

PRE-STROKE PHYSICAL ACTIVITY IN RELATION TO POST-STROKE OUTCOMES: A SYSTEMATIC REVIEW

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ABSTRACT

Background: Stroke has a direct impact on overall health. The interval between the onset of symptoms and arrival at the hospital can greatly influence the effectiveness of treatment and patient prognosis. Stroke survivors are additionally affected by long-term physical and psychosocial well-being.

The aim: This study aims to show pre-stroke physical activity in relation to post-stroke outcomes.

Methods: By comparing itself to the standards set by the Preferred Reporting Items for Systematic Review and Meta-Analysis (PRISMA) 2020, this study was able to show that it met all of the requirements. So, the experts were able to make sure that the study was as up-to-date as it was possible to be. For this search approach, publications that came out between 2013 and 2023 were taken into account. Several different online reference sources, like Pubmed and SagePub, were used to do this. It was decided not to take into account review pieces, works that had already been published, or works that were only half done.

Result: In the PubMed database, the results of our search brought up 74 articles, whereas the results of our search on SagePub brought up 77 articles. The results of the search conducted for the last year of 2013 yielded a total 7 articles for PubMed and 54 articles for SagePub. The result from title screening, a total 5 articles for PubMed and 31 articles for SagePub. In the end, we compiled a total of 10 papers. We included five research that met the criteria.

Conclusion: People who were physically active before the stroke tended to be more independent in physical functioning after the stroke. Regardless of physical activity before stroke, all patients demonstrated improvements in mobility, walking ability, and upper extremity self-perception during functional treatment.

Keyword: Physical activity, pre-stroke, post-stroke, stroke.

INTRODUCTION

Stroke is the second leading cause of death and the most frequent cause of disability in adults globally. In 2010 alone, stroke resulted in 1.7 million deaths in China, indicating that more than 3 individuals die of stroke every minute. The rate of recurrence of ischemic stroke is high; it ranges from 16 to 29% in the USA and is calculated to be 29.43% in China. The high incidence of recurrence increases the mortality, and decreases the ability to compensate for the injury functionally. It has been estimated that active prevention can reduce the rate of the recurrence of ischemic stroke by approximately 80%.¹

Physical activity (PA) is important for primary and secondary prevention of cardiovascular disease (CVD), including stroke. A meta-analysis of prospective cohort studies reported >16% reduction in the relative risk for stroke among physically active individuals (>600 MET-minutes/week). Moreover, studies demonstrated associations between PA after stroke and better clinical and functional outcomes, as well as lower mortality rates, reinforcing the importance of PA not only for stroke prevention, but also as a therapeutic strategy.^{2,3}

Compared to established contributions of PA to primary and secondary prevention of stroke, it is less clear whether PA prior to stroke (pre-stroke PA) is associated with long-term prognosis after incident stroke. The few studies that examined the association of pre-stroke PA on outcomes after stroke were retrospective and based on self-reported information at stroke admission, increasing the possibility of recall bias and underrepresentation of the most severely affected patients. Moreover, most evaluated a single measurement of PA focused in one domain, usually leisure-time or sports PA, which can result in misclassifications of total PA levels since an increase in PA in one domain may be compensated by decreased activity in other domains.²

The health benefits of physical activity are significant, and there is a dose-response relationship between the volume of physical activity and risk of cardiovascular morbidity and mortality. Regular physical activity serves as an important component in the primary and secondary prevention of stroke and counteracts several cerebrovascular risk factors. However, the association between prestroke physical activity and outcomes after stroke is not well established. Prestroke physical activity has been associated with reduced stroke severity, in-hospital mortality, cardiovascular mortality, and all-cause mortality. Contrarily, some previous studies found no association between prestroke physical activity and stroke severity or poststroke mortality, after covariate adjustment.^{4,5}

METHODS

Protocol

By following the rules provided by Preferred Reporting Items for Systematic Review and Meta-Analysis (PRISMA) 2020, the author of this study made certain that it was up to par with the requirements. This is done to ensure that the conclusions drawn from the inquiry are accurate.

Criteria for Eligibility

For the purpose of this literature review, we compare and contrast pre-stroke physical activity in relation to post-stroke outcomes. It is possible to accomplish this by researching or investigating pre-stroke physical activity in relation to post-stroke outcomes. As the primary purpose of this piece of writing, demonstrating the relevance of the difficulties that have been identified will take place throughout its entirety.

In order for researchers to take part in the study, it was necessary for them to fulfil the following requirements: 1) The paper needs to be written in English, and it needs to determine about pre-stroke physical activity in relation to post-stroke outcomes. In order for the manuscript to be considered for publication, it needs to meet both of these requirements. 2) The studied papers include several that were published after 2013, but before the time period that this systematic review deems to be relevant. Examples of studies that are not permitted include editorials, submissions that do not have a DOI, review articles that have already been published, and entries that are essentially identical to journal papers that have already been published.

Search Strategy

We used "pre-stroke physical activity in relation to post-stroke outcomes." as keywords. The search for studies to be included in the systematic review was carried out using the PubMed and SagePub databases by inputting the words: ("Pre-stroke physical activity"[MeSH Subheading] OR "Stroke"[All Fields] OR "Pre-stroke physical activity outcomes" [All Fields]) AND ("Effect of pre-stroke physical activity"[All Fields] OR "Physical activity and stroke"[All Fields]) AND ("Relation physical activity for stroke"[All Fields] OR ("Outcomes pre-stroke physical activity to post-stroke" [All Fields])) used in searching the literature.

Data retrieval

After reading the abstract and the title of each study, the writers performed an examination to determine whether or not the study satisfied the inclusion criteria. The writers then decided which previous research they wanted to utilise as sources for their article and selected those studies. After looking at a number of different research, which all seemed to point to

the same trend, this conclusion was drawn. All submissions need to be written in English and can't have been seen anywhere else.

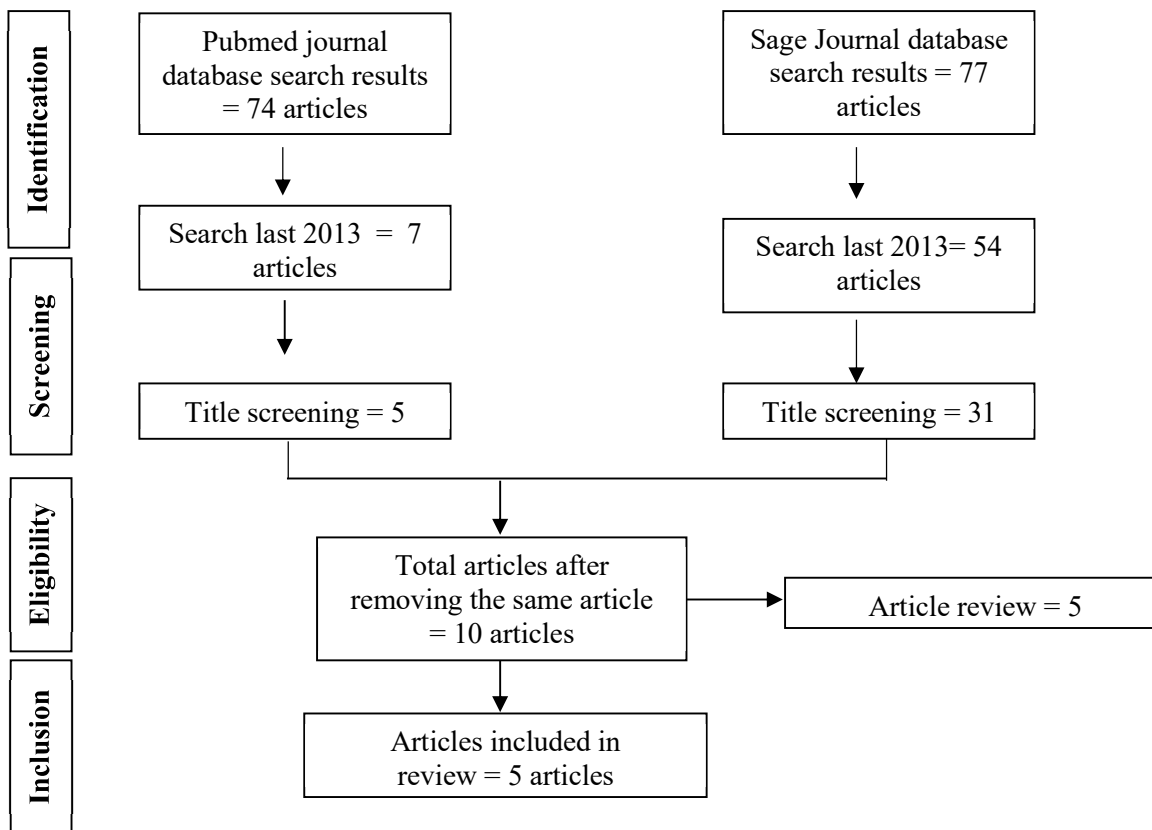


Figure 1. Article search flowchart

Only those papers that were able to satisfy all of the inclusion criteria were taken into consideration for the systematic review. This reduces the number of results to only those that are pertinent to the search. We do not take into consideration the conclusions of any study that does not satisfy our requirements. After this, the findings of the research will be analysed in great detail. The following pieces of information were uncovered as a result of the inquiry that was carried out for the purpose of this study: names, authors, publication dates, location, study activities, and parameters.

Quality Assessment and Data Synthesis

Each author did their own study on the research that was included in the publication's title and abstract before making a decision about which publications to explore further. The next step will be to evaluate all of the articles that are suitable for inclusion in the review because they match the criteria set forth for that purpose in the review. After that, we'll determine which articles to include in the review depending on the findings that we've uncovered. This criteria is utilised in the process of selecting papers for further assessment. In order to simplify the process as much as feasible when selecting papers to evaluate. Which earlier investigations were carried out, and what elements of those studies made it appropriate to include them in the review, are being discussed here.

RESULT

In the PubMed database, the results of our search brought up 74 articles, whereas the results of our search on SagePub brought up 77 articles. The results of the search conducted for the last year of 2013 yielded a total 7 articles for PubMed and 54 articles for SagePub. The result from title screening, a total 5 articles for PubMed and 31 articles for SagePub. In the end, we compiled a total of 10 papers. We included five research that met the criteria.

Viktorisson, A *et al* (2021)⁶ showed a large proportion of stroke survivors experience a change in their physical activity level following stroke. Unimpaired cognition may facilitate a higher level of post-stroke physical activity, present 6 months after stroke. The importance of cognitive function for post-stroke physical activity requires further investigation, and should be evaluated in future studies.

Susts, J *et al* (2023)⁷ showed physical inactivity before stroke is one factor associated with dependency in basic ADL 3 months after stroke. In addition, older age, female sex, pre-stroke living conditions, need for help, previous stroke, and admission stroke severity are also significant contributors to dependency. This study supports previous findings on the

importance of physical activity in preventing the negative consequences of stroke. Therefore, promoting a physically active lifestyle could be a way to reduce the burden of stroke on society. However, these findings require additional knowledge. Future studies should investigate the levels of physical activity that are beneficial in decreasing stroke-related dependency. In addition to physical activity, it is important to investigate the influence of pre-stroke sedentary behavior on stroke outcomes.

Table 1. The literature include in this study

Author	Origin	Method	Sample Size	Result
Viktorisson, A <i>et al.</i> , 2021 ⁶	Sweden	Explorative and prospective, longitudinal study	49 participants	Of 49 participants included, 44 were followed up. The level of physical activity changed in more than half of all participants after stroke. Participants who were physically active 6 months after stroke presented with significantly less cognitive impairments. These results highlight that many stroke survivors experience a change in their physical activity level following stroke, and that unimpaired cognition may be important for a stroke survivors' ability to be physically active.
Susts, J <i>et al.</i> , 2023 ⁷	Sweden	Longitudinal study	3472 patients	In total, 3,472 patients were included in the study. The median age was 75 years, 49% of the patients were physically inactive before stroke, and 75% had a mild stroke. ADL dependency at follow-up was reported to be 32%. Physically inactive patients, compared with physically active patients, had 2.35 times higher odds for ADL dependency 3 months after stroke (odds ratio 2.30 [95% CI 1.89 – 2.80]). The model correctly classified 84% of the patients (the area under the receiver operating characteristic curve was 0.84 [95% CI, 0.83 – 0.86]).
Buvarp, D <i>et al.</i> , 2023 ⁸	Sweden	Cohort study	1367 participants	Of the 1367 included participants (median [IQR] age, 72 years [65-79] years; 844 males [62%]), 2 distinct trajectory groups were identified: increaser (n = 720 [53%]) and decreaser (647 [47%]). The increaser group demonstrated a significant increase in physical activity level (mean difference, 0.27; linear slope $\beta_1 = 0.46$; $P < .001$) and sustained it at light intensity from 1 week to 6 months, whereas the decreaser group showed a decline in physical activity and eventually became inactive (mean difference,

				-0.26; linear slope $\beta_1 = 1.81$; $P < .001$). Male participants and those with normal cognition had higher odds of being in the increaser group, regardless of stroke severity. Increasing physical activity and sustaining it at light intensity were associated with a good functional outcome at 6 months (adjusted odds ratio, 2.54; 99% CI, 1.72-3.75; $P < .001$).
Reinholdsson, M et al., 2022⁹	Sweden	Cross sectional study	1111 patients	Mean age 70 years, 40% women, 61% pre-stroke physically active, and 53% with post-stroke cognitive impairment. Patients with pre-stroke light or moderate physical activity have higher odds for intact cognition compared to inactive: odds ratio (95% confidence interval) 1.32 (0.97-1.80) and 2.04 (1.18-3.53), respectively. In addition to pre-stroke physical activity, people with younger age, a higher level of education, less severe stroke (more mild than moderate), being non-diabetic, and non-smoking have higher odds for intact cognition.
Blaszcz, M et al., 2022¹⁰	Poland	A prospective observational pilot study	31 patients	Measurements were taken on 21 participants at the beginning of and 6 weeks post-conventional rehabilitation with the Barthel Index (BI), Berg Balance Scale (BBS), Trunk Control Test (TCT), Stroke Impact Scale (SIS), General Self-Efficacy Scale, Stroke Self-Efficacy Questionnaire (SSEQ), the original scale of belief in own impact on recovery (BiOIoR), Hospital Anxiety and Depression Scale, Acceptance of Illness Scale and when the patient could walk—Time Up & Go and 6 Minute Walk Test. Daily PA was assessed over 6 weeks using a Caltrac accelerometer. Only outcomes for BI, BBS, TCT, SIS, and SSEQ significantly improved 6 weeks post-rehabilitation. PA energy expenditure per day significantly increased over time ($p < 0.001$; effect size = 0.494), but PA only increased significantly up to the third week. PA change was correlated with BiOIoR post-

				treatment. Self-efficacy in self-management mediated improvement in SIS. The BiOIoR and confidence in self-management could be important factors in the rehabilitation process.
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Buvarp, D *et al* (2023)⁸ showed increased physical activity of at least light intensity during the subacute phase after stroke was associated with a good functional outcome at 6 months, which is consistent with earlier findings in patients with mild or moderate stroke. However, no significant interactions were found in the subgroup analysis, indicating that no other covariate traits could modify the association between the physical activity trajectories and functional outcome at 6 months after stroke. Early rehabilitation is beneficial as the optimal window for increasing recovery becomes narrower with time. Increased physical activity has been shown at the behavioral and molecular levels to be associated with enhanced neuroprotectivity and neuroplasticity. Light-intensity physical activity might already play an optimal role at the early subacute phase in improved functional recovery before spontaneous recovery diminishes.

Reinholdsson, M *et al* (2022)⁹ showed pre-stroke physical activity is associated with intact cognition early after stroke in previously independent patients with mild and moderate stroke. Moderate physical activity, such as exercise at hours 2–3 times/week, seem to be more beneficial compared to light physical activity, such as walking at least 4 h/week. In addition to pre-stroke physical activity, people with younger age, being non-diabetic, non-smoking, a higher level of education, and less severe stroke (more mild than moderate) have higher odds for intact cognition after stroke.

Blaszcz, M *et al* (2022)¹⁰ showed Physical activity increased from week to week, but significant changes were observed only up to the third week. This indicates the need for constant activation of patients to use their potential. Patients could achieve significant improvement in functional independence, trunk control, balance and in stroke-specific self-efficacy and health-related quality of life after 6 weeks of conventional rehabilitation. The psychological outcomes such as general self-efficacy, depression, anxiety and acceptance of illness could not improve significantly during this time with usual care. In the rehabilitation process, it is worth considering the belief in own impact on recovery and self-efficacy in self-management, as they could be associated with better psychophysical functioning of stroke patients.

DISCUSSION

Stroke is one of the most common causes of disability in adults and it is the second most frequent cause of death in Germany as well as on global scale. Lifestyle factors like obesity, poor diet or physical inactivity are seen as major modifiable risk factors for stroke. Regular physical activity decreases stroke incidence and was associated with better cognitive function and even fewer symptoms of depression in those affected. There are a few studies which reported a significant association between pre-stroke physical activity and post-stroke functional status as assessed by the National Institutes of Health Stroke Scale (NIHSS), the Modified Ranking Scale (mRS) and the Barthel Index. In addition, low level of physical activity before stroke predicted low physical activity after stroke.^{11,12}

Modifiable risk factors for stroke, and post-stroke recovery are receiving increasing interest. One emerging topic is the potentially neuroprotective effect of premorbid physical activity (PA). The health benefits of PA are well-established, and the WHO recommends that every adult perform 150–300 min of moderate-intensity PA or 75–150 min of vigorous-intensity PA each week. These recommendations also apply to older adults, and adults with non-communicable diseases. Regular PA has a strong inverse relationship with cardiovascular morbidity and all-cause mortality. Moreover, PA independently reduces the risk of stroke, and may counteract several other cerebrovascular risk factors including hypertension, diabetes, obesity, and psychosocial stress. It is not known whether pre-stroke PA has a significant effect on post-stroke outcomes.¹³

Physical activity (PA) is a crucial, modifiable factor that influences not only long-term physical function but also life expectancy in survivors of stroke. During the acute phase, increasing PA through early mobilization during hospitalization can contribute to improved functional outcomes post-stroke. A previous study using behavior mapping to monitor individuals with stroke every 10 min for 24 h, showed that they spent > 80% of their time either resting in bed or sitting out of bed in the stroke care unit. A recent investigation into 24-h activity in the stroke care unit during the 1st week post-stroke employing accelerometers, demonstrated that the majority of the day (> 90%) was spent engaging in sedentary behavior (energy expenditure of ≤ 1.5 metabolic equivalents [METs]).¹⁴

To provide more effective rehabilitation for individuals with acute stroke, identifying the individual factors associated with PA during the acute phase is crucial. Although PA in stroke survivors living in the community is generally, lower than that in healthy older individuals, a consensus exists that increasing PA after stroke offers health benefits and reduces stroke recurrence. A recent review reported that PA was strongly associated with physical function in community-dwelling stroke survivors. Therefore, hypothesizing that motor function with paralysis and muscle composition might affect PA during the acute post-stroke period. However, it remains unclear which individual patient factors are associated with PA in the acute phase, where medical issues often hinder PA and its compensation relies on medical staff.^{14,15}

CONCLUSION

People who were physically active before the stroke tended to be more independent in physical functioning after the stroke. Regardless of physical activity before stroke, all patients demonstrated improvements in mobility, walking ability, and upper extremity self-perception during functional treatment.

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