

# Physical performance and physical activity in the later stage post-stroke

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## ABSTRACT

**Aims:** The overall purpose of this thesis was to increase knowledge about physical performance and activity in the later stage post-stroke by measuring walking performance in different environments coupled to muscle strength, cardiorespiratory fitness evaluation and self-reported physical activity.

**Methods:** The studies reported in the thesis included a total of 83 subjects with prior stroke living in the community and 144 clinically healthy subjects from the same area. In study I, walking performance (speed and distance) were assessed indoors and outdoors in 36 subjects after stroke, who were divided into slow and fast walkers. Study II evaluated the relationship between muscle strength in the lower extremities and walking performance (speed and distance) in 41 subjects after stroke and 144 healthy reference participants. The correlation between maximal exercise capacity measured during one-legged bicycling test and the 6-minute walking test (6MWT) were examined in 34 subjects after stroke in study III. The influences of motor function and balance on the 6MWT were also investigated. Study IV compared self-reported physical activity in 70 persons with stroke compared to 141 healthy subjects and explored the relationship between this and physical measures.

**Results:** There were no differences in the short and long distance walking test for the slow walkers between different environments. However, those who walked faster walked a longer distance in the outdoor setting. The actual distance walked in the 6MWT was significantly shorter than the distance predicted by 30-meter walking test (30mWT) for both groups in the indoor environment. The parametric model provided evidence for a non-linear relationship between walking performance and strength index. The model explained 37% of the variance in self-selected speed in the stroke group and 20% in the healthy group, and 63% and 38%, respectively, in maximum walking speed. For the 6MWT, the model explained 44% of the variance in the stroke group. Low to moderate correlations were found between the 6MWT and one-legged bicycling measurements in the paretic leg, such as  $VO_{2peak}$ ,  $W_{max}$  and total exercise time. There was a moderate to high correlation between specific stroke impairments and the walking test. The self-reported physical activity was moderately correlated with walking speed. A regression model with the self-reported physical activity as the dependent variable and age and self-selected walking speed as independent variables explained approximately 30% of the variation in the stroke group. In both groups, only the walking speed showed a significant contribution to the model.

**Conclusions:** The environment has an impact on walking performance. Walking speed measured over a short distance seemed to overestimate long distance walking capacity for the slow walkers, despite the environment. A non-linear relationship was found between muscle strength in the lower extremity and walking performance. For those that are weak, changes in muscle strength have a stronger impact on walking. It seems that factors other than cardiorespiratory fitness influence the 6MWT. HR and SBP indicate cardiovascular stress, but the use of only the 6MWT distance as an indicator for cardiorespiratory fitness cannot be recommended. Physical performance including walking performance, muscle strength, cardiorespiratory fitness and self-reported physical activity was below the level of healthy controls. As low levels of physical activity are regarded as a large health-threatening problem in the general population, it is of major importance to find ways to promote physical activity for persons with disabilities.

**Keywords:** cerebrovascular accident, exercise test, gait, healthy control, muscle strength, physical activity, physical therapy, rehabilitation, secondary prevention, stroke, walking.

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This thesis is based on the following papers:

- I. **Carvalho C**, Sunnerhagen KS, Willén C.  
Walking speed and distance in different environments of subjects in the later stage post-stroke.  
*Physiotherapy Theory and Practice* 2010; 26: 519-527.
- II. **Carvalho C**, Sunnerhagen KS, Willén C.  
Walking performance and muscle strength in the later stage post-stroke: a non-linear relationship.  
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- III. **Carvalho C**, Willén C, Sunnerhagen KS.  
Relationship between walking function and one-legged bicycling test in subjects in the later stage post-stroke.  
*Journal of Rehabilitation Medicine* 2008; 40:721-726.
- IV. Danielsson A, **Carvalho C**, Willén C, Sunnerhagen KS.  
Cross-sectional data on physical activity in community-dwelling stroke survivors compared to a healthy population.  
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