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Walking Tasks Experienced by Community-living Individuals with Chronic Stroke

National Traffic Injury Rehabilitation Hospital

Kim Dong-kyu, PT, PhD

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INTRODUCTION

Introduction

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ADL performance level and quality of life are closely related to independence in walking.

Therefore, recovery of walking ability is a very important goal in stroke rehabilitation.

(Kijima et al., 2018)

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As a result of physical and cognitive impairments, people with chronic stroke experience more difficulties in walking than healthy adults of their age.

(Sheffler & Chae, 2015)

Walking speed and endurance are remarkably decreased after stroke, adapting to environmental barriers in the community, such as irregular surfaces, stairs and ramps, and obstacles, is not easy.

(Eckardt & Kibele, 2017; Ng et al., 2013)

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Despite these limitations, most patients achieve a functional level of walking during rehabilitation.

(Pohl et al., 2002)

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However, this does not assure safety while walking in the community.

As there are various complex and challenging tasks related to walking, community ambulation requires relatively greater functional ability and cognitive effort than walking indoors.

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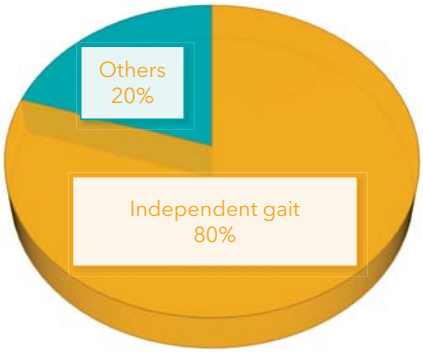

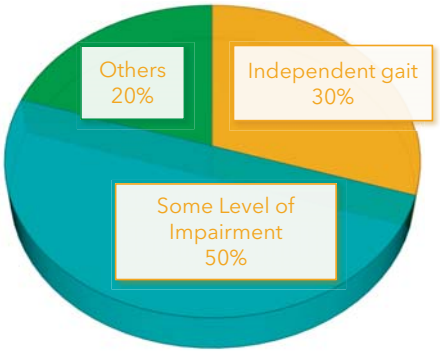

(Jorgensen et al., 1995)

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Only 30–50% of stroke victims

are capable of community ambulation, an important indicator of the activities and participation domains of the International Classifcation of Functioning, Disability and Health (ICF).

(Harvey, 2015)

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To successfully accomplish community integration after stroke, the walking tasks encountered in the community by people with chronic stroke should be identified.

- **Speed** (Perry et al., 1995)
- **Distance** (Lee et al., 2015)
- **Ability to walk on a ramp** (Hammel et al., 2015)
- **8 Dimensions factors** (Patla & Shumway-Cook, 1999)

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Based on the principles of motor learning to demonstrate task-specific effects, better solutions are needed to promote walking skills that are associated with community ambulation in stroke rehabilitation.

(Dean et al., 2000)

However, clinicians have frequently adopted evaluations and interventions only in an indoor setting; hence, it is difficult to precisely estimate their ability to walk in the community.

(Park et al., 2013)

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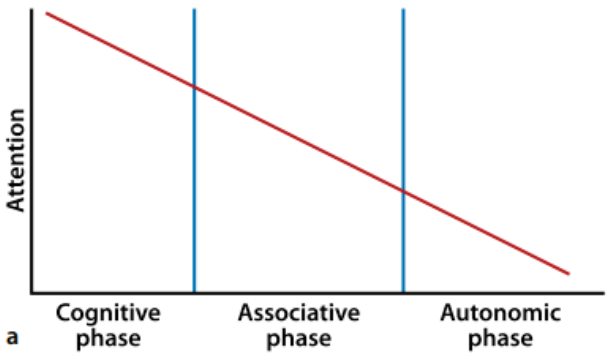

Fig. 1.3 a Phases of motor learning (Fitts and Posner 1967).

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Identifying walking tasks frequently experienced among people with chronic stroke in the community will help develop optimal approaches to facilitate their return to premorbid life.

However, to the best of our knowledge, no studies have achieved this.

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This study had two main purposes:

To develop a community ambulation survey by testing its content and concurrent validities after modifying the previous walking survey

To determine the necessary walking skills for community ambulation of individuals diagnosed with chronic stroke, by comparing their participation with that of age-matched older adults.

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METHODS

Methods

Participants

All participants lived in a city with population of >1,000,000 people, and were samples of convenience.

Representing a relatively well-established public transportation system and amenities considering convenience from urban environments.

Methods

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Participants (People with chronic stroke)

(1) >6 months since stroke onset

(2) The ability to walk independently in the community with or without walking aids (grade 5 in the Functional Ambulation Category)

(3) No cognitive impairments (>24 points in the MMSE)

(4) No disease or injury other than stroke that impedes their walking.

Methods

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Participants (Older adults)

Older adults were recruited from community groups of the two senior welfare centers, and were provided with presentations regarding the aim and procedure of the study.

The older adult group was age-matched with the stroke group.

Older adults who had any disease or injury that affected their walking ability were excluded.

Methods

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Development of the community ambulation survey

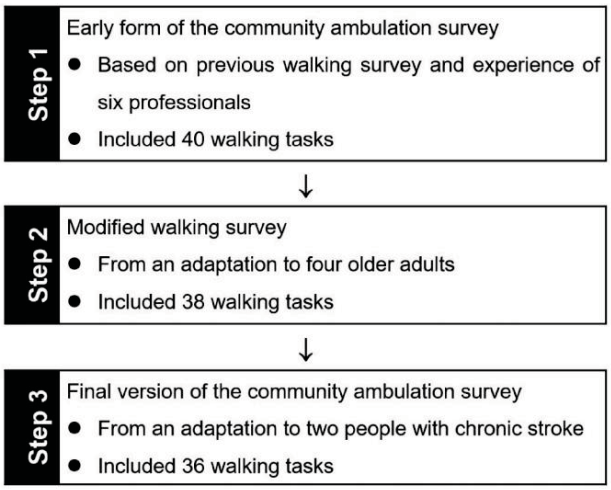

Figure 1. Steps for the development of the community ambulation survey.

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1. Walking surfaces

	None	1-3 times	4-9 times	≥10 times
a. Smooth (e.g. even floor inside the building, tile, hardwood)				
b. Rough (e.g. concrete, sidewalk block, grass, asphalt)				
c. Slippery (e.g. wet ground, icy or snowy roads)				
d. Soft (e.g. thick carper, sand, gym mat)				
e. Uneven (e.g. unpaved or bumpy roads, gravel)				

2. Doors

	None	1-3 times	4-9 times	≥10 times
a. Doors that you open and close manually (e.g. hinged or sliding doors)				
b. Automatic (e.g. automatically open when people approach)				
c. Power-assisted (e.g. button controlled)				
d. Revolving (e.g. doors in the building lobby)				

3. Stairs

	None	1-3 times	4-9 times	≥10 times
a. <6 steps up (e.g. steps to entryway)				
b. <6 steps down (e.g. steps from entryway)				
c. 7-16 steps up (e.g. 1 flight of stairs)				
d. 7-16 steps down (e.g. 1 flight of stairs)				
e. >16 steps up (e.g. >2 of flights)				
f. >16 steps down (e.g. >2 of flights)				

4. Crossways

	None	1-3 times	4-9 times	≥10 times
a. Controlled				
b. Uncontrolled				
c. Overpass				
d. Underpass				

5. Carrying objects				
	None	1-3 times	4-9 times	≥10 times
a. Light objects (e.g. using one hand to carry hand bag or plastic bag)				
b. Heavy objects (e.g. using two hands to carry box or large bag)				
c. Pushing objects (e.g. shopping cart)				

6. Skilled walking tasks				
	None	1-3 times	4-9 times	≥10 times
a. Walking backwards				
b. Walking sideways				
c. Fast walking (e.g. more than comfortable speed)				
d. Ramp/slope (e.g. inclined road up and down)				
e. Walking around the corner (e.g. right-angled corner, curb)				
f. Narrow spaces (e.g. alley, narrow gate and hall)				

g. Walking over and around obstacles (e.g. any objects on ground, road bump, door frame)				
h. Dim lighting (e.g. walking at night, walking in the basement garage)				
i. Walking with talking				
j. Manipulating objects (e.g. using a cell phone to call and send message)				
k. Crowded places (e.g. shopping mall, mart, convenience store)				

7. Distance				
	None	1-3 times	4-9 times	≥10 times
a. <100m				
b. 100-300m				
c. >300m				

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Content validity and concurrent validity of the community ambulation survey

Four healthy older adults (two men and two women) who can walk independently and who were not involved in developing the survey were recruited to evaluate its content validity.

Four members (one physical therapist, two graduate school students, and one occupational therapist) of the committee videotaped the walking episodes of the participants for 12 h a day (8:00 am to 8:00 pm).

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Content validity and concurrent validity of the community ambulation survey

The videos were reviewed by all committee members to identify walking tasks experienced by participants, and to check if the tasks were acceptable in the community level.

To evaluate concurrent validity, four members of the committee followed four older adults for 12 h, after which the committee members independently completed the survey based on the walking tasks encountered by the participants.

A four-week period was required to test the content and concurrent validities.

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Content validity and concurrent validity of the community ambulation survey

Methods

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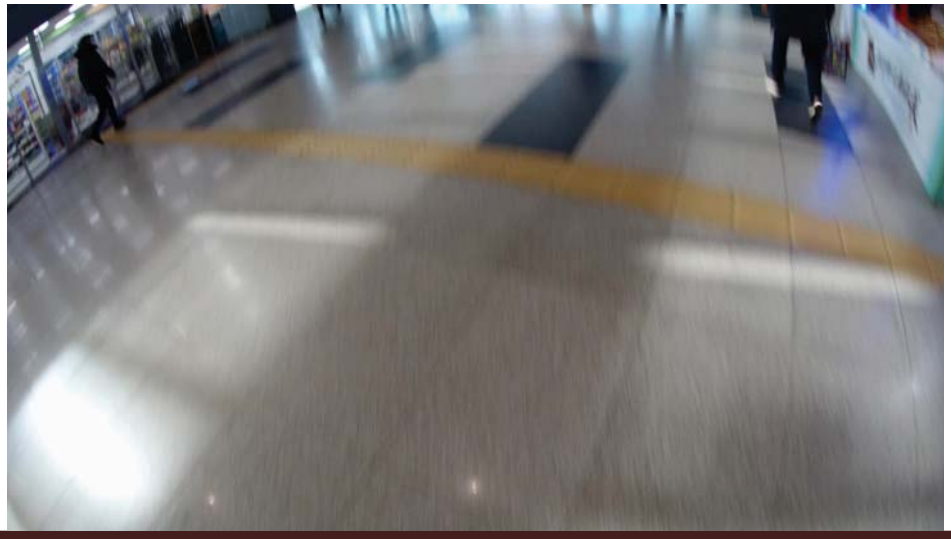
Content validity and concurrent validity of the community ambulation survey



Methods

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Data collection and analysis

Data of the survey obtained from older adult and stroke groups were analyzed using SPSS (Statistical Package for Social Science, Chicago, IL) version 22.0.

Using Cohen's kappa coefficients, the agreement between two raters in terms of the responses on the community ambulation survey was determined to ensure its concurrent validity.

For each survey item, the numbers of participants were reported as proportions (%) of each frequency rating.

The frequency ratings were then compared between the older adult and stroke groups using the x2 test.

$p<0.05$.

RESULTS

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Results

General characteristics of participants

Initially, 117 patients diagnosed with chronic stroke were recruited for this study.

15 declined to participate, and three were excluded because of their inability to walk. Furthermore, from 147 older adults, 40 (12 who did not understand what the walking tasks meant and how to answer the survey, eight who complained of back or limb pain, and 20 who had errors in filling out the survey) were excluded.

Results

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General characteristics of participants

Table 1. General characteristics of stroke and older adult groups.

	Stroke ($n = 99$)	Older adults ($n = 107$)
Sex (male/female)	78/21	47/60
Age (years) (±SD)	61.04 ± 2.53[a]	61.44 ± 1.59
Onset (months)	32.37 ± 11.98	
Types of stoke (infarction/hemorrhage)	80/19	
Walking aids (use/non-use)	44/45	

[a]Mean ± SD.

Results

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Content validity and concurrent validity of the community ambulation survey

Based on the surveys completed by the participants and the committee members, the average agreement was reported as 86.10 ± 5.07% of the total.

Table 2. Kappa coefficients and standard errors for four older adults in testing concurrent validity of the community ambulation survey.

Participants	Kappa coefficient	Standard error	95% CI
1	0.873	0.069	0.892–1.000
2	0.750	0.094	0.522–0.919
3	0.829	0.079	0.667–0.999
4	0.737	0.086	0.558–0.916

Results

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Content validity and concurrent validity of the community ambulation survey

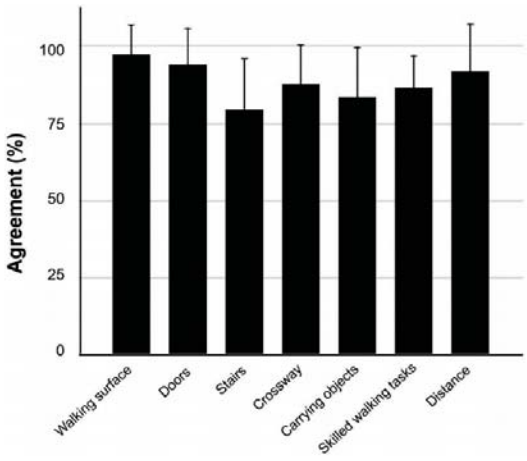

Figure 2. Concurrent validity of the community ambulation survey.

Results

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Comparison of the rate of encountering walking tasks between participants in the older adult and stroke groups

The rate of encountering walking tasks was significantly different between the older adult and stroke groups.

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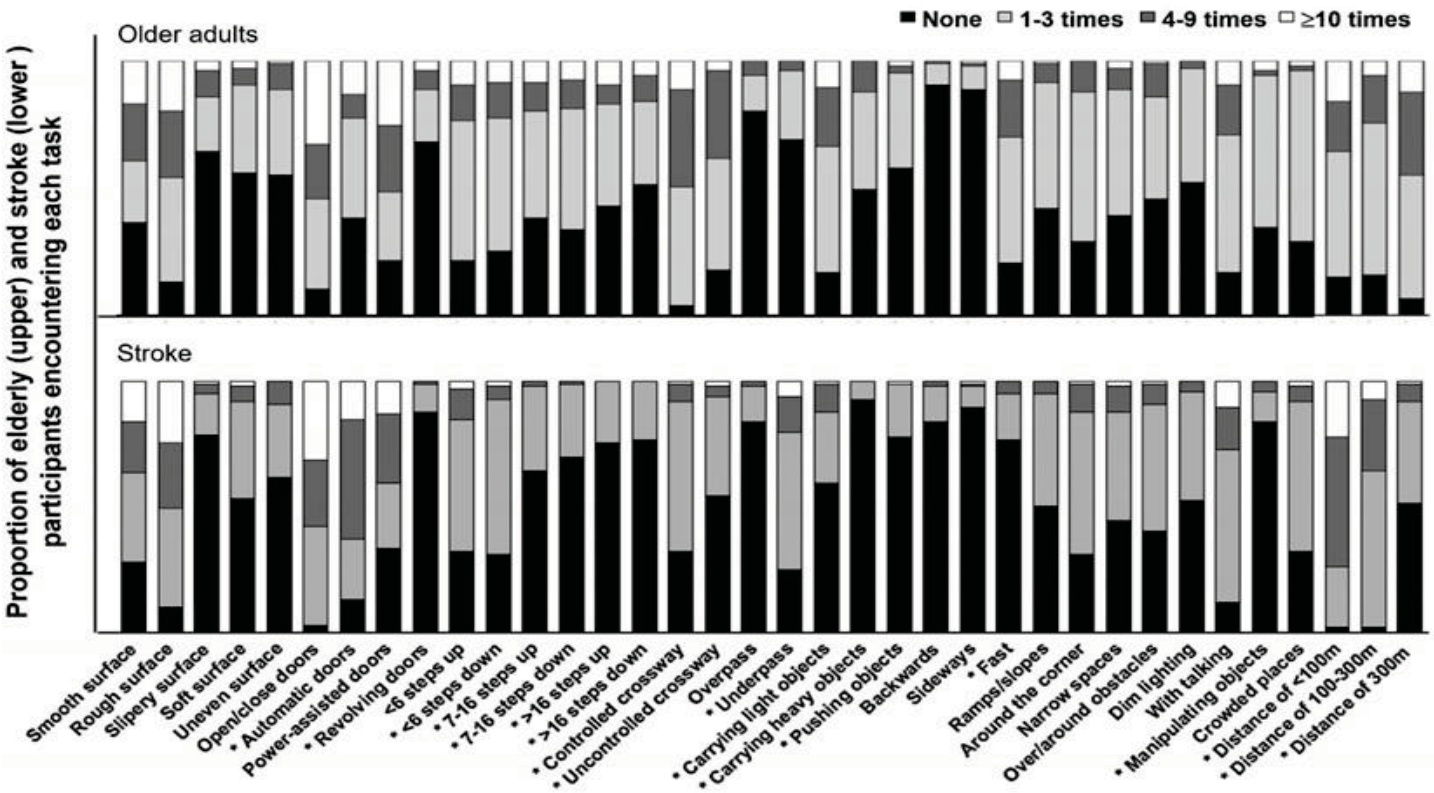

Figure 3. Rate comparison of the walking task experiences between participants in the older adult and stroke groups. *The walking tasks that showed significant differences between participants in the older adult and stroke groups.

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DISCUSSION

Discussion

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The findings of this study indicate that the community ambulation survey is valid for clinical use, and that people with chronic stroke tend to participate less frequently in challenging tasks that require more physical and cognitive efforts, including going up and down the stairs, using crossways, carrying objects, and walking at a fast pace or for long distances, than older adults.

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As the final goal of stroke rehabilitation, community reintegration can be accomplished by restoring independent walking and participating in various community activities.

This implies that gait training after stroke should address many factors that influence efficient and safe community ambulation.

Therefore, identifying the necessary walking skills and tasks for community ambulation, and subsequently including them in gait training, is important to maximize the benefits of rehabilitation (Dean et al., 2000)

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In this study, the results from the doors category showed that people with chronic stroke more frequently use automatic doors than older adults.

Automatic doors are beneficial because they do not require additional efforts.

In contrast, it was less frequent for people in the stroke group to use a revolving door when entering and exiting public facilities and places in the community.

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People with chronic stroke showed less frequent participation in tasks related to going up and down stairs, except for stairs with <6 steps.

People with chronic stroke have commonly reported difficulties in going up and down the stairs because of functional declines caused by negative changes in balance and motor control.

To assure community reintegration after stroke, the natural course of free ambulation frequently involves overcoming stairs, which should be considered as one of the main issues in creating better rehabilitation strategies.

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The most important goal is to assure safety while walking; therefore, attention must be paid when walking across roads with or without traffic signals.

Walking on the crossways requires a higher walking speed and more skillful maneuvers in order to complete them without any difficulty.

However, after stroke, the resulting decreased walking speed and endurance are not sufficient to cross roads without any difficulty.

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The stroke group appeared to participate less frequently in tasks related to crossways than the older adult group, more frequently using underpasses instead.

Many support systems for the convenient and safe ambulation of weak pedestrians in the community have appeared.

Our results indicate that people with chronic stroke use a relatively easy and safe strategy to cross roads.

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Muscle weakness and spasticity impair fine motor control of the affected hand, resulting in a remarkable decrease in grasp and prehension functions.

(Parry et al., 2019)

For these reasons, people with chronic stroke experience great difficulty in performing simultaneous work while walking.

(Pang et al., 2018)

The results of this study revealed that people with chronic stroke are less likely to participate in dual tasks, such as carrying light and heavy objects while walking, as well as in manipulating objects in the skilled walking tasks category.

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In modern society, cell phones are already a daily necessity. However, it may be greatly challenging for people with chronic stroke to perform additional tasks when walking because this requires higher levels of physical and cognitive demands to handle more complex motor control processes.

(Peters et al., 2019)

Although clinicians have used dual task training for stroke rehabilitation in many different forms to benefit from its application, our findings suggest that their ability to perform dual tasks when walking has room for improvement.

(Bhalla et al., 2010)

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After stroke, cognitive impairment is a negative factor that limits the attention process and executive function when performing functional movements and daily activities.

The results of this study revealed that people with chronic stroke are less likely to participate in dual tasks, such as carrying light and heavy objects while walking, as well as in manipulating objects in the skilled walking tasks category.

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After stroke, walking speeds become noticeably decreased, thereby reducing the tolerance to walk long distances.

In general, walking speed and distance have been considered as important parameters for predicting the ability of community ambulation after stroke, with a standard speed and distance of >0.8 m/s and >300 m, respectively.

(Perry et al., 1995) (Hill et al., 1997)

Discussion

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10MWT

> 0.4 m/s Household Ambulation
0.4 ~ 0.79 m/s Limited Community Ambulation
< 0.8 m/s Full Community Ambulation

6MWT

Male = (7.57 x height) - (5.02 x age) - (1.76 x weight) - 309m
Female = (2.11 x height) - (2.29 x weight) - (5.78 x age) + 667m

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The stroke group preferred to walk relatively shorter distances, indicating that they rarely walk long distances (>300 m) without rest.

This suggests that a decline in aerobic fitness after stroke should be addressed to assure free walking in the community even if they are able to walk independently in the community.

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Discussion

Limitation

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A community ambulation survey was developed based on walking episodes encountered by participants living only in large cities.

This study only included people with chronic stroke who were able to walk in the community, our findings do not support the results from patients with lower functional levels.

This study identified the frequency of the patients' participation in walking tasks within a community.

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CONCLUSION

Conclusion

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In stroke rehabilitation, recent evidence supports the use of task- oriented training to promote the ability to perform activities in daily life, which helps to return to premorbid life.

However, people with chronic stroke are more likely to avoid challenging tasks during community ambulation. Therefore, it is important to identify these required tasks, so as to include them in the training process during rehabilitation.

Conclusion

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In our findings, people with chronic stroke showed less frequent participation in walking tasks such as using stairs, using crossways, carrying objects, and walking fast and long distances, which are challenging for them.

These findings suggest that people with chronic stroke prefer to participate in walking tasks which are easily accessible to them in the community. Therefore, to achieve the final goal of stroke rehabilitation, it is necessary to repeatedly practice these walking tasks in a routine rehabilitation schedule.

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