

Osteoarthritis and Cartilage



Review

What proportion of people with hip and knee osteoarthritis meet physical activity guidelines? A systematic review and meta-analysis

Q1 J.A. Wallis †‡*, K.E. Webster §, P. Levinger ||, N.F. Taylor ¶#

Q1 † Physiotherapy Department, Eastern Health, Australia

‡ La Trobe University, Australia

§ School of Allied Health, La Trobe University, Australia

|| Institute of Sport, Exercise & Active Living (ISEAL), Victoria University, Australia

¶ Allied Health Clinical Research Office, Eastern Health, Australia

Department of Physiotherapy, La Trobe University, Australia

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SUMMARY

Objective: To determine the proportion of people with hip and knee osteoarthritis that meet physical activity guidelines recommended for adults and older adults.

Method: Systematic review with meta-analysis of studies measuring physical activity of participants with hip and knee osteoarthritis using an activity monitor. Physical activity levels were calculated using the mean average [95% confidence interval (CI)] weighted according to sample size. Meta-analyses determined the proportion of people meeting physical activity guidelines and recommendations of (1) ≥ 150 min per week of moderate to vigorous physical activity (MVPA) in bouts of ≥ 10 min; (2) ≥ 150 min per week of MVPA in absence of bouts; (3) $\geq 10,000$ steps per day and ≥ 7000 steps per day. The Grades of Research, Assessment, Development and Evaluation (GRADE) approach was used to determine the quality of the evidence.

Results: For knee osteoarthritis, 21 studies involving 3266 participants averaged 50 min per week (95% CI = 46, 55) of MVPA when measured in bouts of ≥ 10 min, 131 min per week (95% CI = 125, 137) of MVPA, and 7753 daily steps (95% CI = 7582, 7924). Proportion meta-analyses provided high quality evidence that 13% (95% CI = 7, 20) completed ≥ 150 min per week of MVPA in bouts of ≥ 10 min, low quality evidence that 41% (95% CI = 23, 61) completed ≥ 150 min per week of MVPA in absence of bouts, moderate quality evidence that 19% (95% CI = 8, 33) completed $\geq 10,000$ steps per day, and low quality evidence that 48% (95% CI = 31, 65) completed ≥ 7000 steps per day.

For hip osteoarthritis, 11 studies involving 325 participants averaged 160 min per week (95% CI = 114, 216) of MVPA when measured in bouts of ≥ 10 min, 189 min per week (95% CI = 166, 212) of MVPA, and 8174 daily steps (95% CI = 7670, 8678). Proportion meta-analyses provided low quality evidence that 58% (95% CI = 18, 92) completed ≥ 150 min per week of MVPA in absence of bouts, low quality evidence that 30% (95% CI = 13, 50) completed $\geq 10,000$ steps per day, and low quality evidence that 60% (95% CI = 47, 73) completed ≥ 7000 steps per day.

Conclusion: A small to moderate proportion of people with knee and hip osteoarthritis met physical activity guidelines and recommended daily steps. Future research should establish the effects of increasing physical activity in this population to meet the current physical activity guidelines.

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Q2 Introduction

Pain associated with mobility is characteristic of people with hip and knee osteoarthritis. Because of impaired mobility associated with

weight bearing pain, people with osteoarthritis may not be expected to be as physically active as people without osteoarthritis^{1–4}. Reductions in physical activity may be further accentuated if people with osteoarthritis believe physical activity is not beneficial or harmful for their joint⁵. Sufficient physical activity is important for people with knee or hip osteoarthritis as the risk of mortality from cardiovascular causes is increased in this population with walking disability⁶.

Physical activity is defined as any bodily movement produced by skeletal muscle that requires energy expenditure⁷ ranging from

* Address correspondence and reprint requests to: J.A. Wallis, Physiotherapy Department, Eastern Health, Australia. Tel: 61-3-9764-6150 (work), 61-3-9895-3715; Fax: 61-3-9764-6149 (work).

E-mail addresses: Jason.wallis@easternhealth.org.au, jasonwallis23@gmail.com (J.A. Wallis).

occupational, recreational or household tasks as well as structured activities like exercise classes, and categorised into light, moderate and vigorous intensity. Current physical activity guidelines for adults and older adults recommend at least 150 min per week of moderate to vigorous physical activity (MVPA) in bouts of 10 min or more^{8–10}. Steps per day are a frequently used metric for assessment of physical activity, specifically walking, and a popular recommendation is 10,000 daily steps¹¹. Furthermore 7000 daily steps may be equivalent to 150 min per week of physical activity in absence of the bout criterion¹².

Activity monitors provide meaningful information to compare with physical activity guidelines and recommended daily steps¹³. Only one previous review was found that investigated the physical activity levels of people undergoing total joint arthroplasty using activity monitors¹⁴. The results of the Naal¹⁴ review concluded that people undergoing joint arthroplasty walked an average of 6721 steps per day which is less than the popular recommendation of 10,000 steps per day and 7000 steps per day. The Naal (2010) review, however, did not examine the proportion of people with osteoarthritis meeting physical activity guidelines and only included a relatively small number of studies ($n = 6$) which measured physical activity pre-operatively with accelerometers.

Therefore, the current review had two main aims: (1) to determine the physical activity levels of people with hip and knee osteoarthritis measured by an activity monitoring device; (2) to determine the proportion of people with hip and knee osteoarthritis that met current physical activity guidelines and recommendations for adults and older adults.

Method

Design

PROSPERO registration number CRD42012002416 <http://www.crd.york.ac.uk/PROSPERO>. Systematic review of empirical studies of multiple designs including observational, cross-sectional and interventional (using baseline data).

Search strategy

The electronic databases MEDLINE, PUBMED, CINAHL, EMBASE, COCHRANE and SPORTdiscus were searched from earliest available time until April 2012. The two concepts population and outcome were combined with the 'AND' operator. Population was defined as participants with osteoarthritis of the hip and knee. Outcome was defined as a physical activity measure using an activity monitor (accelerometer or pedometer) for a minimum of 1 day. For each concept synonyms and MeSH terms were combined with the 'OR' operator (Appendix).

All articles were imported to bibliographic software. Two reviewers independently screened each article for inclusion by title and abstract utilising pre-determined eligibility criteria. Any disagreements were resolved by discussion. Full text copies of articles that were not definitely excluded on title and abstract were retrieved and the criteria reapplied. If uncertain, articles were discussed by the reviewers to achieve consensus. Database searching was supplemented by hand searching the reference lists of included articles and the application of citation tracking using Google Scholar.

Eligibility criteria

The studies were eligible if (1) participants were diagnosed with hip or knee osteoarthritis. If the study included other conditions such as rheumatoid arthritis but did not separate the outcomes

then the study was eligible if at least 80% of participants had hip or knee osteoarthritis; (2) a direct measure of physical activity (accelerometer or pedometer) was used for a minimum of 1 day; (3) the study was peer reviewed; (4) written in English.

The studies were ineligible if (1) they were animal studies; (2) they evaluated the effect of an intervention (such as joint arthroplasty) without baseline data; (3) the physical activity measure was not an activity monitoring device such as a questionnaire or diary; (6) the article was not peer reviewed such as an opinion article or thesis; (7) the article was a systematic review.

Data collection process

A pre-designed form was used to extract data on participants, type of activity monitor and results including strategies (if any) associated with physical activity and health outcomes. Investigators were contacted, if required, to confirm data.

Risk of bias in individual studies

Two researchers independently applied a validated tool, the Epidemiological Appraisal Instrument, to rate the methodological quality of all the trials¹⁵ and 23 items (item numbers 1, 3–9, 11, 13–17, 19, 21, 31, 32, 35, 36, 41–43) were applicable to this review. Each item was scored with 'yes' (scored as 2), 'partial' (scored as 1), and 'no' or 'unable to be determined' (scored as 0) with a maximum score of 46 (100%). A trial with a score of 60% or more was considered high quality¹.

Synthesis of results and summary measures

To describe the physical activity level of participants, the mean average physical activity level [95% confidence interval (CI)] was calculated and weighted according to sample size as represented by: (1) the number of minutes per week of MVPA in bouts of 10 or more minutes; (2) the number of minutes per week of MVPA in the absence of bouts; (3) the number of daily steps.

The principal summary measures were as follows: (1) the proportion of participants (95% CI) that met current physical activity guidelines of at least 150 min per week of MVPA in bouts of 10 or more minutes; (2) the proportion of participants (95% CI) that completed at least 150 min per week of MVPA in absence of the bout criterion; (3) the proportion of participants (95% CI) that completed the popular recommendation of 10,000 steps per day and the proportion that completed 7000 steps per day, estimated to be equivalent to completing 150 min per week of MVPA in absence of the bout criterion.

Where the proportion of participants meeting the physical activity guidelines or recommended number of daily steps were not reported a secondary analysis estimated the results based on z-scores (mean, standard deviation, number of participants). The data were combined *via* proportion meta-analyses (Stats-Direct, Altrincham, UK) using a random effects model¹⁶ where at least two trials had a common population (e.g., knee osteoarthritis) and outcome measure (e.g., number of daily steps). The CIs were calculated by the "exact" method¹⁷. Sensitivity analyses were performed when high statistical heterogeneity ($I^2 > 50\%$)¹⁸ was present by eliminating outlier results. Subgroup analyses were performed to investigate factors related to physical activity level.

Risk of bias across studies

The Grades of Research, Assessment, Development and Evaluation (GRADE) approach was applied to each meta-analysis

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