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**Effectiveness of interventions to promote physical activity among socioeconomically disadvantaged women: A systematic review and meta-analysis**

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**S1: PRISMA checklist for a systematic review or meta-analysis of randomised trials and other evaluation studies**

| Section/topic | # | Checklist item | Reported on page # |
|---|---|---|---|
| **TITLE** | | | |
| Title | 1 | Identify the report as a systematic review, meta-analysis, or both. | Title page |
| **ABSTRACT** | | | |
| Structured summary | 2 | Provide a structured summary including, as applicable: background; objectives; data sources; study eligibility criteria, participants, and interventions; study appraisal and synthesis methods; results; limitations; conclusions and implications of key findings; systematic review registration number. | 2 |
| **INTRODUCTION** | | | |
| Rationale | 3 | Describe the rationale for the review in the context of what is already known. | 3-4 |
| Objectives | 4 | Provide an explicit statement of questions being addressed with reference to participants, interventions, comparisons, outcomes, and study design (PICOS). | 4-6 |
| **METHODS** | | | |
| Protocol and registration | 5 | Indicate if a review protocol exists, if and where it can be accessed (e.g., Web address), and, if available, provide registration information including registration number. | n/a |
| Eligibility criteria | 6 | Specify study characteristics (e.g., PICOS, length of follow-up) and report characteristics (e.g., years considered, language, publication status) used as criteria for eligibility, giving rationale. | 5-6, S3 |
| Information sources | 7 | Describe all information sources (e.g., databases with dates of coverage, contact with study authors to identify additional studies) in the search and date last searched. | 6 |
| Search | 8 | Present full electronic search strategy for at least one database, including any limits used, such that it could be repeated. | S2 |
| Study selection | 9 | State the process for selecting studies (i.e., screening, eligibility, included in systematic review, and, if applicable, included in the meta-analysis). | 5-7, 9-10 |
| Data collection process | 10 | Describe method of data extraction from reports (e.g., piloted forms, independently, in duplicate) and any processes for obtaining and confirming data from investigators. | 6-7 |
| Data items | 11 | List and define all variables for which data were sought (e.g., PICOS, funding sources) and any assumptions and simplifications made. | 5-7, S2, S3 |

| Section/topic | # | Checklist item | Reported on page # |
|---|---|---|---|
| Risk of bias in individual studies | 12 | Describe methods used for assessing risk of bias of individual studies (including specification of whether this was done at the study or outcome level), and how this information is to be used in any data synthesis. | 7-8, 9 |
| Summary measures | 13 | State the principal summary measures (e.g., risk ratio, difference in means). | 8-9 |
| Synthesis of results | 14 | Describe the methods of handling data and combining results of studies, if done, including measures of consistency (e.g., $I^2$) for each meta-analysis. | 8-9 |
| Risk of bias across studies | 15 | Specify any assessment of risk of bias that may affect the cumulative evidence (e.g., publication bias, selective reporting within studies). | 9-10 |
| Additional analyses | 16 | Describe methods of additional analyses (e.g., sensitivity or subgroup analyses, meta-regression), if done, indicating which were pre-specified. | 8-10 |
| **RESULTS** | | | |
| Study selection | 17 | Give numbers of studies screened, assessed for eligibility, and included in the review, with reasons for exclusions at each stage, ideally with a flow diagram. | 10-11, Figure 1 |
| Study characteristics | 18 | For each study, present characteristics for which data were extracted (e.g., study size, PICOS, follow-up period) and provide the citations. | Table 1 |
| Risk of bias within studies | 19 | Present data on risk of bias of each study and, if available, any outcome level assessment (see item 12). | 11-12, Table 2 |
| Results of individual studies | 20 | For all outcomes considered (benefits or harms), present, for each study: (a) simple summary data for each intervention group (b) effect estimates and confidence intervals, ideally with a forest plot. | 11-12, Figure 2 |
| Synthesis of results | 21 | Present results of each meta-analysis done, including confidence intervals and measures of consistency. | 12-13, Table 3, Figure 2 |
| Risk of bias across studies | 22 | Present results of any assessment of risk of bias across studies (see Item 15). | 13-14, Table 2, Table 3 |
| Additional analysis | 23 | Give results of additional analyses, if done (e.g., sensitivity or subgroup analyses, meta-regression [see Item 16]). | 13-14 |
| **DISCUSSION** | | | |
| Summary of evidence | 24 | Summarize the main findings including the strength of evidence for each main outcome; consider their relevance to key groups (e.g., healthcare providers, users, and policy makers). | 15-16 |

| Section/topic | # | Checklist item | Reported on page # |
|---|---|---|---|
| Limitations | 25 | Discuss limitations at study and outcome level (e.g., risk of bias), and at review-level (e.g., incomplete retrieval of identified research, reporting bias). | 17-18 |
| Conclusions | 26 | Provide a general interpretation of the results in the context of other evidence, and implications for future research. | 18-19 |
| **FUNDING** | | | |
| Funding | 27 | Describe sources of funding for the systematic review and other support (e.g., supply of data); role of funders for the systematic review. | 1 |

**S2: Search strategy and results**

Databases and vocabulary tools

The following databases and vocabulary tools were chosen to provide a comprehensive search of relevant peer-reviewed literature:

- Pubmed: MeSH database
- EMBASE: EMTREE function
- Medline with Full Text: MeSH
- CINAHL: CINAHL headings
- PsycINFO: thesaurus
- Web of Science: no vocabulary tools available
- Global Health: no vocabulary tools available

Search terms

Search terms were taken from each of the databases' vocabulary tools where available. The Web of Science and Global Health databases did not have such vocabulary tools, thus the terms that were found in the other databases were also used for these two databases. Initially, key words generated by the authors were entered in each of the databases' vocabulary tools (where available) in order to generate appropriate search terms. These were: "physical activity", "exercise", "health behaviour", and "walking" (terms related to the outcome); "socioeconomic disadvantage", "disadvantaged", and "underserved populations", "women", and "female" (terms related to the population group); and "intervention studies", "programs", and "health promotion programs" (terms related to the study design). Once the appropriate search terms had been established, these were grouped together according to the PICOS (population, intervention, control group, outcome, study design) framework [1] and entered into the search field of each database.

Refining searches

Searches in the above databases were limited (where the database allowed) to peer-reviewed articles, human subjects, female subjects, age 19-64 years, and English language articles. Truncated terms were used where appropriate such as for "study or studies", "program or programs". Wildcard terms were used where appropriate for words that had different spelling (e.g. to search for behaviour or behaviour, the term "behavi$r" was used).

Search results

The specific search terms, strategies and approaches used in each database, and the numbers of resulting articles identified, are provided below.

*PubMed (MeSH terms):*

- #1("Motor Activity"[Mesh] OR "Exercise"[Mesh] OR "Walking"[Mesh] OR "Health Behavior"[Mesh])
- #2("Health Promotion"[Mesh] OR "Intervention Studies"[Mesh] OR "Self-Evaluation Programs"[Mesh])
- #3 ("Socioeconomic Factors"[Mesh] OR "Social Class"[Mesh] OR "Population Characteristics"[Mesh] OR "Income"[Mesh] OR "Educational Status"[Mesh] OR "Occupations"[Mesh])
- #1 AND #2 AND #3
- Limiters: Humans, Female, English, Adult: 19-44 years, Middle Aged: 45-64 years
- Results: 1225 articles identified

*EMBASE (using the EMTREE tool):*

- ('physical activity'/exp OR 'exercise'/exp OR 'walking'/exp) AND ('social status'/exp OR 'socioeconomics'/exp) AND ('health promotion'/exp OR 'intervention study'/exp) AND wom?n AND [adult]/lim AND [humans]/lim AND [english]/lim
- Results: 200 articles identified

*MEDLINE with Full Text, CINAHL with Full Text, PsycINFO, Global Health (with MeSH terms only):*

- #1(MH "Motor Activity") or (MH "Exercise") or (MH "Walking")
- #2 (MH "Health Promotion") or (MH "Intervention Stud*") or (MH "Self-Evaluation Program*") or (MH "Randomized controlled trial")
- #3 (MH "Income") or (MH "Occupations") or (MH "Education") or (MH "Population Characteristics") or (MH "Socioeconomic Factors") or (MH "Social Class") or (MH "Educational Status")
- #1 AND #2 AND #3
- Limiters: Peer Reviewed; English Language; Language: English; Gender: Female; Age Groups: Adult, 19-44 years, Middle Age, 45-64 years; Language: English; English Language; Human; Gender: Female; Age Related: Adult: 19-44 years, Middle Aged: 45-64 years; Languages: English; Language: English; Age Groups: Adulthood (18 yrs & older), Young Adulthood (18-29 yrs), Thirties (30-39 yrs), Middle Age (40-64 yrs); Population Group: Human, Female

- Results: 41 articles identified

*MeSH terms, CINAHL headings and PsycINFO thesaurus:*
- ( "Motor Activity" or "Physical Activity" or "Physical inactivity" or "Exercise" or "Walking" or "Health Behav?r" ) and ( "Self-Evaluation Program*" or "Health Promotion" or "Intervention Stud*" or "Intervention" or "Randomized controlled trial" or "Behavi?r Change" ) and ( "Socioeconomic Factor*" or "Socioeconomic Status" or "Disadvantage*" ) and ( "wom?n" or "female" ) and ( "Income" or "Occupation*" or "Education" or "Educational status" )
- Limiters: Peer Reviewed; English Language; Language: English; Gender: Female; Age Groups: Adult, 19-44 years, Middle Age, 45-64 years; Language: english; English Language; Human; Gender: Female; Age Related: Adult: 19-44 years, Middle Aged: 45-64 years; Languages: English; Publication Type: Peer Reviewed Journal; English; Language: English; Age Groups: Adulthood (18 yrs & older), Young Adulthood (18-29 yrs), Thirties (30-39 yrs), Middle Age (40-64 yrs); Population Group: Human, Female
- Results: 348 articles identified

*Web of Science:*
- Topic=(exercise or walking or motor activity) AND Topic=(health promotion or intervention stud* or self-evaluation program*) AND Topic=(socioeconomic factor* or social class or disadvantaged or income or education or educational status or occupation*) AND Topic=(wom?n or female) AND Topic=(health behavi?r)
- Results: 92 articles identified (search refined to articles only)

*MeSH terms (nesting of search terms to restrict results):*
- ("Motor Activity"[Mesh] OR "Exercise"[Mesh] OR "Walking"[Mesh] OR "Health Behavior"[Mesh]) AND "Health Promotion"[Mesh] AND ("Intervention Studies"[Mesh] OR "Self-Evaluation Programs"[Mesh]) AND ("Socioeconomic Factors"[Mesh] OR "Social Class"[Mesh] OR "Population Characteristics"[Mesh] OR "Income"[Mesh] OR "Educational Status"[Mesh] OR "Occupations"[Mesh]) AND ("women"[MeSH Terms] OR "women"[All Fields] OR "female"[MeSH Terms] OR "female"[All Fields])
- Limiters: Humans, English, Adult: 19-44 years, Middle Aged: 45-64 years
- Results: 33 articles identified

**S3: Data extraction**

General data extraction

Study details (title, authors, country); study characteristics (design,  aims, inclusion/exclusion criteria; recruitment source; blinding, sequence generation, allocation concealment, unit of allocation); participant characteristics (age, sex, ethnicity; indicator of socioeconomic status; baseline differences in participant characteristics); intervention and setting details (setting; target population; intervention length, intervention protocol development,  behavioural strategies employed in the intervention, mode of intervention delivery use of a theoretical framework to guide intervention development and/or implementation; number of intervention groups; other health interventions, e.g. healthy eating;  description of control group); outcome data and results (time points data collected and reported; measure assessed, unit of assessment, measurement tool, tool reliability and validity [where reference to another article was given for reliability and/or validity data, the original source was located and this information extracted]; relevant secondary outcomes [cardiorespiratory fitness, muscular strength, pulse rate]; total length of follow-up, number of follow-up measurements, total number of participants enrolled, number of participants allocated to each group, number of participants included in analyses, number of withdrawals/drop-outs/exclusions, reasons for withdrawals/dropouts/exclusions, number lost to follow-up; summary outcome data, e.g. mean values for each group; type of analysis used; results of analysis, e.g. odds ratios, mean differences; effectiveness of main physical activity outcome measure); miscellaneous information (adverse outcomes; additional outcomes; funding source; key conclusions of authors; cost-effectiveness information; any contact with authors). Behaviour change techniques were coded by two authors (VC, AG) using the taxonomy developed by Abraham and colleagues,[2] which provides standardised definitions of 26 commonly used techniques included in behaviour change interventions.

Physical activity data extraction

Physical activity measures included objective and self-report measures; where both were reported, objective measures were selected for analysis in preference to self-reported measures. Where multiple self-reported outcomes were presented (e.g. walking, moderate activity, vigorous activity, leisure activity), the order of preference for selection was: the behaviour of most relevance to the intervention (e.g., in a study that aims to increase walking, self-reported walking was selected); total physical activity; walking (the most common activity for women); and leisure-time physical activity (since it is discretionary and therefore more likely to be amenable to intervention). The following principles were also applied when selecting self-reported outcomes: where two indicators of the

same outcome were given (e.g. frequency of walking, duration of walking), duration was selected; METs were selected over kilocalorie expenditure; where the same variable was provided at more than one time point post-intervention, preference was given to the time point with the longest duration since the end of the intervention.

**S4: Behaviour change techniques employed in studies, categorised according to the Abraham taxonomy**

| Technique | N Studies Employing Technique | Reference |
|---|---|---|
| Provide information about behavior-health link | 12 | 3-14 |
| Prompt barrier identification | 11 | 3-5, 8, 10, 11, 14-18 |
| Plan social support or social change | 10 | 3-5, 9, 11, 13, 14, 17-19 |
| Prompt self-monitoring of behaviour | 7 | 3, 5, 8, 11, 15-17 |
| Prompt specific goal setting | 6 | 4, 5, 8, 9, 15, 17 |
| Teach to use prompts or cues | 6 | 8-11, 15, 18 |
| Provide general encouragement | 6 | 3, 8-10, 14, 15 |
| Provide feedback on performance | 6 | 3, 5, 9, 14, 15, 17 |
| Model or demonstrate the behaviour | 5 | 3, 12, 14, 16, 20 |
| Provide instruction | 5 | 3, 9, 14, 16, 20 |
| Set graded tasks | 5 | 3, 9, 11, 14, 16 |
| Provide contingent rewards | 4 | 3, 8, 14, 17 |
| Provide opportunities for social comparison | 4 | 3, 9, 11, 15 |
| Relapse prevention | 4 | 3, 5, 8, 15 |
| Provide information on consequences | 3 | 8, 9, 12 |
| Agree on behavioral contract | 3 | 5, 8, 21 |
| Prompt review of behavioral goals | 2 | 3, 17 |
| Prompt practice | 1 | 17 |
| Prompt intention formation | 1 | 3 |
| Prompt identification as a role model | 1 | 4 |
| Time management | 1 | 14 |
| Provide information about others' approval | 0 | |
| Prompt self-talk | 0 | |
| Stress management | 0 | |
| Use follow-up prompts | 0 | |
| Motivational interviewing | 0 | |

**S5: References for supporting information**

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2        Abraham C, Michie S. A taxonomy of behavior change techniques used in interventions. *Health Psychol*. 2008; 27: 379-87.

3        Baranowski T, Simons-Morton B, Hooks P, Henske J, Tiernan K, Dunn JK*, et al.* A center-based program for exercise change among black-American families. *Health Educ Q*. 1990; 17: 179-96.

4        Fahrenwald NL, Atwood JR, Walker SN, Johnson DR, Berg K. A randomized pilot test of 'Moms on the Move': A physical activity intervention for WIC mothers. *Annals of Behavioral Medicine*. 2004; 27: 82-90.

5        Jacobs AD, Ammerman AS, Ennett ST, Campbell MK, Tawney KW, Aytur SA*, et al.* Effects of a tailored follow-up intervention on health behaviors, beliefs, and attitudes. *J Womens Health (Larchmt)*. 2004; 13: 557-68.

6        Lupton BS, Fonnebo V, Sogaard AJ, Finnmark Intervention S. The Finnmark Intervention Study: is it possible to change CVD risk factors by community-based intervention in an Arctic village in crisis? *Scand J Public Health*. 2003; 31: 178-86.

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9        Shirazi KK, Wallace LM, Niknami S, Hidarnia A, Torkaman G, Gilchrist M*, et al.* A home-based, transtheoretical change model designed strength training intervention to increase exercise to prevent osteoporosis in Iranian women aged 40-65 years: a randomized controlled trial. *Health Educ Res*. 2007; 22: 305-17.

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11       Chang MW, Nitzke S, Brown R. Design and outcomes of a Mothers In Motion behavioral intervention pilot study. *J Nutr Educ Behav*. 2010; 42: S11-21.

12      Wendel-Vos GCW, Dutman AE, Verschuren WMM, Ronckers ET, Ament A, van Assema P*, et al.* Lifestyle factors of a five-year community-intervention program: the Hartslag Limburg intervention. *American Journal of Preventive Medicine*. 2009; 37: 50-56.

13      Stoddard AM, Palombo R, Troped PJ, Sorensen G, Will JC. Cardiovascular disease risk reduction: the Massachusetts WISEWOMAN project. *J Womens Health (Larchmt)*. 2004; 13: 539-46.

14      Hovell MF, Mulvihill MM, Buono MJ, Liles S, Schade DH, Washington TA*, et al.* Culturally tailored aerobic exercise intervention for low-income Latinas. *Am J Health Promot*. 2008; 22: 155-63.

15      Albright CL, Pruitt L, Castro C, Gonzalez A, Woo S, King AC. Modifying physical activity in a multiethnic sample of low-income women: One-year results from the IMPACT (Increasing Motivation for Physical ACTivity) project. *Annals of Behavioral Medicine*. 2005; 30: 191-200.

16      Brown WJ, Lee C, Oyomopito R. Effectiveness of a bilingual heart health program for Greek-Australian women. *Health Promotion International*. 1996; 11: 117-25.

17      Fjeldsoe BS, Miller YD, Marshall AL. MobileMums: a randomized controlled trial of an SMS-based physical activity intervention. *Ann Behav Med*. 2010; 39: 101-11.

18      Lucumi DI, Sarmiento OL, Forero R, Gomez LF, Espinosa G. Community intervention to promote consumption of fruits and vegetables, smoke-free homes, and physical activity among home caregivers in Bogota, Colombia. *Prev Chronic Dis*. 2006; 3: A120.

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