1] knee/hip replacement [2] lifting weights [3] pregnant [4] major medical conditions such as diabetes/cancer [5] taking medication affecting body composition Age: female = 59 ± 8 years; male = 62 ± 8 years Sex: 50% female	Community-based group physical activity and diet education sessions Referral: personal contact with community organisations	Uncontrolled before-and-after study [1] initial group education session with food guide and healthy-lifestyle handouts for Indian adults, individually marked waist threads to assess girth change, pedometers, diary to record number of daily steps [2] 3- monthly group sessions (pedometer club, weigh-ins, cooking demonstration) with handouts	Delivered at hospital laboratory (measures) and regular meetings at community groups (intervention) Details of project staff not reported	Measures taken at baseline, 1, and 5 months Group sessions delivered directly following measures at 1 month and then once per month until study end	Anthropometric [1] weight [2] waist girth [3] body fat [4] abdominal fat Blood pressure [1] systolic [2] diastolic Blood biochemistry [1] cholesterol [2] HDL [3] total/HDL [4] triglycerides [5] glucose [6] insulin [7] HOMA-B [8] HOMA-S	N/A	N/A

Table 1 continued. Characteristics of included studies

Study		Inclusion/Exclusion	Setting/Referral	Study design and intervention	Delivered	Measures timing	Outcome measures		
Williams and Sultan[23]	13 (N/A)	**Inclusion** Females of Asian origin Age: 26–55 years, mean age not reported Average attendance: 10 per group with nine per group being overweight or obese Language: seven of 13 women required	Community-based group healthy eating and exercise classes. Referral personal contact with existing women's group, word of mouth by attendees and link worker	Uncontrolled before, after, and follow-up study: (1) Weekly healthy-eating and exercise group over 12 weeks: (a) opportunity to be weighed and discuss individual progress (b) 45 minutes of low impact stretch and tone exercises (c) advice on suitable home exercises and healthy-eating discussions	Delivered at community venue by: (1) dietitian (2) fitness instructor (3) link worker who acted as interpreter and gave assurance that group would be run in a culturally appropriate way	Measures taken at baseline (first group session), 12 weeks (final group session), and follow-up 17 months later	Anthropometric (1) weight (2) BMI	N/A	N/A
Hawthorne and Tomlinson[24]	201 (4.5% n=192)	**Inclusion** Pakistani Muslim patients with T2DM **Exclusion** (1) enrolled in another study (2) participant or spouse received diabetes education in last 6 months (3) planning to go abroad in study period (4) too ill to participate Age: 50–58 years (mean age not reported) Sex: 54% female Education level: 35% no formal education Language: one-third of participants non-English speaking	Clinic or home-based flashcard, diabetes health education. Referral hospital outpatients or diabetes clinic from 10 general practices	RCT (1) A3, colour photographs of Asian models, utensils, and food used as flashcards (2) standardised interview questionnaire used to conduct individual, structured education package (content not reported)	Delivered at hospital clinics, GP surgery, or home by: (1) trained link worker fluent in Punjabi, Urdu, and English	Measures taken at baseline and 6-month follow-up baseline and 6-month follow-up	Blood biochemistry (1) cholesterol (2) HbA1c	N/A	Psychological (1) finds it hard to refuse food at social events (2) can choose correct food at weddings Knowledge (1) agrees importance of diet to diabetes prevention (2) correctly identifies different food values (number of items not reported)

BMI = body mass index. CHD = coronary heart disease. HbA1c = glycosylated haemoglobin type A1c. HDL = high-density lipoprotein. HOMA-B = homeostatic model assessment of β-cell function. HOMA-S = homeostatic model assessment of insulin sensitivity. N/A = not applicable. RCT = randomised controlled trial. T2DM = type 2 diabetes mellitus.

Table 2. Clinical outcomes of included studies

Study	Intervention	Outcome measure	Participants analysed	Results	Notes
Mathews et al[21]	Health clinic one-to-one CHD service with optional community activities	Anthropometric (1) weight (kg) (2) BMI (3) waist girth (cm) Blood pressure (1) systolic (mmHg) (2) diastolic (mmHg) Blood biochemistry (1) cholesterol (mmol/l) (2) HDL (3) triglycerides (mmol/l) Mean collective CHD risk score/100	140	Anthropometric (1) weight (kg): % change –0.9, baseline 70.8[a] (2) BMI: % change –1.1, baseline 28.6[b] (3) waist girth (cm): % change –0.6, baseline 91.3 Blood pressure (1) systolic (mm Hg): % change –2.8, baseline 131[b] (2) diastolic (mm Hg): % change –3.9, baseline 81.0[a] Blood biochemistry (1) cholesterol (mmol/l): % change –3.7, baseline 5.1[a] (2) HDL: % change +0.8, baseline 1.2 (3) triglycerides (mmol/l): % change –13.3, baseline 2.2[a] Mean collective CHD risk score/100 (1) male: % change –35.7, baseline 28.2[a] (2) female: % change –24.6, baseline 27.7[a]	Details of mean collective CHD risk score/100 not specified
Rush et al[22]	Group physical-activity and diet-education sessions	Anthropometric (1) weight (kg) (2) waist girth (cm) (3) body fat (kg) (4) body fat (%) (5) abdominal fat (kg) (6) abdominal fat (%) Blood pressure (1) systolic (mmHg) (2) diastolic (mmHg) Blood biochemistry (1) cholesterol (mmol/l) (2) HDL (mmol/l) (3) total/HDL (4) triglycerides (mmol/l) (5) glucose (mmol/l) (6) insulin (pmol/l) (7) HOMA B (%) (8) HOMA S (%)	20 female 21 male	Anthropometric (1) weight (kg): male % change –2.1, baseline 71.8,[a] female % change –1.9, baseline 63.3 (2) waist girth (cm): male % change –2.1, baseline 95.6,[b] female % change –0.9, baseline 88.9 (3) body fat (kg): male % change –4.8, baseline 23.0,[a] female % change –3.6, baseline 27.9 (4) body fat (%): male % change –3.5, baseline 31.7,[a] female % change –2.1, baseline 44.0 (5) abdominal fat (kg): male % change –5.4, baseline 2.6,[b] female % change –3.8, baseline 2.6 (6) abdominal fat (%): male % change –3.1, baseline 41.6,[b] female % change –2.1, baseline 47.5 Blood pressure (1) systolic (mm Hg): male % change –2.3, baseline 128, female % change –3.1, baseline 131 (2) diastolic (mm Hg): male % change –2.6, baseline 76, female % change –3.9, baseline 78[b] Blood biochemistry (1) cholesterol (mmol/l): male % change –3.9, baseline 5.1, female % change –1.9, baseline 5.4 (2) HDL (mmol/l): male % change +10.1, baseline 1.1, female % change +9.5, baseline 1.4[a] (3) total/HDL: male % change –17.5, baseline 4.9,[a] female % change –11.3, baseline 4.3[a] (4) triglycerides (mmol/l): male % change –13.3, baseline 1.5, female % change +6.7, baseline 1.5 (5) glucose (mmol/l): male % change +1.9, baseline 5.1, female % change +1.8, baseline 5.7 (6) insulin (pmol/l): male % change –5.5, baseline 79.9, female % change –8.8, baseline 83.3 (7) HOMA-B (%): male % change –2.5, baseline 121, female % change –3.0, baseline 99 (8) HOMA-S (%): male % change –6.7, baseline 89, female % change –16.1, baseline 93	N/A
Williams and Sultan[23]	Group healthy-eating and exercise classes	Anthropometric (1) weight (kg) (2) BMI	13	Anthropometric (1) Weight (kg): (a) baseline to 12 months: % change –2.9, baseline 77.3 (b) baseline to 17 months: % change –3.4, baseline 77.3 (2) BMI: (a) baseline to 12 months: % change –3.0, baseline 31.9 (b) baseline to 17 months: % change –3.5, baseline 31.9	Statistical tests and P-values not reported
Hawthorne and Tomlinson[24]	Flashcard one-to-one diabetes health education	Blood biochemistry (1) cholesterol (mmol/l) (2) HbA1c (%)	106 interventions 86 controls	Blood biochemistry (1) cholesterol (mmol/l): ANOVA-adjusted pre-post difference in intervention group <0.1, baseline 5.9 (2) HbA1c, %: (a) ANOVA-adjusted pre-post difference in intervention group –0.3, baseline 8.4	P-values not reported

[a]P<0.01. [b]P<0.05. ANOVA = analysis of variance. BMI = body mass index. CHD = coronary heart disease. HbA1c = glycosylated haemoglobin type A1c. HDL = high-density lipoprotein. HOMA-B = homeostatic model assessment of β-cell function. HOMA-S = homeostatic model assessment of insulin sensitivity. N/A = not applicable.

Table 3. Behavioural outcomes of relevant included studies

Study	Intervention	Outcome measure	Participants analysed	Results	Other analysis	Notes
Mathews *et al*[21]	Health clinic one-to-one CHD service with optional community activities	Lifestyle assessment (1) salt intake (2) consumption of fried meat snacks (3) takes moderate exercise	104 female 36 male	Lifestyle assessment (1) Salt intake (a) male % showing improvement 16.7 ($n = 6$), male % showing deterioration 2.8 ($n = 1$)[a] (b) female % showing improvement 31.1 ($n = 32$), female % showing deterioration 1.9 ($n = 2$)[b] (2) Consumption of fried meat snacks (a) male % showing improvement 44.4 ($n = 16$), male % showing deterioration 8.3 ($n = 3$)[a] (b) female % showing improvement 36.9 ($n = 38$), female % showing deterioration 21.4 ($n = 22$)[a] (3) Takes moderate exercise (a) male % showing improvement 52.8 ($n = 19$), male % showing deterioration 5.6 ($n = 2$)[b] (b) female % showing improvement 45.2 ($n = 47$), female % showing deterioration 14.6 ($n = 15$)[b]	N/A	Actual pre- and post-test values not reported
Rush *et al*[22]	Group physical activity and diet education sessions	N/A	20 female 21 male	N/A	Pre-post changes to diet discussed, but no details of measures, scores, or statistics reported: (1) all participants used healthier cooking oil (2) more than 90% ate more cereals and removed skin from chicken (3) three participants increased fish intake	N/A

[a]$P<0.05$. [b]$P<0.01$. CHD = coronary heart disease. N/A = not applicable.

months, but no significance levels were reported.[24]

Intervention acceptability. Three of the four studies presented data on the acceptability of programmes;[21,23,24] these reported that interventions were positively valued and some participants felt empowered to control health issues following the programme.[24] In one study, 69% of women attending community healthy-eating and exercise classes said they would recommend them to friends, and attended for social reasons as well as weight loss.[23] Word of mouth by link workers or members of the community were the most popular methods of engagement.[23] Prioritising the needs of families and a reluctance to walk to classes were barriers to attending group classes.

Exercise was popular, and women who had a large body mass index were more likely to want the intervention to continue.[23] Participants wanted to keep materials such as audiotapes and flashcards following the interventions to use afterwards.[24] Participants particularly valued the role of South Asian bilingual link workers and interpreters within programmes.[23,24] One study anecdotally reported that changes were adopted by others in the community.[22]

DISCUSSION
Summary
Only four studies, all specifically involving South Asian communities alone, met eligibility criteria. Lack of controls in three, as well as inconsistency in measures and outcomes, meant it was not possible to pool data in a meta-analysis; as a result of this, firm conclusions about the effectiveness of the interventions that were assessed cannot be made. However, several insights and common themes can be offered from this review to inform future intervention development and research.

In relation to clinical outcomes, all programmes with combined physical activity and dietary change components reported decreases in weight where measured, but where the results were analysed by sex, changes in weight, waist circumference, and body and abdominal

Table 4. Psychological and knowledge-based outcomes and acceptability of included studies

Author, year	Intervention	Outcome measure	Participants analysed	Results	Acceptability	Notes
Mathews et al [21]	Health clinic one-to-one CHD service with optional community activities	Psychological motivational stage of change in relation to CHD and diabetes control (precontemplation/ contemplation/ preparation/action/ maintenance)	137	Psychological motivational stage[a] (a) % increased motivational stage: +50 (b) % decreased motivational stage: −21 (c) % showed no change: 29	Qualitative research showed the project was highly valued, reported elsewhere[26]	N/A
Rush et al [22]	Group physical activity and diet education sessions	N/A	20 female 21 male	N/A	Anecdotally reported that changes were adopted by others in the community group and wider families	N/A
Williams and Sultan[23]	Group healthy-eating and exercise classes	N/A	13	N/A	Nine women recommended the group to friends. Link worker and word of mouth were the most frequent recruitment methods. Women attended for weight loss and social reasons. Barriers to attendance included reluctance to walk to the group (winter months time, fear of walking alone) and prioritising the needs of other family members. Exercise was a popular aspect of group. Those with higher BMIs were more likely to say they would reattend. The bilingual link worker was particularly valued as seven of the 13 women wished to be interviewed in their own language.	N/A
Hawthorne and Tomlinson[24]	Flashcard, one-to-one diabetes health education	Psychological (1) finds it hard to refuse food at social events (%) (2) can choose correct food at weddings (%) Knowledge (1) agrees importance of diet to diabetes prevention (%) (2) correctly identifies different food values (%)	106 interventions 86 controls	Psychological (1) finds it hard to refuse food at social events: % change intervention group: +10, baseline 73, % change control group: +5, baseline 69 (2) can choose correct food at weddings: % change intervention group: +14, baseline 64, % change control group: −1.9, baseline 63 Knowledge (1) agrees the importance of diet to diabetes prevention: % change intervention group: +20, baseline 74, % change control group: +6, baseline 76 (2) correctly identifies different food values: % change intervention group: +20 (ANOVA-adjusted pre-post difference 11.8) baseline 51, % change control group +1.5, baseline 58	Most participants rated the intervention positively, liked the bilingual link worker's sensitive approach, valued the information, and felt empowered to control diabetes. Two patients wanted videos or audiotapes; some wanted to keep the flashcards to use when shopping	Details of 'different food values' not reported P-values not reported

[a] $P<0.01$. CHD = coronary heart disease. N/A = not applicable.

fat, these were only significant for men.[22] The sex difference could relate to South Asian women from a variety of religious backgrounds being deterred from attending mixed-sex activities[27] but, as programme engagement data were not provided, this

cannot be ascertained. Mixed results were found for other clinical outcomes, with some reduction in blood pressure and blood lipid profiles, but no improvement, for example, in insulin sensitivity or resistance.

Participants in one study appeared to change dietary and activity patterns, but reliability of these behavioural outcomes was limited by use of single-item measures and self-reporting. Support for the efficacy of improving dietary knowledge was weak and no study measured knowledge of physical activity. One study suggested its community-based programme may encourage participants to progress through motivational stages of change,[21] but this was reported in relation to general risk rather than specific behaviours.

Factors contributing to intervention engagement and acceptability

The involvement of trained bilingual community link workers appeared key to enhancing intervention acceptability and delivery in those studies that involved participants who were socially disadvantaged; for example, those from Pakistani and Bangladeshi communities, with significant proportions of participants across studies speaking little or no English.[23,24] Qualitative feedback confirmed that, in addition to language skills, link workers were valued for their sensitivity and cultural understanding, which may have facilitated more meaningful and personal engagement in programmes. This finding is consistent with previous research suggesting that establishing relationships is important to the receptivity of lifestyle interventions in primary care.[28]

Programmes that were also promoted in the community and recruited by word of mouth appeared to generate more positive outcomes than those initiated from more formal healthcare settings, such as hospitals or clinics. Generating interest through local-community resources appeared to be beneficial due to the familiarity of the setting and the informal, social element of the meetings.[23]

Most programmes offered some form of personalised feedback, either in the form of one-to-one consultations or measurements of individual progress. This approach seemed to be potentially promising when accompanied by visual aids and handouts.[21] Pictures and other visual aids were also valued and may help to overcome language and literacy barriers.[22]

Implications for research and practice

Many intervention studies that were identified had, or may have, included South Asian participants who were historically immigrant, but experiences that were distinguishable for South Asian individuals were not reported; as a result, only four studies met review criteria. Potentially important insights for enhancing appropriateness and implementation of interventions may be missed if relevant data are not reported when South Asian individuals are part of study populations. In addition to outcomes, information about participants' engagement, language abilities, and social demographic, including deprivation and education status, may enable assessment of relevance and transferability. This is particularly pertinent for those South Asian communities that are more disadvantaged and at higher risk, where effective interventions are most needed and evidence is lacking.[17]

Three of the four studies reviewed appeared to have benefited from some prior qualitative work with target communities to inform intervention components; this may have been important to enhancing their acceptability.[17,29] However, the quality of outcome data in the studies reviewed was generally poor, with a failure to consider potential confounders or adverse effects, and a lack of formal statistical-significance testing. All studies had flaws in internal validity, due to a lack of concurrent controls and data concerning programme compliance. Another common problem was a lack of standardised measures, particularly for behavioural, psychological, and knowledge-based outcomes. The majority of these measures lacked clear definition and appeared to be purpose designed, with no data available on piloting outcomes, validity, or reliability. Where possible, objective measures of behaviour, using standardised scales that have been validated in South Asian populations, are needed alongside clinical measures, as maintained behaviour change is necessary for sustained clinical benefit.

The importance of theoretical frameworks for evaluating complex interventions is increasingly recognised,[29] but none of the studies designed their intervention with this in mind. Improving the effectiveness of lifestyle interventions requires an understanding of the causal techniques and procedures responsible for change.[30] In the absence of a clear evidence base, progress is likely to be slow, with 'wheels' being reinvented rather than reapplied. All studies but one failed to measure the motivation of participants to change their lifestyles, which may account for the relative lack

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of intervention effects. Greater emphasis on combining targeted information with appropriate motivational techniques and specific behavioural guidance is needed. In addition, interventions may have been time and resource intensive in these studies, but no economic evaluation data were provided.

This review highlights a dearth of well-evaluated, community-based, physical activity, and dietary interventions for South Asian populations. Nevertheless, programmes were well received, suggesting that the potential to enhance physical activity and promote dietary change in these communities is considerable. Interventions that were reviewed may have resulted in some initial effects on health outcomes and offer useful first steps for enhancing health promotion in this group, which is at high risk of developing chronic disease. However, there remains much to be done to impact disease risk or morbidity, given the sustained and highly intensive interventions necessary to achieve this in other populations that are at risk. [9,10,13]

Further research should focus on developing interventions that:

- are informed by prior qualitative work with target communities;
- incorporate a theoretical framework;
- employ a robust methodology, with standardised and objective measures;
- target education and behavioural motivation; and
- provide a comparison group to assess effectiveness when naturally occurring change is controlled.

Approaches, particularly for South Asian populations that are socio-educationally deprived, may usefully build on current experience by using community-based programmes in a familiar environment with trained, bilingual community link workers. Interventions that include feedback and audiovisual media seem to be well received. Health–economic analyses should be performed alongside future experimental studies to ensure that promising preventative health programmes in these high-risk groups are cost effective and can be feasibly implemented.

REFERENCES

1. Bhopal R. Epidemic of cardiovascular disease in South Asians. *BMJ* 2002; **324(7338):** 625–626.

2. Mather HM, Chaturvedi N, Fuller JH. Mortality and morbidity from diabetes in South-Asians and Europeans: 11 year follow-up of the Southall Diabetes Survey London, UK. *Diabetic Med* 1998; **15(1):** 53–59.

3. Chowdhury T, Lasker S, Mahfuz R. Ethnic differences in control of cardiovascular risk factors in patients with type 2 diabetes attending an Inner London diabetes clinic. *Postgrad Med J* 2006; **82(965):** 211–215.

4. Department of Health. NHS East Midlands: From Evidence to Excellence, Our Clinical Vision for Patient Care; 2008.

5. Abate N, Chandalia M. The impact of ethnicity on type 2 diabetes. *J Diabetes Complicat* 2003; **17(1):** 39–58.

6. Chambers JC, Kooner JS. Diabetes, insulin resistance and vascular disease among Indian Asians and Europeans. *Semin Vasc Med* 2002; **2(2):** 199–214.

7. Hussain A, Claussen B, Ramachandran A, Williams R. Prevention of type 2 diabetes: a review. *Diabetes Res Clin Pr* 2007; **76(3):** 317–326.

8. Yang Q, Cogswell M, Flanders D, *et al.* Trends in cardiovascular health metrics and associations with all-cause and CVD mortality among US adults. *JAMA* 2012; **307(12):** 1273–1283.

9. Li G, Zhang P, Wang J, *et al.* The long-term effect of lifestyle interventions to prevent diabetes in the China Da Qing Diabetes Prevention Study: a 20-year follow-up study. *Lancet* 2008; **371(9626):** 1783–1789.

10. Lindstrom J, Ilanne-Parikka P, Peltonen M, *et al.* Sustained reduction in the incidence of type 2 diabetes by lifestyle intervention: follow-up of the Finnish Diabetes Prevention Study. *Lancet* 2006; **368(9548):** 1673–1679.

11. Norris SL, Zhang X, Avenell A, *et al.* Long-term effectiveness of weight-loss interventions in adults with pre-diabetes: a review. *Am J Prev Med* 2005; **28(1):** 126–139.

12. Mente A, de Koning L, Shannon H, *et al.* A systematic review of the evidence supporting a causal link between dietary factors and coronary heart disease. *Arch Int Med* 2009; **169(7):** 659–669.

13. Gillies CL, Abrams KR, Lambert PC, *et al.* Pharmacological and lifestyle interventions to prevent or delay type 2 diabetes in people with impaired glucose tolerance: systematic review and meta-analysis. *BMJ* 2007; **334(7588):** 299.

14. Fischbacher CM, Hunt S, Alexander L. How physically active are South Asians in the United Kingdom? A literature review. *J Pub Health* 2004; **26(3):** 250–258.

15. Justin M, Jemni M. South Asians, physical exercise and heart disease. *Heart* 2011; **97(8):** 607–609.

16. Misra A, Alappan NK, Vikram NK, *et al.* Effect of supervised progressive resistance-exercise training protocol on insulin sensitivity, glycemia, lipids, and body composition in Asian Indians with type 2 diabetes. *Diabetes Care* 2008; **31(7):** 1282–1287.

17. National Institute for Health and Clinical Excellence. *Preventing type 2 diabetes: population and community-level interventions in high-risk groups and the general population.* NICE public health guidance 35. London: DoH, 2011.

18. Kirkham J, Altman D, Williamson P. Bias due to changes in specified outcomes during the systematic review process. *PLoS One* 2010; **5(3):** e9810.

19. Downs S, Black N. The feasibility of creating a checklist for the assessment of the methodological quality of both randomised and non-randomised studies of health care interventions. *J Epidemiol Commun Health* 1998; **52(6):** 377–384.

20. Petticrew P, Roberts H. *Systematic reviews in the social sciences: a practical guide.* Oxford: Blackwell Publishing, 2006.

21. Mathews G, Alexander J, Rahemtulla T, *et al.* Impact of a cardiovascular risk control project for South Asians (Khush Dil) on motivation, behaviour, obesity, blood pressure and lipids. *J Pub Health (Oxf)* 2007; **29(4):** 388–397.

22. Rush E, Chandu V, Plank L. Reduction of abdominal fat and chronic disease factors by lifestyle change in migrant Asian Indians older than 50 years. *Asia Pac J Clin Nutr* 2007; **16(4):** 671–676.

23. Williams J, Sultan M. Evaluation of a Asian women's healthy eating and exercise group. *J Hum Nutr Diet* 1999; **12:** 91–98.

24. Hawthorne K, Tomlinson S. One-to-one teaching with pictures-flashcard health education for British Asians with diabetes. *Br J Gen Pract* 1997; **47(418):** 301–304.

25. Prochaska, JO, DiClemente CC. Stages and processes of self-change of smoking: Toward an integrative model of change. *J Consult Clin Psychol* 1983; **51(3):** 390–395.

26. Netto G, McCloughan I, Bhatnagar A. Effective heart disease prevention: lessons from a qualitative study of user perspectives in Bangladeshi, Indian and Pakistani communities. *Public Health* 2007; **121(3):** 177–186.

27. Sriskantharajah J, Kai J. Promoting physical activity among South Asian women with coronary heart disease and diabetes: what might help? *Family Practice* 2007; **24(1):** 71–76.

28. Whittemore R, Melkus G, Wagner J, *et al.* Translating the diabetes prevention program to primary care. *Nurs Res* 2009; **58(1):** 2–12.

29. Medical Research Council. *A framework for development and evaluation of RCTs for complex interventions to improve health.* London: MRC, 2000.

30. Michie S, Abraham C. Interventions to change health behaviours: evidence-based or evidence-inspired? *Psychol Health* 2004; **19(1):** 29–49.