

REVIEW ARTICLE (META-ANALYSES)

# Interventions to Promote Long-Term Participation in Physical Activity After Stroke: A Systematic Review of the Literature



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## Abstract

**Objective:** To investigate the effects of interventions to promote long-term participation in physical activity (PA) on measures of frequency, duration, or intensity of PA at 3 months or longer in community-dwelling stroke survivors.

**Data Sources:** MEDLINE, Cumulative Index to Nursing and Allied Health (CINAHL), PsycINFO, and Cochrane Library of Systematic Reviews between 1987 and December 2012. Search terms included “physical activity, exercise promotion,” “stroke,” “behavior change interventions,” and their synonyms.

**Study Selection:** Randomized controlled trials or comparison studies involving stroke survivors, with follow-up of  $\geq 3$  months, examining interventions to increase long-term participation in PA.

**Data Extraction:** Preferred reporting items for systematic reviews and meta-analyses guidelines informed data extraction. Risk of bias was assessed using the Cochrane Collaboration tool. Two reviewers independently reviewed abstracts and extracted data.

**Data Synthesis:** Of 2888 studies, 11 involving 1704 participants were included. Risk of bias occurred in randomization methods and blinding. Limited data and study heterogeneity meant that data pooling was not possible. Odds ratios and continuous data as weighted mean differences, however, were calculated using fixed-effect models and 95% confidence intervals. Two intervention types were identified: individualized tailored counseling with or without supervised exercise ( $n=6$  studies) and supervised exercise with advice ( $n=5$  studies). Three studies illustrated increased odds of meeting recommended PA levels and participation in PA at 12 months after tailored counseling ( $P<.05$ ). Two studies showed improved step count at 3 months with supervised exercise only ( $P<.05$ ); however, PA levels had declined by 3 months. Tailored home exercise was the only predominantly exercise-based intervention to demonstrate higher PA participation at 12 months.

**Conclusions:** This study provides some evidence that tailored counseling alone or with tailored supervised exercise improves long-term PA participation and functional exercise capacity after stroke better than does tailored supervised exercise with general advice only. Interventions to improve participation in PA should incorporate PA-specific tailored counseling based on sound behavioral theory to promote long-term participation in PA.

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Effectively supporting stroke survivors to participate in physical activity (PA) after stroke is now a priority. Participation in moderate- or high-intensity exercise reduces the risk of secondary ischemic or hemorrhagic stroke<sup>1-3</sup>; improves walking speed, functional mobility,<sup>4-6</sup> muscle strength, and bone density<sup>7</sup>; and

positively affects quality of life.<sup>8,9</sup> However, stroke leads to complex disability,<sup>10-12</sup> which makes participation in PA difficult, intensifying cardiovascular deconditioning,<sup>13</sup> which, in turn, negatively affects well-being, disability, and functional independence<sup>14,15</sup> and increases the risk of secondary stroke.<sup>3</sup> Therefore, understanding how best to support survivors to participate in regular PA is vital for their health and well-being.

Despite these benefits, most survivors do not engage in regular PA,<sup>16-18</sup> and fewer than 30% undertake minimal levels of PA.<sup>19</sup> Notably, in cases in which stroke survivors have attended organized exercise classes, benefits are often lost at follow-up,

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suggesting that survivors face barriers to undertaking self-directed activity.<sup>20-22</sup>

Interventions to address barriers to participation and foster motivation, confidence, and enjoyment are necessary to promote behavior change and support survivors' long-term participation in PA.<sup>22,23</sup> Barriers to PA include low motivation and confidence, physical disability, cost, access, support, and transport.<sup>24-27</sup> Tailored interventions to address barriers and provide support for behavioral change are known to improve PA uptake and maintenance in sedentary and older adults.<sup>28-32</sup> These interventions may also be effective for stroke survivors. This study aimed to investigate the effects of interventions to promote long-term participation in PA on measures of frequency, duration, and intensity of PA at 3 months or longer in community-dwelling stroke survivors.

## Methods

### Search methods

Preferred reporting items for systematic reviews and meta-analyses principles guided this review.<sup>32</sup> We searched MEDLINE, Cumulative Index to Nursing and Allied Health (CINAHL), PsycINFO, and the Cochrane Library of Systematic Reviews between 1987 and December 2012 using search terms "physical activity, exercise promotion," "stroke," "disability and behavior change interventions," and their synonyms. The full search string for Cumulative Index to Nursing and Allied Health is presented in appendix 1. Electronic databases [clinicaltrials.gov](http://clinicaltrials.gov) and [controlled-trials.com](http://controlled-trials.com) were searched for registered and completed trials. Reference lists of included publications were also searched.

### Inclusion criteria

We considered for inclusion any type of study testing the effectiveness of interventions to promote PA behavior in community-dwelling stroke survivors. Interventions to improve participation in PA could include counseling, advice, or behavior change interventions with or without structured exercise. Outcomes included any measure of frequency, duration, or intensity of PA at 3 months or longer, energy expenditure, or functional walking capacity. Measures included self-reported questionnaires, diaries, devices, or scales to measure activity or step count.

### Data extraction and assessment of methodological quality

Two reviewers (J.H.M. and S. McFarlane) independently screened titles and abstracts of publications. Relevant full-text articles were assessed for inclusion, and reviewers independently extracted data. Disagreement was resolved through discussion with a third reviewer (S. MacGillivray). Extracted data included study date and location, study design and comparison interventions, participant characteristics (age, sex, and ethnicity), intervention strategies, intervention frequency, duration and type, study outcome measures, intervention effectiveness, and adverse events. Methodological

#### List of abbreviations:

CI	confidence interval
MD	mean difference
OR	odds ratio
PA	physical activity

quality (risk of bias) was assessed using the Cochrane Collaboration's risk of bias tool.<sup>33</sup> The tool is used to assess the risk of bias that is likely to affect trial results or conclusions. The tool examines 6 domains of bias. Each is judged as high, low, or unclear. The judgment is based on criteria and examples provided in the *Cochrane Handbook for Systematic Reviews of Interventions*.<sup>33</sup>

### Data analysis

We calculated outcomes for binary data as odds ratio (OR) (with 95% confidence intervals [CIs]) and for continuous data used the mean difference (MD) (difference in means with 95% CIs). Arithmetic means and SDs were extracted for continuous data. For both ORs and MDs, we calculated the Z statistic to indicate whether the null hypothesis of no difference between groups could be rejected. We undertook a narrative review of all studies and intended to conduct a pooled meta-analysis, if possible, of *only* those studies with appropriate data and similarity of population, intervention, and comparison.

## Results

Searches identified 2888 publications. Eleven trials met inclusion criteria (fig 1) and included 1704 community-dwelling stroke survivors who were 63 days to 25 years poststroke and aged between 47 and 91 years.<sup>21,34-43</sup>

Study interventions were heterogeneous (table 1); however, 2 broad types were identified: (1) tailored counseling (6 studies) and (2) tailored supervised exercise individualized for physical ability with activity advice (5 studies) (see table 1).

### Assessment of risk of bias

Lack of blinding of study participants and personnel led to potential bias in all studies (table 2). One study<sup>41</sup> had a high bias potential due to lack of blinding of outcome assessors. Five studies<sup>21,34,38,41,43</sup> had a low bias potential in terms of allocation concealment; however, 5 studies demonstrated high bias potential due to inadequate or absent reporting of allocation concealment.<sup>36,37,39,40,42</sup>

Because of study heterogeneity in terms of outcomes and timing of assessments, it was not possible to pool data. Only ORs and MDs for individual studies are therefore reported. Three studies provided no data that could be analyzed in this review.<sup>34,38,40</sup>

### Intervention characteristics

#### Studies of the effectiveness of tailored counseling: Description of interventions and comparisons

Six studies investigating tailored counseling interventions were identified.<sup>34,37,39,42,43</sup> Interventions involved group or individual counseling strategies and a range of components including mapping or setting/monitoring of PA goals, motivational interviewing/counseling, goal setting and reviewing techniques, or follow-up visits/phone calls to promote adherence. Comparison interventions were usual care,<sup>37,38,42,43</sup> usual care plus information,<sup>34</sup> or a stroke discussion program.<sup>39</sup>

#### Studies of the effectiveness of tailored counseling: Description of PA outcomes

Four studies<sup>37,39,42,43</sup> provided data regarding the effects of tailored counseling interventions on PA behavior at 3-month follow-up or longer. Dichotomous data were provided in 3

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