RESEARCH PAPER

Determinants of Walking Aid Selection During Acute Stroke Rehabilitation: A Pilot Study

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ABSTRACT
Stroke survivors often face significant challenges with mobility, and walking aids are commonly prescribed to support ambulation and functional independence. However, the decision to prescribe such aids is frequently based on subjective clinical judgment rather than evidence-based criteria. This research focused to develop and evaluate a predictive model to assist clinicians in prescribing walking aids for stroke patients. The study involved twenty participants undergoing rehabilitation at a clinical facility in Rajkot, India. A comprehensive assessment was conducted, examining variables such as age, affected and dominant side, balance impairments, comorbidities, fear of falling, intrinsic motivation, socioeconomic status, spasticity, Brunnstrom recovery stage, proprioception, visual limitations, walking capacity, activities of daily living (ADL), and the patient's own preference for aid. These factors were evaluated through standardized clinical measures and tests. Statistical analyses were performed using SPSS version 23. The findings revealed that intrinsic motivation, proprioception, and fear of falling were significantly associated with the need for walking assistance ($p < 0.05$). These variables emerged as key predictors in the model. The study contributes a preliminary framework for predicting the necessity of walking aid prescription in stroke survivors, offering potential for improving clinical decision-making. While the small sample size and localized population limit the generalizability of the results, the model holds promise for practical implementation in rehabilitation settings. Future studies with larger, diverse populations are recommended to refine and validate the model. The proposed approach also has social implications, potentially enhancing patient safety, independence, and quality of life through personalized rehabilitation strategies.

Keywords: Stroke, Walking Aids, Predictive Model, Activities of Daily Living, Gait
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INTRODUCTION

The leading cause of disability globally, stroke greatly influences mobility and functional independence. The World Health Organization (WHO) estimates that 5 million individuals become permanently handicapped, and around 15 million people suffer from strokes a year (WHO, 2020). Walking aids are crucial for safe and efficient ambulation, as stroke patients generally suffer from motor problems, decreased balance, and gait irregularities. Clinically, walking aids like crutches, walkers, and canes are often recommended. But rather than using standardized prediction models, the prescription of walking aids often depends on clinical judgment, which produces arbitrary and subjective decision-making. Individual characteristics, including motivation, proprioception, fear of falling, and balance, affect how successful walking aids are. Inappropriate walking assistance prescriptions may impede rehabilitation progress, raise fall risk, and lower mobility confidence. Developing an evidence-based, predictive model for walking assistance will help make better clinical choices and enhance functional results in stroke rehabilitation. [1-3]

Several research studies have looked at how walking aids could help stroke recovery. According to Barbeau and Visintin (2003), stroke patients who used walking aids showed better gait symmetry and balance; yet, the efficiency of rehabilitation was greatly impacted by the assistance used. [4] Lamontagne et al. (2001) discovered that poor gait stability correlated with proprioception deficiencies; therefore, choosing walking assistance becomes rather important in avoiding falls. Tyson et al. (2007) underlined the need for desire and fear of falling in walking rehabilitation after a stroke, indicating that psychological elements are just as important as physical ones when choosing treatments. Notwithstanding these realizations, there are not any consistent prediction models that combine many elements to direct walking assistance prescriptions. Most research has concentrated on personal elements instead of creating a whole picture. This disparity calls for further study to provide a dependable and useful paradigm for therapeutic use. [5,6]

Walking aids are extensively utilized in stroke rehabilitation, although their prescription based on patient-specific criteria is not well supported by any evidence-based approach. Many times, present methods ignore psychological elements like motivation and fear of falling, which greatly affect gait performance and independence. [7,8] This study aims to bridge this gap by developing a predictive model that considers both physical and

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psychological factors, enabling clinicians to make informed decisions. By identifying key predictors such as proprioception, motivation, and fear of falling, this study seeks to enhance the precision and effectiveness of walking aid prescriptions in acute stroke rehabilitation.

METHODOLOGY

This was a pilot, exploratory, cross-sectional study designed to assess the correlation between various patient factors and the need for walking aids. The study was conducted at physiotherapy centers in Rajkot, India, with a sample size of twenty acute stroke subjects recruited through convenience sampling. The study was carried out in the duration between 27/09/2023 to 25/10/2024 after receiving ethical approval from the CDSCO-approved Ethical Committee and it being registered as a clinical trial on the Clinical Trials Registry-India.

The inclusion criteria consisted of acute stroke subjects willing to participate, both male and female neurological patients with a post-stroke duration of less than one month, and individuals aged between 40 and 65 years. Participants were required to have a Mini-Mental State Examination (MMSE) score greater than 24 and a minimum Barthel Index score of 10 in mobility. The exclusion criteria involved neurological patients who were uncooperative, those with auditory and visual deficits, and individuals with neurological conditions other than stroke.

Scales used in the Study:

The Intrinsic Motivation Inventory (IMI) is a self-report questionnaire used to assess participants' motivation levels regarding a particular activity. It measures factors such as interest, competence, effort, and pressure. The scale uses a 7-point Likert scoring system (1 = not at all true, 7 = very true), with higher scores indicating stronger intrinsic motivation. In this study, the IMI was used to evaluate the subjects' motivation toward mobility and rehabilitation, which is a key factor influencing walking aid usage.

The Modified Falls Efficacy Scale (MFES) assesses the fear of falling during daily activities. It consists of 14 items, each rated on a 10-point scale (0 = no confidence, 10 = complete confidence). Higher scores indicate greater confidence and lower fear of falling. This scale was used to determine the psychological impact of fear of falling on walking aid dependency in stroke subjects.

The Modified Kuppuswamy Scale classifies socioeconomic status (SES) based on the education, occupation, and monthly income of the household head. The combined score categorizes individuals into five classes: upper, upper middle, lower middle, upper lower, and lower. In this study, the scale helped assess whether SES influenced the choice and accessibility of walking aids.

The Brunnstrom scale assesses motor recovery in stroke patients through six stages, ranging from flaccidity to near-normal function. Lower stages indicate severe motor impairment, while higher stages reflect improved voluntary control. This scale was used to grade motor recovery and determine the level of assistance required for walking.

The Berg Balance Scale (BBS) evaluates balance performance and fall risk through 14 functional tasks (e.g., standing, reaching, and turning). Each task is scored from 0 to 4, with a total score of 56. Higher scores indicate better balance. This study utilized the BBS to evaluate balance deficits and their influence on the prescription of walking aids.

The Timed Up and Go (TUG) test measures how functional a subject's mobility is and their fall risk by recording the time it takes to stand up, walk three meters, turn, return, and sit down. Faster times indicate better mobility, with a time of ≤10 seconds reflecting normal mobility, 11–20 seconds indicating moderate impairment, and ≥30 seconds representing severe impairment. This test was used to assess gait efficiency and mobility in stroke subjects.

The Functional Independence Measure (FIM) evaluates functional abilities in daily activities across two domains: the motor domain, which includes 13 items covering self-care, mobility, and locomotion, and the cognitive domain, which consists of 5 items assessing communication and social interaction. Each item is scored on a 7-point scale (1 = total dependence, 7 = complete independence), with a total score range of 18 to 126. Higher scores indicate greater independence. The FIM was used to evaluate subjects' functional status and dependence on walking aids.

RESULT

In present study mean-age of acute stroke subjects was 60.5 ± 8.7 years, as determined by the results of SPSS version 23. Hypertension was present in acute stroke subjects in 76.5% cases and diabetes mellitus was present in 41.2%. Indicating a moderate level of motivation, the mean score for the Intrinsic Motivation Inventory was 4.8 ± 1.1. The mean score of the Modified Falls Efficacy Scale was 29.7 ± 8.2, suggesting a high level of fear of falling. The mean score for the Modified Kuppuswamy Scale was 2.7 ± 0.6, which suggests a middle-level socio-economic class. Brunnstrom grading for the upper extremities mean value was 4.2 ± 0.7, whereas the mean of lower extremities was 3.6 ± 0.8. Balance score by the use of Berg Balance Scale average was 43.3 ± 6.9. The Timed Up and Go test was completed in an average time of 20.2 ± 4.7 seconds. Acute stroke cases shown the mean score of 85.3 ± 12.4 on the Functional Independence Measure.

Table 1: Mean Values of all result analysis

Variable	Mean ± SD	Shapiro-Wilk Statistic (W)	p-value
Intrinsic Motivation (IMI)	4.8 ± 1.1	0.963	0.61
Fear of Fall (MFES)	29.7 ± 8.2	0.952	0.37
Socioeconomic Status (Kuppuswamy)	2.7 ± 0.6	0.929	0.13
Brunnstrom Grading - UL	4.2 ± 0.7	0.945	0.26
Brunnstrom Grading - LL	3.6 ± 0.8	0.938	0.21
Balance (BBS)	43.3 ± 6.9	0.968	0.7
Timed Up and Go (TUG)	20.2 ± 4.7	0.947	0.28

Functional Independence (FIM)	85.3 ± 2.4	0.956	0.45

The table presents demographic and clinical characteristics of the participants in the pilot study on walking aid prescription in stroke rehabilitation: Mean Age of acute stroke subjects was 60.5 years, indicating the study population largely consisted of older adults, a common demographic for stroke survivors. A high percentage of participants had hypertension (76.5%) and diabetes mellitus (41.2%), both of which are common stroke risk factors and may influence recovery and rehabilitation outcomes. The Intrinsic Motivation Inventory (IMI) had a mean score of 48, suggesting a moderate level of internal motivation among participants, which is important for engagement in rehabilitation. The Modified Falls Efficacy Scale (MFES) score was 29, reflecting moderate concern about falling, which can affect confidence and willingness to mobilize. The Modified Kuppuswamy Scale mean score of 2.7 indicates that the majority of participants likely belonged to a lower-middle socioeconomic status, which may influence access to care and resources. The Brunnstrom stages for upper and lower limbs were 4.2 and 3.6 respectively, suggesting moderate recovery of motor function post-stroke, with slightly better recovery in the upper limb. The Berg Balance Scale (BBS) mean score was 43.3, indicating participants had moderate balance impairment, placing them at a risk of falls. The Timed Up and Go (TUG) test mean time of 20.2 seconds reflects reduced mobility and potential need for assistive walking devices, as times over 13.5 seconds typically suggest increased fall risk. The Functional Independence Measure (FIM) score was 85.3, showing moderate functional independence, but with room for improvement in daily activities and mobility. (Table: 1)

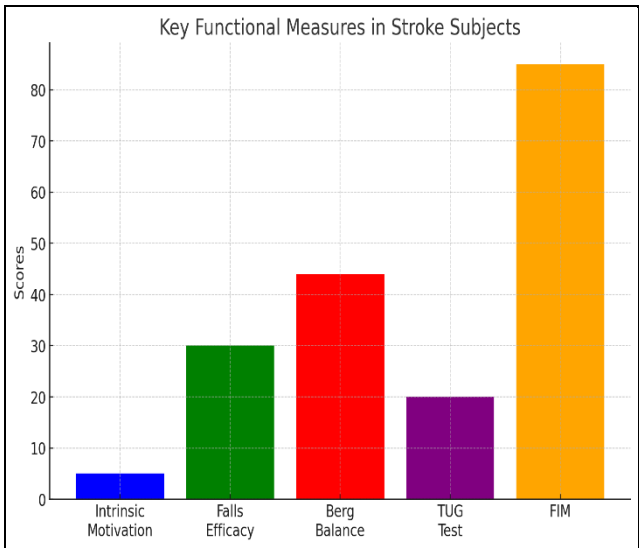

Figure 1: Graph representing various mean values of factors.

As per the table 1 the data following normality, so for result analysis parametric Pearson correlation test applied.

Table 2: Application of test for Normality for the analysis.

Variable	Pearson_r	p_value	Significance
Intrinsic Motivation (IMI)	-0.57	0.01	Significant
Fear of Fall (MFES)	0.635	0.004	Significant
Socioeconomic Status (Kuppuswamy)	0.61	0.006	Significant
Balance (BBS)	-0.43	0.07	Not Significant
Timed Up and Go (TUG)	0.445	0.06	Not Significant
Brunnstrom UL	-0.4	0.09	Not Significant
Brunnstrom LL	0.185	0.43	Not Significant
FIM	0.27	0.25	Not Significant

The correlation analysis (Figure: 2) reveals that **intrinsic motivation (r = -0.57, p = 0.01), fear of falling (r = 0.635, p = 0.004),** and **socioeconomic status (r = 0.61, p = 0.006)** are significantly associated with walking aid prescription, suggesting these factors play a meaningful role in determining the type or need for assistive devices in stroke rehabilitation. The negative correlation with motivation indicates that lower motivation is linked to greater reliance on walking aids, while higher fear of falling and lower socioeconomic status is positively associated with increased aid usage. Other variables such as balance (BBS), mobility (TUG), motor recovery (Brunnstrom stages), and functional independence (FIM) did not show statistically significant correlations ($p > 0.05$), indicating they may have a lesser or more complex relationship with walking aid prescription in this sample. (Table:2)

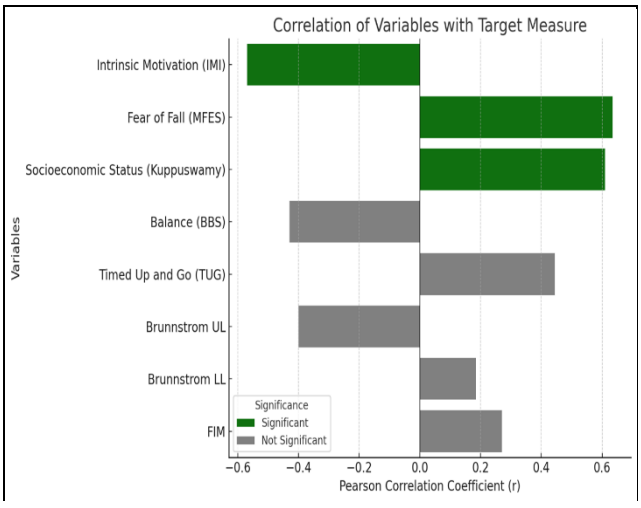

Figure 2: Graph representing correlation of various factors with walking aids.

DISCUSSION

Current research focused to analyze the different factors influencing the application of walking aids in the acute stroke patients by recruiting 20 participants from the various rehabilitation center in Rajkot, India. Analysis of factors showing that age, balance, fear of the falling, spasticity, proprioception, and patient's preference were significant factors affecting walking aid application, while the level of socioeconomic status found insignificant. These findings have important clinical implications, as identifying these factors assist clinicians to make decisions of prescriptions, thereby enhancing the overall functional outcomes and quality of life for stroke patients. [9-11]

When compared to previous studies, our findings align with and expand on existing literature. The identification of age, balance, affected side, motivation, and fear of falling as significant predictors is consistent with earlier research. For example, Tyson et al. (2007) emphasized that psychological factors, including fear of falling and motivation, are as crucial as physical impairments in walking recovery post-stroke, supporting our findings. Similarly, Barbeau and Visintin (2003) reported that balance deficits significantly influence the effectiveness of walking aids, which aligns with our observation of balance being a key determinant in walking aid prescription. [12] Moreover, Lamontagne et al. (2001) demonstrated that proprioception deficits negatively affect gait stability, making it a critical factor in the appropriate selection of walking aids, consistent with our results. [13]

The present study adds to the knowledge in existing literature by uniquely incorporating economic level as a factor in walking aid application to stroke cases for that Modified Kuppuswamy Scale used in India, this is, to author's knowledge. However, current analysis revealed that socioeconomic status did not significantly influence walking aid selection, suggesting that clinical and functional factors outweigh economic considerations in such prescriptions. This finding is particularly valuable, as it challenges the assumption that socioeconomic status plays a major role in determining access to assistive devices in stroke rehabilitation settings.

Additionally, our study highlights the significance of spasticity and proprioception, further validating their influence on walking aid prescriptions. Earlier research by Bohannon et al. (1987) and Hsiao-Wecksler et al. (2008) showed that issues with spasticity and proprioception lead to problems with walking and balance, which are key factors in deciding if someone needs walking aids. The results of this study confirm these observations, reinforcing the necessity of considering both physical and neurological factors during clinical assessments. [14,15]

Overall, this study emphasizes the necessity of a comprehensive, multidimensional assessment in walking aid prescription for stroke subjects, incorporating physical, psychological, and even patient-preference factors. By demonstrating the influence of subject preference and psychological factors, our study promotes a more patient-centered approach to rehabilitation. Furthermore, the inclusion of economic status, despite its insignificance in our findings, opens avenues for future research to explore its potential impact in larger, more diverse populations. Future researches with large sample, stratified sampling, and progressive follow-ups are required to further validate and generalize these findings. Additionally, investigating the effectiveness of personalized, patient-centered walking aid prescription approaches could enhance rehabilitation outcomes and optimize patient satisfaction.

CONCLUSION

The pilot study provides preliminary evidence for the feasibility of the predictive model for application of walking aids in stroke subjects. The study highlights the importance of considering multiple factors such as age, balance, dominant and affected side, comorbidities, motivation, fear of falling, economic status, spasticity, proprioception, visual limitation, ability to walk, ADL, and subject preference for prescribing appropriate walking aids. The development of such a model has the potential to improve clinical decision-making and enhance functional outcomes for stroke survivors.

Clinical implication

Walking aids are extensively utilized in stroke rehabilitation, although their prescription based on patient-specific criteria is not well supported by any evidence-based approach. Many times, present methods ignore psychological elements like motivation and fear of fall, which greatly affect gait performance and independence. This research seeks to close this gap by creating a prediction model that takes psychological and physical elements into account, therefore guiding doctors in their choices. This work aims to improve the accuracy and efficacy of walking assistance prescriptions in acute stroke rehabilitation by means of important factors like proprioception, motivation, and fear of fall.

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Authors contribution

The authors were equally responsible for the conceptualization, design, and execution of the study. They carried out participant recruitment, data collection, and statistical analysis. The author also interpreted the results, reviewed relevant literature, and drafted the manuscript. Additionally, they were involved in revising and finalizing the manuscript for submission.

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