Evaluating the Population Health Impact of Physical Activity Interventions in Primary Care—Are We Asking the Right Questions?

Elizabeth G. Eakin, Ben J. Smith, and Adrian E. Bauman

Background: This article evaluates the extent to which the literature on primary care-based physical activity interventions informs the translation of research into practice and identifies priorities for future research. Methods: Relevant databases were searched for: (1) descriptive studies of physician barriers to physical activity counseling (n = 8), and (2) reviews of the literature on primary care-based physical activity intervention studies (n = 9). The RE-AIM framework was used to guide the evaluation. Results: Lack of time, limited patient receptiveness, lack of remuneration, and limited counseling skills are the predominant barriers to physical activity counselling. Issues of internal validity (i.e., effectiveness and implementation) have received much more attention in the literature than have issues of external validity (i.e., reach and adoption). Conclusions: The research agenda for primary care-based physical activity interventions needs greater attention to the feasibility of adoption by busy primary care staff, generalizability, and dissemination.

Key Words: translation, population health

The evidence surrounding physical activity and health is strong and consistent. Physical inactivity is a significant risk factor for the majority of chronic conditions, many of which have reached epidemic proportions in industrialized nations (i.e., overweight/obesity, cardiovascular disease, type 2 diabetes, hypertension).

Most developed countries have adopted the “30 minute a day on five or more days of the week” moderate physical activity guideline. Population health survey data from these same countries, however, indicate that between 40 to 70% of these populations fail to achieve this goal. Clearly, a focus on ways to increase population levels of physical activity is critical.

With the majority of adults seeing a primary care physician at least once each year, physical activity interventions delivered in the primary care setting are
believed to hold particular promise. Indeed, the role of the primary care physician in delivering counseling on physical activity has been espoused in numerous reports and recommendations.\textsuperscript{7,8} It is also well documented that patients want advice from their physicians on physical activity.\textsuperscript{9,10}

There is a sizeable literature on physical activity interventions in the primary care setting.\textsuperscript{11-19} This includes surveys of patients and physicians on frequency of physical activity counseling,\textsuperscript{20,21} descriptive studies of physician barriers to the provision of counseling, and trials evaluating physical activity interventions delivered in primary care.

The majority of primary care-based physical activity intervention studies come from the US, Australia, the UK, and New Zealand. Most have evaluated interventions involving advice on the importance of physical activity, counseling on increasing activity, provision of written materials and, in many cases, follow-up by telephone or mail. While most were delivered in the primary care setting, many of the actual intervention sessions took place during an additional visit outside the context of routine care. Delivery agents include primary care physicians, other members of the health care team (i.e., nurses, health educators, and exercise specialists), and trained research staff.

The literature on physical activity interventions in primary care has been reviewed nine times with modestly positive, albeit sometimes conflicting, findings.\textsuperscript{11-19} Most reviews have concluded that these interventions can achieve at least short-term behavior change. The notable exception is the recent US Preventive Services Task Force (USPSTF) review,\textsuperscript{8} which, based on a review of eight of the now more than 20 published studies in this area, concluded that there was insufficient evidence to support the efficacy of such interventions.

Factors related to external validity (generalizability) are now critically important to consider.\textsuperscript{22-24} Indeed, if this body of work is to inform the translation of research into practice, it must adopt a more balanced approach to evaluation. The RE-AIM framework proposed by Glasgow and colleagues\textsuperscript{22} is particularly valuable in this regard. It identifies 5 dimensions that combine to determine the potential for population health impact (i.e., reach, efficacy, adoption, implementation, and maintenance). The framework suggests that interventions must do more than produce intervention effects if they are to achieve population health benefit; they must also reach large and representative proportions of the target population, and be able to be consistently implemented by practitioners in the course of routine care. As an example, an intervention that produced small effects but reached a large percentage of the population (e.g., the primary care-based physical activity interventions reviewed here) would have a greater impact than one that produced large effects but reached a much smaller proportion of the population (e.g., referral to fitness center-based exercise classes).\textsuperscript{23-25}

This article identifies critical issues concerning the generalizability of primary care-based physical activity intervention research. For the first time, studies on physician barriers to physical activity counseling are reviewed to identify practical considerations in the design of interventions. Secondly, published reviews of physical activity interventions in primary care are examined with a focus on the degree to which population health relevance has been addressed. The focus is on reviews of the literature, and not on individual studies, because the size of the literature is such that the individual studies have been reviewed a number of times.\textsuperscript{11-19} In
addition, given the impact of such reviews on research and policy, it is important to examine the extent to which they address issues relevant to the generalizability and potential for population health impact of this body of research. The RE-AIM framework is used to highlight areas that require special attention and to provide a conceptual, yet practical grounding to recommendations for future research.

Methods

Two sources of data are used in this article: (1) descriptive studies of barriers to the delivery of physical activity counseling in primary care, and (2) reviews of the literature on primary care-based physical activity interventions. Only English-language studies were sought.

The barriers studies were identified from a search of the Medline and CINAHL databases (from the years of their inception to 2003), using key words (physical activity, physical fitness, exercise, health care, primary care, family practice, medical office, physician’s office). Only studies which reported barriers specific to physical activity counseling were included, and this yielded eight published studies.\(^\text{26-34}\)

To identify all relevant reviews of physical activity intervention studies in primary care, the Medline and CINAHL databases were searched using the key words (physical activity, physical fitness, exercise, health care, primary care, general practice, family practice, medical office, physician’s office, review). This resulted in seven published review articles.\(^\text{12-16, 18, 19}\) In addition, experts in the area were consulted for sourcing of nonpublished reports, which resulted in the inclusion of two additional unpublished reviews.\(^\text{11,17}\)

The RE-AIM Framework

The 5 dimensions of the RE-AIM framework and their operational definitions used in the context of this article are:

- **Reach** – the percentage of the eligible population participating in the intervention, and whether they are representative of the larger population from which they were selected.
- **Efficacy/Effectiveness** – the impact of the intervention on short-term changes in physical activity, including adverse outcomes/injuries.
- **Adoption** – the percentage and representativeness of the settings or practitioners willing to undertake the intervention.
- **Implementation** – the extent to which the intervention is delivered as intended.
- **Maintenance** – at the individual level, the extent to which improvements in physical activity are sustained for 6 months or more after the intervention is delivered, and at the systems level, institutionalization of the intervention such that it becomes part of routine health service delivery.

Data Abstraction

In Table 1, data abstracted from the 8 physician barrier studies included: a brief description of the study (i.e., number of participants and method of data collection) and findings related to physician barriers. In Table 2, data abstracted from the 9 reviews include: the number of studies included in the review and the dates of
inclusion, selection criteria, and a column for each RE-AIM dimension indicating whether that dimension was addressed in the review, and if so, the related findings. Information was abstracted by the first and second authors, reviewed by all coauthors, and any discrepancies resolved by group consensus.

Results

Physician Barriers to Delivery of Physical Activity Counseling

Among the 8 studies, 5 investigated barriers to physical activity counseling among medical practitioners in primary care, 2 examined barriers among both medical and nurse practitioners, and 1 studied nurses only (Table 1). Four were conducted in the United States, 2 in the United Kingdom, and 1 each in Canada and Australia. All except one recruited random samples, with response rates ranging from 54% to 81%. Data were collected by means of physician self-completed questionnaires in all studies.

Lack of time was the most common barrier identified, with between 40.6% and 92.5% of respondents reporting this as a problem. In 7 studies perceived lack of patient interest or willingness to adhere to physical activity advice were identified (range: 7.4% to 55%). Lack of reimbursement or financial incentive was reported in 6 studies (range: 11.6% to 46.7%). Barriers that could be grouped under a heading of perceived lack of practitioner knowledge, skill, or training relevant to physical activity counseling were reported in 5 studies (range: 12% to 64.9%). Barriers that could be grouped under a heading of perceived lack of practitioner knowledge, skill, or training relevant to physical activity counseling were reported in 5 studies (range: 12% to 64.9%). Barriers that could be grouped under a heading of perceived lack of practitioner knowledge, skill, or training relevant to physical activity counseling were reported in 5 studies (range: 12% to 64.9%). Barriers that could be grouped under a heading of perceived lack of practitioner knowledge, skill, or training relevant to physical activity counseling were reported in 5 studies (range: 12% to 64.9%). Barriers that could be grouped under a heading of perceived lack of practitioner knowledge, skill, or training relevant to physical activity counseling were reported in 5 studies (range: 12% to 64.9%). Barriers that could be grouped under a heading of perceived lack of practitioner knowledge, skill, or training relevant to physical activity counseling were reported in 5 studies (range: 12% to 64.9%). Barriers that could be grouped under a heading of perceived lack of practitioner knowledge, skill, or training relevant to physical activity counseling were reported in 5 studies (range: 12% to 64.9%). Barriers that could be grouped under a heading of perceived lack of practitioner knowledge, skill, or training relevant to physical activity counseling were reported in 5 studies (range: 12% to 64.9%). Barriers that could be grouped under a heading of perceived lack of practitioner knowledge, skill, or training relevant to physical activity counseling were reported in 5 studies (range: 12% to 64.9%).

Table 2 shows primary care physical activity intervention reviews classified according to the RE-AIM framework. Across the 7 published review articles and 2 commissioned reports, the number of studies included in the reviews ranged from 6 to 20, with the Smith et al. report being the most recent and containing the largest number. The majority of reviews included studies dating back to the inception of the databases searched (i.e., the 1960s), while some limited the dates of inclusion for various reasons. Selection criteria were explained for all reviews, but differed across reviews, with Riddoch et al. being most inclusive (i.e., including studies without a comparison group) and Eden et al. being most exclusive (i.e., only including papers published between 1994 and 2002 and applying the stringent criteria regarding methodologic quality developed for the US Preventive Services Task Force).

Of particular note is the fact that none of the reviews were in the form of a meta-analysis, nor were any able to provide a reliable quantitative estimate of effect size or number needed to treat (an estimate of the number of patients that would need to receive the intervention to detect a significant intervention effect). As stated in many of the reviews, the large variation in study methodologies, particularly the fact that there is no standardization of physical activity-related outcome measures in this literature, renders a quantitative comparison of outcomes across studies impossible.
<table>
<thead>
<tr>
<th>Study</th>
<th>Design</th>
<th>Sample Description</th>
<th>Barriers identified</th>
<th>Comments</th>
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<tbody>
<tr>
<td>Kennedy &amp; Meeuwisse</td>
<td>Self-completed questionnaire</td>
<td>330 family physicians and GPs who speak English from 6 provinces in Canada (response 61%)</td>
<td>lack of time (65.8%)</td>
<td>Fair response rate from a sample covering most of Canada; most respondents were male, age &gt; 40 y and had been in practice for ≥ 10 y; representativeness not reported</td>
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<td>lack of training in medical school (64.9%)</td>
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<td>lack of education in college training (62.9%)</td>
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<td>lack of continuing medical education (60.9%)</td>
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<td>lack of guidelines on exercise counseling (54.6%)</td>
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<td>insufficient personal knowledge (50.6%)</td>
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<td>patients not interested (49.6%)</td>
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<td>not paid enough (46.7%)</td>
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<td>patients will not change (41.4%)</td>
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<td>other lifestyle issues more important (40.2%)</td>
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<td>patients prefer drugs (39%)</td>
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<td>lack of evidence about exercise (12.9%)</td>
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<td>Burns, Camaione &amp; Chatterton</td>
<td>Self-completed questionnaire</td>
<td>606 ANPs in the U.S. (response 61%)</td>
<td>lack of time (62.5%)</td>
<td>Fair response rate from a nationwide sample; responses regarding barriers only elicited from the ANPs currently practicing in primary care (n = 396); representativeness not reported</td>
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<td>other issues more important (58.3%)</td>
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<td>patients will not adhere (21.2%)</td>
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<td>neighborhood unsafe (19.8%)</td>
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<td>language barrier (16.9%)</td>
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<td>not a priority (11.8%)</td>
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<td>no reimbursement (11.6%)</td>
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<td>Study</td>
<td>Design</td>
<td>Sample</td>
<td>Barriers identified</td>
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<td>Lawlor, Keen &amp; Neal</td>
<td>Self-completed questionnaire</td>
<td>174 GPs in Bradford, UK (response 74%)</td>
<td>lack of time (92.5%) physical activity not relevant to consultation (68.4%) belief that patients would not follow advice (55.2%).</td>
<td>Good response rate; responders more likely than nonresponders to be in partnership practices, to be a member of the Royal College of GPs and to have 10 y experience; not clear if all findings regarding barriers presented as results not tabulated</td>
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<tr>
<td>Walsh, Swangard, Davis &amp; McPhee</td>
<td>Self-completed questionnaire</td>
<td>175 general internists, family practitioners and internal medicine residents affiliated with four hospitals in San Francisco (response 54%)</td>
<td>lack of time (40.6%) need more counseling practice (12%) do not think counseling is effective (10.3%) unsure of knowledge (7.4%) patients not interested (7.4%) prefer to counsel about other issues (6.9%).</td>
<td>Fair response rate; respondents mostly young (mean age: 34 y) and internists (81%); representativeness not reported</td>
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<tr>
<td>McKenna, Naylor &amp; McDowell</td>
<td>Self-completed questionnaire</td>
<td>419 GPs (response 73%) and 196 PNs (response 81%) in southwest England</td>
<td>lack of time (GP 64.6%, PN 40%) lack of resource (GPs 32.4%, PNs 18.7%) lack of success (GPs 24.7%, PNs 20.6%) lack of protocols (GPs 22.3%, PNs 20.4%) lack of incentives (GPs 20.5%, PNs 15.5%).</td>
<td>Good response rates; representativeness not reported</td>
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<tr>
<td>Authors</td>
<td>Methodology</td>
<td>Sample Description</td>
<td>Barriers</td>
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<td>Long, Calfas, Wooten et al.</td>
<td>Self-completed questionnaire</td>
<td>25 physicians and 2 nurse practitioners from 5 regions in the US</td>
<td>lack of time (52%)&lt;br&gt;lack of support staff (42%)&lt;br&gt;lack of reimbursement (38%)&lt;br&gt;lack of knowledge (25%)&lt;br&gt;patients’ unwillingness to change (25%)</td>
<td>Small sample size; respondents were interested volunteers participating in the field testing of the PACE physical activity counseling protocol; most in urban family practices; responses regarding barriers collected prior to field testing</td>
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<tr>
<td>Bull, Schipper, Jamrozik, &amp; Blanksby</td>
<td>Self-completed questionnaire</td>
<td>908 GPs from Perth and Bunbury, Western Australia (71% response)</td>
<td>lack of time (47%)&lt;br&gt;insufficient educational materials (29.2%)&lt;br&gt;patient preferences for drugs (27.2%)&lt;br&gt;lack of continuing education (22.8%)&lt;br&gt;lack of training in medical school (21.4%)&lt;br&gt;patient resistance to health promotion (21.1%)&lt;br&gt;lack of financial incentive (15%)&lt;br&gt;inappropriate education materials (14.9%)&lt;br&gt;not established as good medical practice (6.8%)&lt;br&gt;insufficient evidence about benefits of exercise (6.8%)</td>
<td>Good response rate; most GPs surveyed were from metropolitan Perth; representativeness not reported</td>
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<tr>
<td>Sherman &amp; Hershman</td>
<td>Self-completed questionnaire</td>
<td>422 internal medicine physicians in Massachusetts (response 61%)</td>
<td>lack of time (55%)&lt;br&gt;do not think counseling is effective (35%)&lt;br&gt;need more counseling practice (33%)&lt;br&gt;prefer to counsel about other issues (33%)&lt;br&gt;patients not interested (31%)&lt;br&gt;unsure about how to counsel about exercise (28%)&lt;br&gt;reimbursement not sufficient (28%)&lt;br&gt;not convinced exercise is beneficial (11%)&lt;br&gt;believe lifestyle is personal choice, so counseling not appropriate (7%)</td>
<td>Fair response rate; representativeness not reported</td>
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*Note. ANP, adult nurse practitioner; GP, general practitioner; PN, practice nurse.*
<table>
<thead>
<tr>
<th>Review</th>
<th>Number of studies &amp; years included in review</th>
<th>Selection criteria</th>
<th>Reach (and representativeness of patients)</th>
<th>Efficacy</th>
<th>Adoption (and representativeness of providers)</th>
<th>Implementation</th>
<th>Maintenance</th>
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</table>
| Eden et al.\(^{12}\)  | 8 studies from 1994–2002                   | a. controlled trials, case-control and observational studies of “good” or “fair” quality  
b. intervention to increase PA in primary care patients in which the primary care clinician performed some of the counseling  
c. included measure of PA  
d. English language  | Not addressed  | – Evidence is inconclusive that counseling adults in the primary care setting to increase PA is effective.  | Not addressed  | Abstracted data on percentage of patients receiving intervention, time physician spent delivering intervention, and on how initial patient assessment was conducted.  
Found that data on intervention implementation was not adequately reported in many studies, and that interventions are frequently not implemented as intended.  | Evidence is inconclusive that counseling adults in the primary care setting to increase PA is effective.  |
| Petrella & Latanzio\(^{13}\) | 13 studies from past 30 y                      | a. RCT or quasi-experimental design with comparison group  
b. intervention delivered by physicians in primary care or secondary or tertiary care settings  
c. outcome measures of PA or cardiorespiratory fitness  | Not addressed  | + for short-term outcomes (defined as 4 wk to 2 months)  | Not addressed  | Abstracted data on time taken to deliver intervention.  | – for longer-term outcomes (defined as > 6 months)  |
<table>
<thead>
<tr>
<th>Smith et al.</th>
<th>20 studies from 1966–2001</th>
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<tbody>
<tr>
<td><strong>a.</strong> RCT or controlled trial of “good” or “fair” quality</td>
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<td><strong>b.</strong> intervention to promote PA delivered to adults recruited from a primary care setting</td>
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<td><strong>c.</strong> included measure of PA</td>
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<td><strong>d.</strong> English language</td>
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<td>Abstracted data on reach and representativeness. Found that reach varied considerably from 37% to 85%. Where representativeness could be determined, participants differed from nonparticipants, often with women more likely to participate than men.</td>
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<tr>
<td>+ for short-term outcomes (defined as ≤ 6 months)</td>
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<tr>
<td>Abstracted data on adoption and representativeness of providers. Found that adoption varied from 18% to 60%. Representativeness of providers was reported in only one study.</td>
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<tr>
<th>Lawlor &amp; Hanratty</th>
<th>8 studies from 1966–2000</th>
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<tr>
<td><strong>a.</strong> RCT or quasi-experimental design with comparison group</td>
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<td><strong>b.</strong> intervention delivered in the context of a routine consultation by any primary health care practitioner</td>
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<td><strong>c.</strong> any language</td>
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<td>Not addressed</td>
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<td>– lack of evidence to support efficacy of short-term outcomes (defined as up to 8 weeks)</td>
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<td>Not addressed</td>
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<td>Abstracted data on time taken to deliver intervention.</td>
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<td>Poor evidence for sustained outcomes (defined as 4-12 months)</td>
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Table 2 (continued)

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<tr>
<th>Review</th>
<th>Number of studies &amp; years included in review</th>
<th>Selection criteria</th>
<th>Reach (and representativeness of patients)</th>
<th>Efficacy</th>
<th>Adoption (and representativeness of providers)</th>
<th>Implementation</th>
<th>Maintenance</th>
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| Eakin et al. 14         | 15 studies from 1980–1998                   | a. RCT or controlled trial  
   b. intervention to promote PA delivered to primary care patients by primary care clinician or other professionals, including those outside the clinical setting  
   c. included measure of PA  
   d. English language | Abstracted data on reach and representativeness of patients. Found that reach ranged from 35% to 100% (median = 74%). Few studies reported on patient representativeness. In those that did, males, older adults, and smokers were overrepresented among nonparticipants. | + for short-term outcomes (defined as < 12 months) | Abstracted data on adoption and representativeness of providers. Found only 3 studies that reported on provider adoption, none of which reported on provider representativeness. | Abstracted data on the extent to which the intervention was delivered as intended. Found that intervention delivery ranged from 30% to 80% of patients, but was generally high, especially for the delivery of initial advice (80% to 100%), as opposed to follow-up contacts. | – for longer-term outcomes (defined as > 12 months) |
| Simons-Morton et al. 15 | 12 studies from 1966–1997                   | a. RCT or controlled trial  
   b. intervention to promote PA delivered in or via clinical setting to patients without disease (primary prevention) or to patients with cardiovascular disease (secondary prevention)  
   c. included measure of PA  
   d. English language | Abstracted data on representativeness but not reach. Found that women were more likely to participate in primary prevention studies and men more likely in studies of patients with cardiovascular disease. | + for short-term outcomes (defined as < 6 months) | Not addressed | Abstracted data on the type of provider delivering the intervention. Found that interventions for both primary and secondary prevention were delivered by a variety of providers (e.g., physicians, nurses, allied health professionals, exercise specialists). | – for longer-term outcomes |
**Eaton & Menard**\(^\text{16}\) 8 studies from 1961–1997  
- a. Assignment to control or intervention group  
- b. Interventions delivered in doctor’s office  
- c. PA assessed a minimum of 4 wk postintervention and interpretable as dichotomous outcome so that odds ratios could be calculated  
- d. English language  

**Limited data abstracted on the percentage of the eligible patient population that participated.**  
**+ some evidence for short-term improvements in PA**  
**Not addressed**  
**Not addressed**  
**Inconclusive evidence to support longer-term effects**

**Riddoch et al.**\(^\text{17}\) 20 studies from 1960s–1998  
- a. Adults (> 16 y)  
- b. Aim of study to improve PA, mediator of PA, or attitude towards PA with related outcome measure  

**Not addressed**  
**+ Small, positive effects in short-term**  
**Not addressed**  
**Not addressed**  
**– Too few studies with longer-term outcomes to reach definitive conclusions**

**Ashenden et al.**\(^\text{19}\) 6 studies from 1960s–1995  
- a. RCTs of treatment vs. control or randomized comparisons of varying intensities of treatment  
- b. PA advice provided in a general practice setting  
- c. English language  

**Not addressed**  
**– Limited evidence of short-term outcomes, but too few studies and too many methodologic problems to draw definitive conclusions.**  
**Not addressed**  
**Not addressed**  
**Limited evidence of long-term outcomes.**
Reach and Representativeness

As seen in Table 2, 3 of 9 reviews addressed the issue of reach (the percentage of the eligible population participating in the study),\textsuperscript{11,14,15} finding that it varied widely across studies, from as low as 35\% to as high as 100\%. Of course, the way that patients are targeted (i.e., population-based recruitment which attempts to reach the entire adult patient population of participating providers versus more selective targeting) and the way in which the corresponding denominator is chosen have a large impact on the calculation of reach. For example, studies using mail-based recruitment often had incomplete data on recruitment rate, as the eligibility of nonresponders was unknown (unless patient records for all those contacted by mail were accessible), whereas studies recruiting patients from waiting room settings were better able to track the total number of potentially eligible patients.

The representativeness of study participants was addressed in 3 reviews. Simons-Morton et al.,\textsuperscript{15} who categorized studies as either primary prevention (those targeting patients without disease) or secondary prevention (those targeting patients with cardiovascular disease), found that women were more likely to participate in primary prevention studies, while men were more likely to participate in secondary prevention (CVD) studies. Smith et al.\textsuperscript{11} and Eakin et al.\textsuperscript{14} also found that women were more likely to participate than men, and Eakin et al.\textsuperscript{14} reported that older adults and smokers were overrepresented among nonparticipants in several studies. Smith et al.\textsuperscript{11} point out that there are few studies which provided adequate data to determine the extent to which participants are representative of the population from which they have been drawn.

Efficacy

All 9 reviews reported on the efficacy of interventions to produce changes in physical activity. Six of these reported that there was evidence supporting the efficacy of physical activity interventions delivered in the primary care setting to produce short-term increases in patient physical activity levels.\textsuperscript{11,14-18} The definition of “short-term” varied, ranging from a few weeks to 11 months postintervention. Three of the reviews concluded that there was insufficient evidence.\textsuperscript{12,13,19} In the earliest review, conducted by Ashenden et al. in 1997,\textsuperscript{19} there were an inadequate number of studies and the study methodologies were too varied to allow for firm conclusions to be drawn. Similarly, Lawlor and Hanratty\textsuperscript{13} based their review on only 8 studies. Eden et al.\textsuperscript{12} used inclusion criteria that resulted in a large number of studies that were considered in other reviews being excluded from theirs, reviewing only 8 studies and finding mixed results across these. Only one of the 9 reviews mentioned adverse outcomes,\textsuperscript{12} finding that potential harms were reported in only 1 study, and could not be clearly tied to the intervention.

Viewed as a whole, the 9 reviews provide a reasonable degree of support for the efficacy of physical activity interventions delivered in primary care settings to achieve short-term improvements. Much remains to be done to improve this evidence base, however (see Recommendations for Research).

Adoption

Only 2 of the 9 reviews addressed the issue of adoption (the percentage of providers approached who agreed to participate) and the representativeness of providers.\textsuperscript{11,14}
These reviews found very few studies that reported on either of these issues, with Smith et al. reporting that for those studies addressing adoption, it ranged from 18% to 60%, with only 1 study reporting on provider representativeness. The majority of studies used convenience sampling of settings and providers to deliver interventions.

**Implementation**

Six of the 9 reviews abstracted data on indices of how the interventions were implemented (e.g., patient self-report on receipt of various intervention components, and use of provider checklists completed following intervention delivery), or on the type of provider delivering the intervention. The reviews concluded that implementation rates were quite varied, with 30% to 80% of patients receiving the interventions as intended, and that, in general, more detailed and systematically collected process evaluation about intervention delivery is needed. Those reviews that reported on the type of provider indicated that interventions were delivered by a wide variety of providers, including physicians, nurses, allied health care professionals, and exercise specialists, although the numbers of nonphysician providers were too small to allow for comparison of implementation delivery or physical activity outcomes by provider type. Smith et al. reported that while the majority of interventions were delivered by health care staff (as opposed to research staff), most of the interventions took place outside the context of a routine primary care visit. It was also noted that implementation of study protocols (and patient adherence to physical activity prescriptions) declined the greater the number of contacts. In addition, rates of usage of self-help and other adjunct (supportive) materials (e.g., newsletters, booklets, videos, etc.) were rarely reported.

**Maintenance**

All 9 reviews addressed the issue of longer-term maintenance of treatment gains, with none finding evidence to support sustained increases in patient levels of physical activity. Continued delivery of the intervention at the practice/provider level beyond the study period was not addressed in any of the reviews, likely because this is an issue more relevant to dissemination studies, as discussed below.

**Discussion**

The review of literature on barriers to delivery of physical activity counseling in primary care revealed that lack of time, followed by perceived lack of receptiveness to counseling among patients, lack of remuneration, and perceived limitations in counseling skills are the obstacles consistently reported by physicians and nurse practitioners. This highlights the importance of making time efficiency a consideration in the design of interventions, and the need for protocols to be straightforward for practitioners with limited experience in counseling to use. It also suggests that barring major changes to health care reimbursement policy, and in the absence of clinic systems to support such work, it is not realistic to expect busy primary health care staff to devote a significant proportion of already brief primary health care encounters to physical activity or other preventive counseling. As discussed by Stange et al., we need to focus on leveraging the impact of brief (perhaps as
brief as 1 min) primary care counseling by combining it in innovative ways with resources and interventions outside the primary care setting (e.g., technological supports and community resources). This is discussed below under Implications for Future Research.

Examination of reviews of physical activity intervention studies in primary care indicates that the questions that have been posed have been overly focused on intervention efficacy (and related issues of internal validity), with significantly less attention paid to practical issues related to implementation and generalizability. Across the 9 reviews, issues related to the efficacy of interventions to increase patient levels of physical activity, and to some extent over the longer-term (maintenance), received the most attention. This was followed by data on intervention implementation, although implementation rates are quite varied and most of the interventions appear to be delivered outside the context of a routine visit. An evaluation of reach and adoption (participation rates and representativeness of patients and providers) was the exception rather than the rule. From the limited available data, it appears that studies are not reaching the most representative samples, with men, older adults, and smokers less likely to participate. Further, next to nothing is known about the representativeness of providers in these studies, or about whether these interventions can be effectively delivered by nonphysician staff. Thus, while the trials to date are generally effective in demonstrating short-term changes in physical activity, they are much less informative about the potential for such interventions to play a role in impacting population health by reaching large segments of the population in a way that is feasible in the busy primary care context. For a recent exception, see Eakin, Brown, Marshall et al.

The lack of attention to public health relevance is also reflected in the characteristics of the interventions that have been tested, many of which would be difficult to transfer to routine care. For instance, a number of studies have relied on additional staff to those usually available in the primary care setting to deliver interventions, such as exercise scientists and health educators, while others have involved multiple telephone or face-to-face contacts above those normally provided to patients. Furthermore, a number of studies have relied on third parties, usually research staff, to undertake assessments to identify inactive patients prior to the intervention. While these additional intervention resources/delivery mechanisms have been demonstrated to be effective in increasing intervention outcomes, the reality is that much of the physical activity intervention research in primary care provides data about what might be achieved with optimal levels of resources rather than what is possible in the current service environment.

Methodological rigor will always be paramount, as there is little to be generalized from studies with low internal validity. In addition, it is acknowledged that there is more to be done to strengthen the evidence base, both in terms of establishing the short-term and longer-term effectiveness of physical activity interventions in primary care. To facilitate the transfer of physical activity interventions in primary care into routine practice where they can begin to have an impact on population levels of physical activity, questions about the generalizability of findings (i.e., reach/participation rates, patient and provider representativeness, feasibility of interventions being implemented by busy health care staff) must be given a greater priority in all phases of research. Specific recommendations to address these research needs are given below.
Implications for Future Research – Asking the Right Questions

1. Patient reach, retention, and representativeness need to be reported on to ascertain whether those most in need are being reached. This involves the systematic tracking of the number of patients targeted for the study, the number actually approached for participation, the number agreeing to participate, the number retained at each follow-up, and the comparison of patients reached/retained at each stage with those not. Reporting of these characteristics is increasingly becoming mandatory in published papers. Such information will also assist in refining recruitment and retention protocols for various subgroups.

2. More effectiveness trials are needed—trials that use existing clinical staff and resources and focus on integrating brief physical activity counseling into routine primary care. Pilot testing of interventions prior to implementation in trials will be necessary to ensure that these have adequately taken into account practice realities, including the barriers to physical activity counseling reported by primary care practitioners. The 5As framework (assess, advise, agree, assist, arrange) might be particularly useful in addressing both patient and practice-level changes. There is also a need for assessment mechanisms to identify inactive patients that can be adopted in day-to-day service delivery. These could entail brief assessments by clinicians or other practice staff, or questionnaires that patients can self-complete in the waiting room.

3. Having developed an intervention that is proven effective and feasible to deliver in routine primary health care, efforts need to be directed towards translating research into practice on the widest possible scale (e.g., targeting all providers in a given health care system or geographic area and reaching representative patient samples). Such dissemination research should investigate methods to increase both patient participation and provider uptake and implementation, including the understudied issue of provider/practice representativeness (i.e., comparing the number and characteristics of participating and nonparticipating practitioners in the study area). Dissemination efforts will also need to be cognizant of engaging the multiple stakeholders necessary to support such efforts (i.e., patients, purchasers, payers, clinicians, health systems leaders, and policy makers).

4. Improving maintenance of outcomes is a key area for future research. It is known from the vast literature on health behavior change that there is a strong relationship between the length of the intervention (in particular, the extent of ongoing support provided following an initial intervention) and the maintenance of treatment gains. The challenge will be to find feasible and cost-effective means of providing such support to patients following receipt of brief primary care-based physical activity counseling. This will likely involve looking to integrate physical activity interventions delivered in primary care settings with supportive strategies delivered in other settings, such as is promoted as part of the UK National Quality Assurance Framework for General Practitioner Referral Systems. Linkages with community support are especially important for higher risk patient subgroups (e.g., older adults and those with chronic conditions) who might need additional assistance in developing appropriate activity regimens as well as ongoing support. Maintenance of outcomes could also be enhanced by using automated strategies, such as computer-generated telephone counseling or web-based supports.
5. Finally, some attempt to standardize the measurement of physical activity outcomes would significantly improve cross-study comparability. At a minimum, studies should use measures that allow comparison to epidemiologic data on population physical activity levels and calculation of the percent of participants meeting national physical activity recommendations. This would also facilitate health economic evaluations, an important but often neglected aspect of physical activity intervention studies.

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