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Review

Community-based efforts to promote physical activity: A systematic review of interventions considering mode of delivery, study quality and population subgroups

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ABSTRACT

Objectives: Despite the known benefits of physical activity, the majority of adults in developed countries lead sedentary lifestyles. The community setting is a promising venue for physical activity-promoting interventions. Our objectives were to investigate the effectiveness of community-based physical activity interventions by mode of delivery, study quality and to analyse intervention effectiveness in different subgroups in the population.
Design: We conducted a systematic literature review in Medline and other databases to identify controlled, community-based physical activity interventions published between 2001 and 2012.
Methods: We performed several post hoc subgroup comparisons for mode of delivery, study quality and selected population characteristics, using net per cent change in physical activity outcomes between baseline and follow-up as an effect measure.
Results: We identified 55 studies on exercise/walking sessions, face-to-face counselling, public campaigns and interventions by mail, the Internet and telephone presenting data on 20,532 participants. Overall, half of the studies reported positive physical activity outcomes (total net per cent change: 16.4%; $p = 0.159$; net per cent change for high-quality studies, i.e. studies meeting more than 5 out of 7 quality criteria: 16.2%; $p = 0.010$). Interventions using face-to-face counselling or group sessions were most effective (net per cent change: 35.0%; $p = 0.014$). Net per cent change was also higher in studies exclusively tailored to women (27.7%; $p = 0.005$) or specific ethnic groups (38.9%; $p = 0.034$).
Conclusions: This systematic review supports the effectiveness of community-based physical activity interventions in high-quality studies. Our results suggest that interventions using personal contact as well as tailored interventions are most promising.

1. Introduction

Regular physical activity (PA) is a key factor in the prevention and treatment of many chronic diseases. It is associated with increased physical and psychological well-being and reduced risk of all-cause mortality.[1,2] Acknowledging the health benefits of PA in the general population, it is recommended that all healthy adults engage in moderate-intensity PA for a minimum of 30 min on five days per week or in vigorous PA for a minimum of 20 min on three days per week.[3] Population-based data world-wide suggest, however, that at most half of adults in developed countries engage in sufficient PA.[4–6]

Given significant gaps between recommendations and self-reported levels of activity, increasing the population level of PA has become a leading area of focus in contemporary public health policy. Earlier reviews have demonstrated the effectiveness of community-based PA interventions using face-to-face interaction in small groups, mail or telephone contact and community-wide campaigns in increasing PA.[7,8] Since the beginning of the new century, newer approaches using technologies like e-mail and the Internet have been used increasingly to disseminate public health information. Previous studies suggest the promise of incorporating new technology in the delivery of PA interventions.[9–11] However, traditional approaches for promoting PA may still be more appropriate in some community settings. Previous work documents, for example, that Internet use among subgroups at higher risk for cardiovascular morbidity and mortality (e.g., older or less educated persons and those living in rural areas) is lower.[12] To date, little is known about the comparative effectiveness of community-based

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PA interventions using different modes of delivery. Additionally, there is a relative lack of data on the effectiveness of such interventions in deprived subgroups of the population in whom PA interventions may prove most valuable. Furthermore, previous work suggests significant variability in study quality and this may affect the conclusions that can be drawn. In this paper, we provide an overview on the effectiveness of community-based PA interventions through a systematic review of recent literature. Our objectives were to investigate the effectiveness of PA interventions by mode of delivery, study quality and in different subgroups in the population.

2. Methods

The following computerized databases were searched for original research articles published between January 1, 2001 and June 30, 2012: Medline, PsycINFO, CSA Sociological Abstracts and SPOLIT. The following keywords and search strategy were chosen using the Medical Subject Headings thesaurus: (physical activity OR exercise) AND (randomized controlled trial OR intervention OR health promotion) AND (community OR community setting). The initial screen produced $n = 2302$ hits from the four databases. We further examined the reference lists of articles in an effort to identify all relevant publications. Following the initial application of exclusion criteria (as described below) to information contained in the study abstract, the number of hits was reduced to 80. The pool of potentially eligible studies was reduced further to $n = 55$ following review of the entire manuscript (Fig. 1). Wherever possible, the procedure used in this study follows the PRISMA statement, which was developed to guide the reporting of systematic reviews.[13] Approval by an ethics committee was not necessary because only published data were used. The authors followed the principles outlined in the Declaration of Helsinki and the guidelines on good epidemiological practice.[14]

Studies from developed countries published in English were included in the review if they contained the following elements: (a) adults aged 18+; (b) PA intervention initiated in a community setting; (c) randomized controlled trial (RCT) or quasi-experimental study with a comparison group; and (d) reported outcomes including at least one measure of PA. We defined "community" as an administrative or geographical boundary area (place of residence) or as social networks that were generally open to a large part of the population (e.g., churches). In contrast, we excluded interventions conducted in clinical or occupational settings (e.g., health care or workplace) because they comprise a separate body of literature. Furthermore, studies focusing on clinically-defined subgroups of the population (e.g., obese individuals or those with a specific clinical diagnosis), were also excluded as they are not representative of the general population in communities. We focused on studies with both an explicit intervention to increase PA and a measure of post-intervention PA behaviour reported with sufficient detail to calculate effect estimates. Only studies from developed countries were considered in this review given concerns for substantial differences that may exist in lifestyles, social structures and the "built" environment that might contribute to different opportunities for PA. Methodologically, such variability from these and other sources would increase heterogeneity and non-comparability within the sample of reports under consideration. We also excluded studies in which the sole outcome measures were motivation to exercise or self-efficacy, as these may not necessarily translate into action. Other exclusion criteria are shown in Fig. 1.

Each study included in this review was evaluated using a standardized abstraction form. We specifically assessed the mode of intervention delivery, length of intervention and follow-up, treatment in experimental and control groups and the theoretical basis of the intervention. Outcome measures of PA and other health effects (e.g., improvement in physiologic parameters, other behaviour or knowledge) as well as level of significance were extracted if reported. Wherever possible, we extracted data on the proportion of participants achieving a sufficient level of PA as defined by ACSM/AHA recommendations,[3] to enable cross-study comparisons. If these data were unavailable, we extracted data on the total minutes of moderate to vigorous PA, total steps per week or scores based on metabolic equivalents (MET). The mode of delivery was classified as face-to-face counselling/group sessions, exercise/walking sessions, mail- or telephone-mediated interventions, public campaigns or studies using e-mail, computer- or web-based formats for intervention delivery. Studies applying several modes of delivery were classified as multicomponent in nature.

We judged the quality of results in each study using a previously described approach based on the extent to which seven binary criteria were met.[15] These included: randomization, exclusion of exposure contamination in the control group, representativeness of the sample, comparability of intervention and control group, attrition rate <30% or sample size > 100 in each group, sufficient period for PA data collection and use of a valid instrument for PA assessment. For the studies in the analytic sample, two authors (CB, MNJ) independently determined whether each criterion was fulfilled. Per cent agreement for these criteria was good and ranged between 0.6 and 1.0. Finally, values for each criterion were summed to form a quality score.

Net per cent change (NPC) in PA was calculated using the formula by Kahn et al.[8] We determined the net per cent change in PA from baseline to follow-up in the intervention (I) and the control (C) groups as $[((I_{post} - I_{pre})/I_{pre}) - ((C_{post} - C_{pre})/C_{pre})] \times 100\%$. In subgroup analyses, we assessed differences in NPC by mode of intervention delivery, study quality and selected population and study characteristics such as age (e.g., older adults defined as mean age 50+), sex, ethnicity (percentage Caucasian), socioeconomic status (SES), region (North America, Europe, Asia, Australia/New Zealand), short- ($\leq$6 months) and long-term (>6 months) follow-up. To assess intervention effectiveness by a specific study condition, we used individual one-sample t-tests to determine if the average NPC in these studies weighted by sample size significantly differed from zero. Because we encountered substantial heterogeneity, we were unable to conduct a meta-analysis and instead present NPC with unadjusted 95% confidence intervals (95%-CI). All statistical analyses were conducted with SAS 9.2 (SAS Institute Inc., Cary, USA) with a two-sided alpha level of $p < 0.05$.

3. Results

Our sample was comprised of 37 RCTs and 18 quasi-experimental studies. More than half of these studies ($n = 31$) were conducted in the U.S., twelve in Australia/New Zealand, ten in Europe and two in Asia. The median total quality score was 5 (range: 3–7). Forty-three studies had sufficient sample sizes and almost all studies measured PA over at least a one-week period and used previously validated measures for outcome assessment. Only a few studies included representative samples of the general community population; 23 studies focused on previously underactive adults and 20 reported on PA in samples restricted to women only. The total number of participants across the 55 studies was 20,532; individual sample sizes ranged from 31 to 3114 (median: 154). Across studies, participants had a weighted mean age of 50.1 years, were predominantly female (66.9% [95%-CI: 62.3%; 71.6%]), married (64.3% [58.6%; 70.0%]) and Caucasian/white (64.5% [50.4%; 78.6%]). A summary of the study characteristics and quality score is provided in the supplemental Table S2.

Supplementary data associated with this article can be found, in the online version, at http://dx.doi.org/10.1016/j.jsams.2013.04.009.