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Environmental barriers to leisure participation in community-dwelling individuals living with stroke

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Short title: Environmental barriers to leisure participation after stroke

Objective: To characterize environmental barriers to leisure participation among individuals living with stroke; examine relationships between environmental barriers and leisure interest and satisfaction; and investigate participant factors associated with the perception of environmental barriers.

Design: Survey.

Setting: Community.

Participants: Convenience sample of 51 community-dwelling adults less than six months post stroke.

Interventions: Not applicable.

Main outcome measure(s): Craig Hospital Inventory of Environmental Factors-Short Form.

Results: Physical and structural environmental barriers were reported as the most frequent and large barrier to leisure participation (n = 26 (51%) rated as "monthly or more," n = 12 (24%) rated as "big problem"). While attitude and support and policy barriers were not as commonly encountered, participants labeled these as "big problem(s)" (attitude and support n = 6 (12%), policy n = 7 (14%)). The presence of depressive symptoms was associated with the frequency in which attitudinal and support (rho = 0.50, P < 0.001), physical and structural (rho = 0.46, P < 0.001), and service and assistance (rho = 0.28, P = 0.04) barriers were reported, as well as magnitude of attitude and support barriers (rho = 0.48, P < 0.001). In multivariable regression analysis, depressive symptoms and walking capacity explained 21% of the variance of the frequency of attitude and support barriers (P = 0.004), where depressive symptoms was an independent correlate (P = 0.004). No other factors were associated with environmental barriers to leisure participation.

Conclusion: Individuals with stroke report frequent and large physical and structural environmental barriers to leisure participation, which may be associated with the presence of depressive symptoms.

Keywords: Stroke; depression; environment; leisure activities.

Stroke is the leading cause of adult neurological disability, resulting in long-term disability and decline in quality of life.[1] Resuming participation in leisure activities after stroke is an important strategy for successful community integration. Leisure pursuits can be described as an intrinsically motivated activity that a person does during free time;[2] and includes a wide and varied range of active, passive, and social activities that provide value and enjoyment.[3, 4]

In the general population, leisure participation can contribute to improved quality of life,[5] help develop self-expression and self-determination,[6] provide relief from stress,[7] and promote and strengthen social relationships.[6, 8] Participation in leisure-time physical activities can also provide positive health benefits, such lowered risk for obesity,[9] hypertension,[10] and all-cause mortality.[11, 12]. Engagement in leisure activity is low in people with stroke,[13, 14] which may be influenced by a multitude of factors. In addition to personal and stroke-related factors (including physical function, cognitive or communication impairment, or emotional changes[15]), environmental factors such as accessibility, social support, and institutional and governmental policies, may also present as barriers to leisure participation.[16, 17] Identifying environmental barriers to leisure participation after stroke is an important research goal in rehabilitation,[18] such that strategies may be implemented to reduce their impact and lead to enduring changes with greater societal impact, including increased social opportunities, community access, and societal enfranchisement and empowerment.[19] Historically, interventions aimed at increasing leisure participation in the elderly population and

individuals living with chronic conditions have focused on reducing impairments and activity limitations, with little emphasis given to the environment.[20, 21] Moreover, the full breadth of factors related to environmental barriers is often overlooked, with research being limited to the consideration of architectural barriers in the individual's home rather than social, institutional, and policy factors that might determine how a person carries out their daily activities.[20]

This study aimed to: 1) Characterize environmental barriers to leisure participation among individuals living with stroke, 2) Examine the relationships between environmental barriers and leisure interest and satisfaction, and 3) Investigate factors (physical, cognitive, emotional, community reintegration) associated with the perception of environmental barriers.

Methods

This study was an analysis of data from a larger observational study investigating factors associated with leisure participation following stroke. The larger study was approved by the local institutional research ethics board, and informed written consent was obtained from all participants.

Participants

Participants were eligible to participate if they were 18 years or older, >6 months post-stroke, living in the community, completed formal rehabilitation, free from other neurological conditions (e.g. Parkinson's Disease), significant unstable co-morbidities (e.g. unclipped aneurysms, uncontrolled seizures), and cognitive, communication or behavioral issues that may affect the ability to understand study instructions. Potential participants were recruited from local communities, through stroke recovery groups, community flyers, and from a database of former research participants who consented to be contacted for future studies.

Assessments

Participant characteristics were recorded, including age, sex, gait aids used, and where available, details of stroke (time post-stroke, type, location).

Environmental barriers to leisure participation

Craig Hospital inventory of Environmental Factors Short Form (CHIEF-SF). Environmental barriers to leisure participation were measured using the CHIEF-SF (Appendix), a 12-item, self-rated questionnaire that examines environmental barriers within five domains: (i) Attitude and Support (encouragement and help in the home and community, or discrimination or prejudice), (ii) Physical and Structural factors (infrastructure design, natural environment, or other aspects of surroundings (lighting, noise, crowds)), (iii) Policy (access to health care, governmental programs, businesses,

organizations, social services), (iv) Services and Assistance (transportation, information, and education), and (v) Work and School (encouragement and help in workplace and educational settings, or discrimination or prejudice).[22] The CHIEF has been used extensively in individuals across many age ranges, and those living with traumatic brain injury, spinal cord injury, stroke, and other disabilities.[21-26] Participants rate the Frequency that they experience each domain (5-point scale of 0 “Never” or “Not Applicable”, 1 “Yearly”, 2 “Monthly”, 3 “Weekly”, or 4 “Daily”, or Not Applicable), and Magnitude of the problem the barrier poses (2-point scale where 0 “Not a problem” or “Not Applicable”, 1 “Little Problem,” 2 “Big Problem”). The original and short forms have demonstrated high test-retest, subject-proxy and internal consistency reliability, and content, construct, and discriminant validity in both the general population and among people with disabilities.[22]

Leisure interest and leisure satisfaction

Leisure Interest Measure (LIM) and Leisure Satisfaction Measure (LSM). The LIM and LSM were used to assess interest and satisfaction in leisure participation, respectively. The LIM assesses intensity and breadth of leisure interest in eight activity domains of physical, outdoor, mechanical, artistic, service, social, cultural, and reading.[27] The LSM measures satisfaction in leisure activities in psychological, educational, social, relaxation, physiological, and aesthetic domains.[28] Higher scores indicated greater interest in the LIM (maximum score 40) or satisfaction in the LSM (maximum score 30)

for leisure participation. Should we include how it is scored? And how the score is calculated? Only because it is one of the main measures along with environment

Factors associated with environmental barriers to leisure participation

To examine potential correlates with environmental barriers to leisure participation, we also assessed physical (motor impairment, walking and balance ability, upper limb function), cognitive, and emotional factors, as well as community integration.

A number of measures were used to quantify physical factors. The *Chedoke-McMaster Stroke Assessment (CMSA)* was used to assess motor impairment of the affected-side arm, hand, leg and foot on a 7-point scale, where 1 = no voluntary movement, 7 = full movement with normal speed and coordination.[29] Walking and balance ability were assessed with self-paced walking speed (*5-Meter Walk Test*, in m/s), *6-Minute Walk Test (6MWT)*[30] distance (in m), and the *Mini-Balance Evaluation Systems Test (Mini-BESTest)*[31] (maximum score 28, where higher scores indicate better balance). The *Chedoke Arm and Hand Activity Inventory (CAHAI-7)* quantified upper limb function (maximum score 49, higher scores indicate better function).[32]

Cognition was evaluated using the *Montreal Cognitive Assessment (MoCA)*,[33] a rapid screening instrument that assesses domains of attention and concentration, executive functions, memory, language, visuoconstructional skills, conceptual thinking, calculations, and orientation (maximum score 30, where higher scores represent better

function, and scores >25 indicative of mild cognitive impairment).[34]. Emotional factors was assessed using the *Centre for Epidemiological Studies Depression Scale (CESD-10)*, a 10-item test with a maximum score of 30, and where a score >11 is indicative of mild to significant depressive symptomatology.[35] Finally, the *Reintegration to Normal Living Index (RNL)* was used to assess the reintegration to normal activities (maximum score 22, with higher scores indicating better reintegration).

Analyses

Descriptive statistics (mean and standard deviation for continuous variables, frequency counts for non-continuous variables) were performed.

To characterize environmental barriers to leisure participation experienced by individuals with stroke (Objective 1), the numbers of participants reporting the frequency and magnitude of each barrier domain from CHIEF-SF were summarized, and chi-square analyses were performed to compare counts between domains and levels. For chi-square analyses, the frequency scores for “Monthly”, “Weekly” and “Daily” (i.e. scores of 2 or greater) were collapsed and assigned a score of 2 to represent “Monthly or more”.

To examine the relationship between environmental barriers and leisure interest and satisfaction (Objective 2), Spearman correlation analyses were first performed between CHIEF-SF frequency and magnitude scores and LIM and LSM scores. Then, variables with

significance level $P<0.10$ were entered into regression analyses to explore the environmental barrier domains (independent variables) associated with both leisure interest and leisure satisfaction (dependent variables). Multi-collinearity was examined using tolerance and variance inflation factors.

For Objective 3, bivariate correlation analyses were performed between CHIEF-SF frequency and magnitude scores of each domain, and candidate variables related to physical impairment and function (CMSA impairment, CAHAI, self-paced gait speed, 6MWT distance, Mini-BESTest), cognitive (MoCA) and emotional (CESD-10) factors, and community reintegration (RNL). These variables were selected from previous literature suggesting their relationship with perceived environmental barriers and leisure participation.[4, 19, 20, 36, 37] Variables with significance level $P<0.10$ were entered into regression analyses to explore these clinical variables (independent variables) and their associations with environmental barrier domains (dependent variables). Multi-collinearity was examined using tolerance and variance inflation factors.

Statistical Package for the Social Sciences (Version 23, Chicago IL) was used for all analyses.

RESULTS

Characteristics for the 52 participants enrolled in this study are presented in Table 1. In general, our sample represented a relatively high functioning cohort with walking speeds of 74.9±27.5% of age-matched non-stroke individuals[38] and the majority of the participants (n=32 (62%)) had Mini-BESTest scores exceeding the 17.5 threshold value that identifies those with a history of falling.[39] Many participants in this sample presented without cognitive impairment (n=28 (54%) with MoCA score ≥25[34]) or depressive symptoms (n=33 (64%) with CESD-10 scores <11[35]).

The Figure displays the distributions for Frequency (Figure, panel A) and Magnitude (Figure, panel B) of each barrier domain for the CHIEF-SF. The distributions differed across domains (Frequency and Magnitude chi-square $P<0.001$). Physical and Structural barriers were most commonly reported, with half of participants (n=26, 50%) reporting it a problem that occurred "Monthly or more", and 12 participants (23%) reporting it a "Big Problem". Attitude and Support (n=14, 27%), and Policy (n=11, 21%) barriers were not as commonly encountered "Monthly or more", but were reported to be "Big Problem(s)" (Attitude and Support n=6 (12%), Policy n=7 (13%)). While nearly one-third of participants (n=16, 31%) reported encountering barriers related to Services and Assistance "Monthly or more", they were not commonly reported to be "Big Problems" (n=3, 6%). Most participants (n=44, 85%) reported having "Never" encountered barriers related to Work and School.

Bivariate correlation analyses revealed that the Frequency of Policy (*rho*=0.25; *P*=0.08), Services and Assistance (*rho*=0.28; *P*=0.05), and Work and School (*rho*=0.23; *P*=0.10) barriers were associated with LIM, but when entered into multivariable regression analysis, the model was not significant (R^2 0.10, *P*=0.16) (Table 2). There were no associations between any environmental barrier domain and LSM (*P*=0.29-0.99) in the correlation analyses.

To examine factors associated with environmental barriers, bivariate correlation analyses found CESD-10 and RNL were associated with the Frequency of Attitude and Support (CESD-10 *rho*=0.50, *P*<0.001; RNL *rho*=-0.33, *P*=0.02), Physical and Structural (CESD-10 *rho*=0.46, *P*<0.001; RNL *rho*=-0.27, *P*=0.06) and Services and Assistance barriers (CESD-10 *rho*=0.28, *P*=0.04; RNL *rho*=-0.285, *P*=0.04). CESD-10 and RNL were also associated with the Magnitude of barriers related to Attitude and Support (CESD-10 *rho*=0.48, *P*<0.001; RNL *rho*=-0.35, *P*=0.01). None of the other potential variables were associated with any other environmental barrier.

CESD-10 and RNL explained 18-24% of the variance of the frequency of barriers related to Attitude and Support (Table 3A), Physical and Structural (Table 3B), and Services and Assistance (Table 3C). These variables also explained 22% of the variance of the magnitude of barriers related to Attitude and Support (Table 3D).

DISCUSSION

This was the first study to characterize environmental barriers related to leisure participation after stroke. Physical and structural environmental factors were most commonly identified as barriers to leisure participation. Furthermore, factors related to community integration and emotional status, rather than physical or cognitive function, were associated with environmental barriers.

Physical and structural barriers were most commonly reported as frequent and major barriers to leisure participation after stroke. These issues may be related to the natural (temperature, terrain, climate; lighting, noise crowds) or the built environment (unadjustable furniture, steep stairs, or other physically inaccessible infrastructures), which may limit participation in leisure activities in individuals with disabilities.[19] Similar findings have been reported in individuals with traumatic brain injuries,[40], but also in stroke in other geographic locations such as Hong Kong,[25] Korea,[24], and rural China.[41] Arguably, individuals living with stroke may be more aware of physical and structural barriers due to functional limitations imposed by neurological impairments, or that physical barriers are more concrete when compared to more abstract barriers related to attitude, service, and policy and hence more easily conceptualized and identified by study participants. Nonetheless, these findings underscore the importance of addressing physical and structural barriers to participation after stroke in order to facilitate enhanced engagement.

Attitude and Support, Services and Assistance, and Policy-related barriers were less frequently problematic than physical and structural barriers, and is mostly consistent with previous research using the CHIEF to examine environmental factors.[25, 41] One exception was a study conducted in Seoul, Korea that included older adults with (n=100) and without stroke (n=300) that reported barriers related to services and assistance, specifically access to transportation, to be especially problematic.[24] The authors speculate that such discrepancies highlight the potential influence of cultural and social differences between research settings on environmental barriers,[24] an important factor for consideration with respect to the applicability of research findings to different communities and settings.

Not surprisingly, Work and School barriers were rarely identified in this cohort, given that the majority of our participants have graduated school and retired from work. Previous studies that applied the CHIEF on the stroke population reported similar findings[40, 41] and some authors have completely removed the Work and School from the analysis or have replaced its questions with those of more relevant domains due to low response rates. [40, 41] While this domain may be least problematic in studies involving individuals with stroke, these results may not be generalizable to younger stroke survivors who may still be employed or enrolled in school. Research into younger cohorts of stroke survivors has been limited due to their low representation within the general stroke[1, 42], but represents a knowledge gap to be filled.

We found no relationships between perceived environmental barriers and either interest or satisfaction in leisure participation. These findings seemingly contrast with previous research where negative correlations between environmental barriers and level of leisure participation have been consistently reported.[20, 21, 24] This discrepancy suggests there is an important distinction between interest and satisfaction in leisure participation and actual level of participation. Environmental barriers may interfere with levels of participation, but seems to have minimal influence on the interest and satisfaction in leisure activities.

One potential explanation for this phenomenon could be the scene-setting property of the environment as a contextual influence of health and function.[43] Under this framework, the environment can define the repertoire of activities an individual can conceive of undertaking, and what options that person would consider realistically possible.[43] Thus, while individuals with stroke engage in relatively lower levels of leisure activities compared to those without stroke, they may nevertheless express a high level of satisfaction in the activities they do perform as it falls within the sphere of what is possible and available to that person.[43] Similarly, individuals with stroke may also exhibit a high level of interest in leisure activities that are possible within established environmental confines. This notion is strongly linked to the personalized definition of leisure participation that suggests that value, meaning, and enjoyment of an activity is based on the perceptions of the individual, rather than evaluated based on external criteria.[3] To our knowledge, this was the first study to consider individual preferences

and satisfaction in leisure, rather than just level of participation alone. Thus, evaluating interest and satisfaction together with actual leisure participation can provide valuable additional information on a person's level of enjoyment, and serve as predictors of future engagement in leisure activities.[44]

Barriers associated with Attitude and Support, Physical and Structure, and Services and Assistance were associated with depressive symptoms and reintegration to everyday activities. That no measure of physical function was associated with perceived environmental barriers is aligned with previous research that suggests that leisure participation and perceived barriers cannot be explained by physical disability alone, but should consider psychosocial factors as well.[4, 16, 36, 40, 45] As correlations do not infer causation, it is not known if poor social support or difficulties navigating home and community environments leads to challenges with community reintegration and depressive symptomology, or alternatively if poor reintegration and presence of depressive symptoms contributes to challenges in soliciting social support or exacerbates physical barriers to leisure participation. Future research is warranted to delineate the causal links to environmental barriers to leisure participation after stroke.

We acknowledge several limitations within the current study. Firstly, CHIEF serves as a measure of environmental barriers that does not examine facilitators, whereas frameworks such as the International Classification of Function consider environmental factors to potentially be both facilitators and barriers to participation.[46] Future research

may include scales that assess both facilitative as well as disruptive properties of environment factors on leisure participation. Our findings may not be generalizable to individuals with lower functional abilities or greater barriers related to physical, structural and transportation factors, since participants in the current study were relatively high functioning and had adequate community mobility or access to transportation to attend the testing sessions. Finally, the relationship between environmental barriers and emotional factors and community reintegration factors may be more complex than simple unidirectional explanations suggest. The variables examined in the current study were selected to represent a broad range of health and contextual factors, but multifactorial interactions of visible and hidden variables may be examined for greater insight into understanding social, psychological, and physical recovery following stroke, and the interplay between such factors as they contribute to leisure participation.

In conclusion, individuals with stroke commonly report frequent and large physical and structural environmental barriers to leisure participation. Furthermore, factors related to community integration and emotional status were associated with environmental barriers. Recognizing the importance of environmental factors as determinants of leisure participation, research considering the holistic effects of physical, social, political, and economical factors is a growing field of study.[19] Our findings highlight the importance of addressing environmental barriers to enhance leisure participation after

stroke, with particular consideration of contributing psychosocial factors that may influence such barriers.

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Table 1. Participant characteristics

Characteristic	N	n (%) or mean ± SD (min-max)
Age	52	59.1 ± 13.4 (23-86)
Sex (Male / Female)	52	36 (69%) /16 (31%)
Time post stroke, years	52	6.3 ± 7.2 (0.3-35.5)
Stroke type		
- Infarct	52	26 (50%)
- Hemorrhagic		13 (25%)
- Unknown		13 (25%)
Hemisphere Affected (Left / Right / Bilateral)	51	21 (40%)/ 28 (54%)/ 2 (4%)
Hand Dominance (Left / Right / Bilateral)	52	4 (8%)/ 47 (90%)/ 1 (2%)
Mobility Aide (None / Cane / Walker)	52	32 (62%)/ 16 (31%)/ 4 (8%)
Leisure Interest Measure score	52	26.8 ± 4.3 (18-39)
Leisure Satisfaction Measure score	52	24.0 ± 3.3 (15-30)
Chedoke-McMaster Stroke Assessment		
- Hand / Arm	52	4.6 ± 1.9 (1-7) / 4.7 ± 2.2 (1-7)
- Leg / Foot		5.4 ± 1.4 (2-7) / 4.5 ± 1.8 (2-7)
CAHAI	52	33.5 ± 17.3 (7-49)
Self-paced gait speed, m/s	52	0.98 ± 0.36 (0.25-1.57)
6-Minute Walk Test, m	51	346.6 ± 121.8 (107-535)
Montreal Cognitive Assessment	52	24.0 ± 4.8 (6-30)
Mini-Balance Evaluation Systems Test	51	18.5 ± 17.3 (3-28)

Reintegration to Normal Living Index	52	19.1 ± 2.6 (13-22)
CESD-10	52	8.3 ± 5.6 (0-22)

Abbreviations: CAHAI = Chedoke Arm and Hand Activity Inventory-7; CESD-10 = Centre for Epidemiological Studies Depression Scale-10

Table 2. Multivariable regression to examine associations between environmental barriers domains and Leisure Interest Measure score

Correlates	R^2	Adjusted R^2	Unstandardized B (SE)	Standardized B	*P*
Model	0.10	0.04			0.16
Policy			0.12 (0.10)	0.19	0.25
Services and Assistance			0.16 (0.10)	0.23	0.13
Work and School			-0.04 (0.14)	-0.41	0.80

Table 3. Multivariable regression analyses to examine associations between depressive symptoms, reintegration to normal living, and Craig Hospital Inventory of Environmental Factors Short Form domains A) Frequency of Attitude and Support barriers, B) Frequency of Physical and Structural barriers, C) Frequency of Services and Assistance barriers, and D) Magnitude of Physical and Structural barriers

A) Frequency of Attitude and Support barriers	R^2	Adjusted R^2	Unstandardized B (SE)	Standardized B	*P*
Model	0.23	0.120			0.002*
Centre for Epidemiological Studies Depression Scale-10			0.04 (0.02)	0.38	0.01*
Reintegration to Normal Living Index			-0.04 (0.04)	-0.16	0.29

*$P<0.05$

B) Frequency of Physical and Structural barriers	R^2	Adjusted R^2	Unstandardized B (SE)	Standardized B	*P*
Model	0.24	0.21			0.001*
Centre for Epidemiological Studies Depression Scale-10			0.08 (0.05)	0.44	0.003*
Reintegration to Normal Living Index			-0.04 (0.03)	-0.10	0.50

*$P<0.05$

C) Frequency of Services and Assistance barriers	R^2	Adjusted R^2	Unstandardized B (SE)	Standardized B	*P*
Model	0.18	0.15			0.007*
Centre for Epidemiological Studies Depression Scale-10			0.03 (0.02)	0.21	0.16
Reintegration to Normal Living Index			-0.08 (0.04)	-0.28	0.06

*$P<0.05$

D) Magnitude of Physical and Structural barriers	R^2	Adjusted R^2	Unstandardized B (SE)	Standardized B	*P*
Model	0.22	0.19			0.002*
Centre for Epidemiological Studies Depression Scale-10			0.03 (0.01)	0.35	0.02*
Reintegration to Normal Living Index			-0.03 (0.03)	-0.19	0.20

$P<0.05$

Figure. Distribution of A) Frequency and B) Magnitude of environmental barrier domains as identified on the Craig Hospital Inventory of Environmental Factors Short Form