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Research Article

Environmental barriers and social participation in individuals with chronic stroke: a cross-sectional analysis

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Abstract

Introduction: Stroke is a major cause of long-term disability, often limiting individuals' participation in social, occupational, and community life due to both functional impairments and environmental barriers. Understanding the interaction between these factors is crucial for optimizing rehabilitation outcomes.

Aim: This study aimed to assess functional independence, quality of life, social participation, and environmental barriers in individuals with chronic stroke and to compare outcomes based on stroke duration (<5 years vs. >5 years).

Material and methods: A total of 50 chronic stroke patients followed in a neurorehabilitation outpatient clinic were included. Sociodemographic and stroke-related data were collected. Functional Independence Measure (FIM), Short Form-12 (SF-12), Frenchay Activities Index (FAI), and Craig Hospital Inventory of Environmental Factors - Short Form (CHIEF-SF) were applied. Additionally, the patients were grouped by stroke duration to compare long-term outcomes.

Results: The mean age of participants was 58.12±12.41 years. Mean FIM motor and cognitive scores were 58.12±24.24 and 31.12±7.45, respectively, with a total FIM score of 88.64±28.49. SF-12 physical and mental scores were 37.78±8.92 and 47.32±12.80. FAI and CHIEF-SF mean scores were 12.92±11.16 and 13.90±17.16, respectively. FIM motor score was significantly associated with age, employment, income, stroke duration, and affected side ($p<0.05$). FIM cognitive scores correlated with income ($p<0.05$); total FIM score was associated with sex, employment, and income ($p<0.05$). SF-12 physical scores were significantly related to employment ($p<0.05$). FAI was associated with age, sex, income, and stroke duration ($p<0.05$), while CHIEF-SF scores correlated with education, employment, and stroke duration ($p<0.05$). Patients with >5 years poststroke had significantly better FIM motor, cognitive, and total scores ($p<0.001$, $p=0.031$, $p=0.001$), and higher SF-12 physical scores ($p=0.051$).

Conclusion: Stroke duration and socioeconomic context significantly influence participation and independence. Long-term survivors appear to develop adaptive strategies that mitigate environmental barriers. Integrative rehabilitation approaches that address both physical function and contextual challenges are crucial for improving long-term participation and autonomy in stroke survivors.

Keywords

chronic stroke, environmental barriers, participation, quality of life, stroke

Introduction

Stroke remains a leading cause of long-term disability worldwide, profoundly impacting individuals' physical, cognitive, and psychosocial functioning. Beyond the immediate neurological impairments, stroke survivors often face challenges in resuming their roles within family, work, and community settings.[1] The World Health Organization's International Classification of Functioning, Disability and Health (ICF) emphasizes the importance of participation—defined as involvement in life situations—as a critical component of health and well-being. However, many stroke survivors experience restrictions in participation, which can persist for years after the initial event.

Environmental factors play a pivotal role in facilitating or hindering participation among individuals with disabilities, including those recovering from stroke. Physical barriers such as inaccessible buildings, lack of transportation, and uneven terrain can limit mobility and engagement in community activities.[1,2] Social and attitudinal barriers, including stigma and lack of support, further exacerbate these challenges. A systematic review by Ezekiel et al.[3] highlighted that environmental factors, alongside personal and health-related factors, significantly influence participation outcomes poststroke.

Recent interventions have aimed to address these barriers to enhance community reintegration. For instance, the Community Participation Transition After Stroke (COMPASS) program, as studied by Bollinger et al.[4], implemented home modifications and strategy training to support stroke survivors transitioning from inpatient rehabilitation to home settings. While the program showed promise in reducing environmental barriers, the impact on community participation levels was modest, indicating the complexity of factors influencing reintegration.

Longitudinal studies have also shed light on the predictors of sustained participation. A study by Jonsson et al.[5] found that factors such as the ability to drive, walk certain distances, and having a robust social network were associated with higher levels of social and leisure activities a decade poststroke. These findings underscore the importance of both personal capabilities and environmental supports in long-term recovery.

Despite these insights, there remains a need for comprehensive assessments that consider the interplay between functional independence, quality of life, social participation, and environmental barriers, especially in diverse populations. Understanding these relationships can inform targeted interventions and policies to support stroke survivors in achieving meaningful community engagement.

Aim

This study aims to evaluate the levels of functional independence, quality of life, social participation, and perceived environmental barriers among individuals with chronic stroke. Additionally, it seeks to explore the associations between these factors and examine differences based on the duration since stroke onset. By integrating these dimensions, the research endeavors to provide a holistic understanding of the challenges and facilitators of participation in the post-stroke population.

Materials and methods

This cross-sectional study was conducted in a university hospital's outpatient neurological rehabilitation clinic and included 50 individuals who had experienced a stroke at least one year prior. Inclusion criteria were: (i) confirmed ischemic or hemorrhagic stroke via MRI or CT, (ii) at least 1 year poststroke, (iii) hemiplegia following first-ever stroke, and (iv) normal cognitive function assessed by MMSE (score >24). Exclusion criteria included: (i) severe comorbid diseases (e.g., advanced heart disease, Parkinson's), (ii) peripheral nerve injury, (iii) aphasia or communication disorder, (iv) movement disorders (ataxia, dystonia), and (v) unclear CVA history.

Data collected included age, sex, body mass index (BMI), education, marital and employment status, monthly income, stroke type (ischemic/hemorrhagic), stroke side, duration since stroke, recurrent stroke history, number of annual rehabilitation sessions, presence of spasticity, use of walking aids, fear of falling, comorbidities, and medication use. A thorough physical, neurological, and musculoskeletal examination was performed.

The study protocol was approved by the Institutional Ethics Committee. The patients were informed about the study and signed a written consent form before enrollment in the study.

The following validated tools were used for assessment:

- Functional Independence Measure (FIM): Evaluates 18 items (13 motor, 5 cognitive), scored 1-7 per item, yielding a total score between 18 and 126. Higher scores indicate better functional independence. The Turkish validity and reliability study of the scale was conducted by Kuqukdeveci et al.[6]

- Short Form-12 Health Survey (SF-12): Comprising physical (PCS) and mental (MCS) component summaries, it captures overall health-related quality of life.[7]

- Frenchay Activities Index (FAI): Assesses 15 higher-level activities (household, leisure, outdoor), with scores indicating frequency of participation. It covers activities that require greater independence and social participation. Scores range from 0 to 45.[8]

- Craig Hospital Inventory of Environmental Factors - Short Form (CHIEF-SF):

Measures frequency and impact of environmental barriers across 5 domains (policies, physical/structural, services, support, attitudes). Total scores range from 0-8 per item, with higher scores indicating more frequent and severe barriers.[9] The Turkish version of this scale has been validated for reliability.[10]

Participants were stratified into subgroups by stroke duration (<5 years and >5 years) to explore long-term differences.

Statistical analysis

All statistical analyses were conducted using IBM SPSS Statistics version 25.0. Descriptive statistics (mean, standard deviation, median, frequency, ratio, minimum, maximum) were used to summarize the study data.

Pearson's chi-squared test and Fisher-Freeman-Halton test were used to compare qualitative data. The relationships among parameters were analyzed using Pearson correlation analysis and Spearman's correlation analysis. The significance was set at $p<0.05$ levels.

The post-hoc power analysis for a correlation effect size of 0.40 with a sample size of 50 and a significance level of $\alpha=0.05$ yielded an achieved power of approximately 51.6%, indicating limited statistical sensitivity to detect moderate associations.

Results

The mean age of participants was 58.12±12.41 years. The cohort included 62% males and 38% females. Most participants were unemployed (90%), and 81.8% had a monthly income above minimum wage. Stroke types included ischemic (68%) and hemorrhagic (32%). The average stroke duration was 6.4±3.7 years, with 22% being more than 10 years poststroke **(Table 1)**.

Table 1. Sociodemographic and clinical characteristics of participants

	Min-Max	Mean±SD
Age (year)	24-84	58.12±12.41
	n	%
Sex		
Female	19	38.0
Male	31	62.0
Education		
Illiterate	7	14.0
Primary school	20	40.0
High school	13	26.0
University	10	20.0
Marital status		
Married	38	76.0
Single	12	24.0
Employment status		
Employed	5	10.0
Unemployed	45	90.0
Monthly income		
Below minimum wage	8	18.2
Above minimum wage	36	81.8
Type of stroke		
Ischemic	34	68.0
Hemorrhagic	16	32.0
Duration of stroke		
0-3 years	7	14.0
3-5 years	13	26.0
5-10 years	19	38.0
>10 years	11	22.0

Recurrent stroke	4	8.0
Continuity to rehabilitation	30	60.0
Number of annual rehabilitation sessions		
60 sessions	14	46.6
90 sessions	16	53.3
Spasticity	44	88.0
Walking aid	26	52.0

Functional Independence Measure (FIM) motor and cognitive scores were 58.12±24.24 and 31.12±7.45, respectively. The total FIM score was 88.64±28.49. The SF-12 physical component score was 37.78±8.92, and the mental component score was 47.32±12.80.

FAI and CHIEF-SF mean scores were 12.92±11.16 and 13.90±17.16, respectively **(Table 2)**.

In subgroup analysis, individuals >5 years poststroke had significantly better FIM motor, cognitive, and total scores ($p<0.001$, $p=0.031$, $p=0.001$, respectively), and higher SF-12 physical scores ($p=0.051$) compared to those <5 years poststroke. FAI scores were higher, and CHIEF-SF scores were lower in the long-term group, indicating better participation and fewer perceived barriers **(Table 3)**. Comparison of outcomes based on stroke duration is shown in **Fig. 1**.

Significant correlations were found between FIM motor score and age, income, stroke duration, and side ($p<0.05$). FIM total score correlated with employment status, sex, and income. FAI showed positive associations with age, stroke duration, income, and male sex. CHIEF-SF scores were higher (worse) among those with lower education, unemployment, and shorter stroke duration **(Table 4)**.

Discussion

This study confirms that stroke duration plays a critical role in shaping functional independence, participation, and perception of environmental barriers. Individuals with longer post-stroke durations demonstrated significantly higher independence and physical quality of life. Our

Table 2. Evaluation of functional independence, quality of life, social participation, and environmental barriers

	Min-Max	Mean±SD
FIM (motor)	13-91	58.12±24.24
FIM(cognitive)	6-35	31.12±7.45
FIM (total)	19-126	88.64±28.49
SF-12 PCS	22.05-55.91	37.78±8.92
SF-12 MCS	25.87-65.45	47.32±12.80
Frenchay Activities Index	0-42	12.92±11.16
Craig Hospital Inventory of Environmental Factors - Short Form	0-80	13.90±17.16

FIM: functional independence measure; SF-12: short form-12

Table 3. Comparison of outcomes based on stroke duration (<5 years vs. >5 years)

	<5 years Med (IQR)	>5 years Med (IQR)	*p*
FIM (motor)	32 (22)	67 (35)	0.000*
FIM (cognitive)	35 (7)	35 (3)	0.642
FIM (total)	65 (19)	100 (48)	0.003*
SF-12 PCS	30 (17.23)	40.10 (13.50)	0.010*
SF-12 MCS	33.35 (31.08)	51.89 (21.32)	0.174
Frenchay Activities Index	2 (3)	14 (16)	0.007*
Craig Hospital Inventory of Environmental Factors - Short Form	34 (29)	5 (14)	0.000*

*$p<0.05$, FIM: functional independence measure; SF-12: short form-12

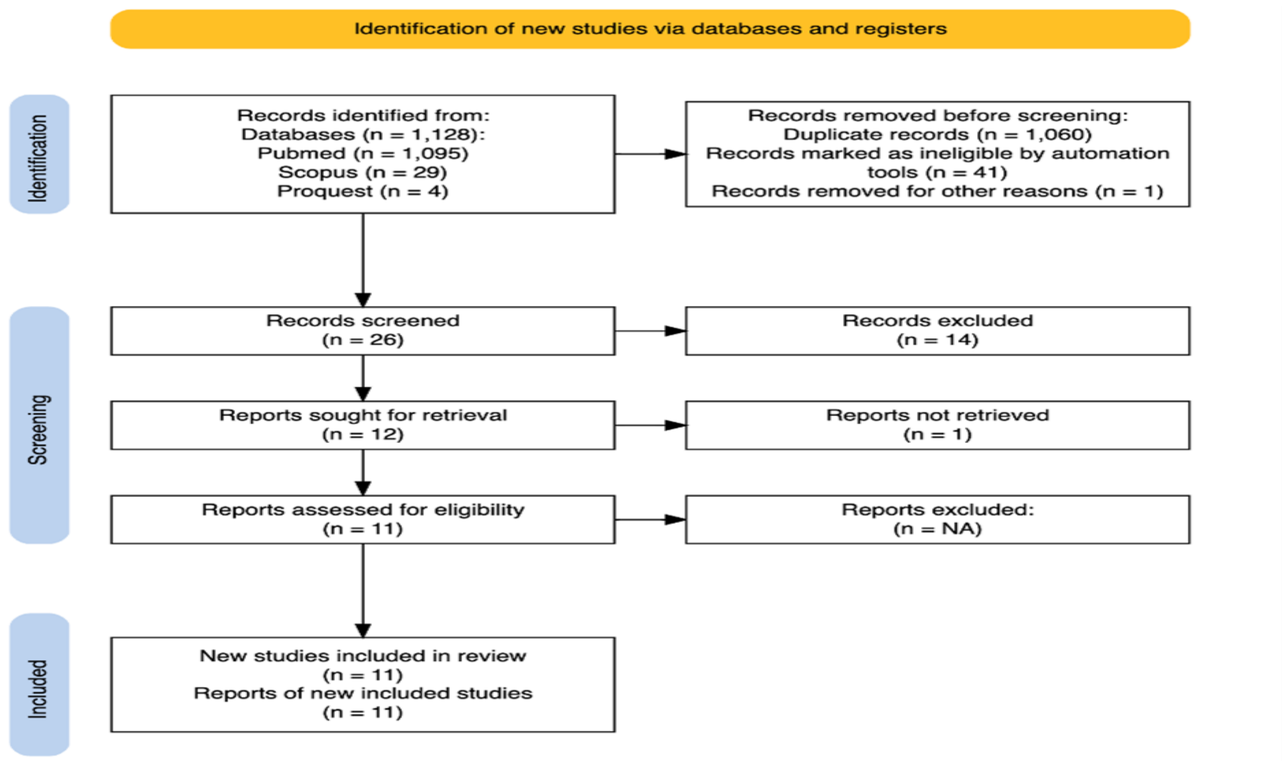

Figure 1. Comparison of outcomes based on stroke duration.

Table 4. Correlation between functional independence, participation, environmental barriers, and clinical parameters

	FIM	FIM	FIM	SF-12 PCS	SF- 12 MCS	Frenchay Activities Index	CHIEF-SF
Age	−0.331*	−0.055	−0.151	−0.029	−0.038	−0.425**	−0.072
Sex	−0.170	0.058	−0.309*	0.070	−0.210	−0.356*	−0.153
Marital status	0.039	0.134	0.050	0.96	−0.47	−0.112	−0.153
Education	0.083	0.100	0.093	0.112	0.036	0.126	−0.328*
Employment status	0.308*	0.143	0.326*	0.284*	0.224	0.195	−0.333*
Monthly income	0.351*	0.318*	0.377*	0.108	0.188	0.325*	0.133
Type of stroke	0.006	−0.076	−0.070	−0.270	0.101	−0.009	−0.064
Duration of stroke	0.305*	0.163	0.243	0.180	0.102	0.286*	−0.384**
Stroke side	−0.314*	0.132	−0.261	−0.088	−0.177	−0.225	−0.116
Recurrent stroke	−0.038	−0.140	0.008	−0.110	−0.013	−0.113	−0.118
Comorbidities	0.188	0.107	0.192	0.136	−0.060	−0.98	−0.182
Continuity to rehabilitation	−0.065	0.012	0.003	0.065	−0.081	0.052	−0.033

*$p<0.05$, **$p<0.001$, FIM: functional independence measure; SF-12: short form-12; PCS: physical component score, MCS: mental component score, CHIEF-SF: Craig Hospital Inventory of Environmental Factors - Short Form

findings align with those of Jonsson et al.[11], who reported sustained independence in long-term stroke survivors in Sweden, and Crichton et al.[12], who found minimal quality of life deterioration over 15 years poststroke.

Environmental barriers remain significant, particularly among those who are unemployed or less educated. These results support the hypothesis that physical surroundings, policy frameworks, and societal attitudes are modifiable determinants of community reintegration. The relationship between FIM and participation is consistent with Silva et al.[13], who emphasized functional independence as a key predictor of social involvement.

This study highlights the long-term impact of stroke on functional independence, participation, and environmental challenges, confirming the multifaceted nature of post-stroke recovery. Our findings support the growing consensus that stroke outcomes are influenced not only by physical and cognitive impairments but also by personal, social, and environmental contexts.

Palstam et al.[14] further strengthen this notion by reporting that participation restrictions remain common five years after stroke, especially in domains requiring physical mobility and cognitive engagement. Severe stroke, depression, older age, and female sex were found to be independent predictors of lower participation, echoing our findings linking shorter stroke duration and unemployment to poorer outcomes.

Toglia et al.[15] showed that both younger and older stroke survivors experience participation limitations, but the subjective desire to increase involvement in specific activities—like work, parenting, or social life—differs by age group. In our cohort, this is paralleled by the observation that participants with shorter stroke duration (<5 years) perceived higher environmental barriers and lower participation. These findings highlight the importance of tailoring rehabilitation strategies to life roles and age-specific priorities, especially for younger survivors.

Overall, these findings converge on the idea that rehabilitation must go beyond motor recovery and consider the long-term lived experiences of stroke survivors. Targeted efforts to reduce environmental barriers, promote emotional well-being, and support meaningful role re-engagement can improve autonomy, social participation, and quality of life. Personalized and context-sensitive approaches, including community-based and home-modification programs like COMPASS[4], may offer scalable solutions to improve outcomes. While the program did not yield a statistically significant difference in community participation over 12 months compared to control, this was potentially influenced by external factors like the COVID-19 pandemic. In our cohort, environmental barriers were likewise a significant determinant of participation, especially in those with lower education, lower income, and shorter time since stroke. These shared findings suggest that although environmental adaptations may not immediately change broad participation scores, they do enhance functional engagement and satisfaction—two critical components of long-term stroke rehabilitation.

A systematic review by Ezekiel et al.[3] reinforces this perspective, highlighting that cognitive impairment, depression, fatigue, and environmental challenges are consistently associated with poorer participation outcomes. Importantly, many included studies failed to operationalize environmental factors robustly, which aligns with the need for refined and validated instruments to quantify environmental barriers. Our use of the CHIEF-SF and its correlation with duration of stroke further emphasizes the critical role of the environment in determining life quality and community involvement poststroke.

Long-term survivorship and adaptation were illustrated in the landmark study by Jonsson et al.[11], where a substantial proportion of survivors at 10 years poststroke reported good functional independence and health status, despite advanced age and some degree of disability. Similar to our findings, those with longer post-stroke duration in our sample showed higher independence, better quality of life, and fewer reported environmental barriers. This reinforces the hypothesis that time allows for behavioral and environmental adjustment, social reintegration, and perhaps even redefinition of one's sense of well¬being despite disability.

Taken together, these studies, including ours, suggest that addressing environmental barriers and fostering adaptive strategies are central to improving long-term outcomes in stroke survivors. Rehabilitation strategies should prioritize individualized, context-aware interventions that not only restore function but also promote autonomy and participation within real-life environments.

A limitation of this study is the relatively low statistical power (51.6%) to detect moderate correlations ($r=0.40$), which may limit the ability to identify significant associations among variables and the exclusion of individuals with severe communication or cognitive impairments. Future studies should address these gaps and investigate longitudinal changes and intervention effects targeting environmental facilitation.

Conclusion

This study highlights the complex interplay between functional ability, social participation, and environmental factors in individuals with chronic stroke. Stroke duration emerged as a critical determinant, with long-term survivors exhibiting better functional independence, higher physical quality of life, and fewer perceived environmental barriers. Socioeconomic variables such as employment, education, and income also significantly influenced participation levels and access to rehabilitation. These findings underscore the importance of not only early rehabilitation efforts but also sustained, individualized, and context-aware interventions that target long-term community reintegration. Addressing environmental challenges—such as accessibility, social support, and policy-related barriers—alongside physical and cognitive rehabilitation, may substantially improve quality of life and social autonomy in stroke survivors.

Ethical approval

The authors declared that all procedures performed in studies involving human participants were in accordance with the ethical standards of the Institutional and National Research Committee and with the 1964 Helsinki declaration and its later amendments or comparable ethical standards. Approval was granted by the Ethics Committee of Istanbul Medeniyet University (2022/0601).

Ethical statements

The authors declared that no clinical trials were used in the present study.

The authors declared that no experiments on humans or human tissues were performed for the present study.

The authors declared that they obtained written informed consent from the patients who were informed about the study prior to including them into the study.

The authors declared that no experiments on animals were performed for the present study.

The authors declared that no commercially available immortalized human and animal cell lines were used in the present study.

Conflict of interest

The authors have declared that no competing interests exist.

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Use of AI

No use of AI was reported.

Data availability

The data that support the findings of this study are available on request from the corresponding author.

Author contributions

BDK and AI designed the experiments; BDK, IAA, SNB, IHA, BCS, and GK did the data collection, BDK and AI analyzed the data and prepared the manuscript. All authors approved the final manuscript.

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