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Brief Report

The impact of stroke on psychological and physical function outcomes in people with long-term physical disability

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ABSTRACT

Background: An increased number of people who have a long-term physical disability (LTPD) are aging. Similar to older adults without previous disability, individuals with LTPD may experience age-related comorbidities secondary to aging. A leading cause of disability in the United States among older adults is stroke. Limited evidence supports that individuals with LTPD are at higher risk of a stroke compared to those without disability. Stroke may negatively impact physical, cognitive, and/or psychosocial function. For those who have lived longer with LTPD, the impact of stroke may differ.

Objective: To determine the impact of stroke on health outcomes in people with LTPD.

Methods: Thirty-three individuals with both LTPD and self-reported stroke were identified in a national purposive sample of adults reporting physical disability associated with LTPD (Group A). Group A was compared to an age matched sample of 33 individuals with the same conditions but no stroke (Group B). Group A participants were also compared to national norms based on age cohort from a national sample of 182 stroke survivors (Group C).

Results: Age range of all participants = 65–74 years. Combine sample among three groups = 248. Group A did not differ from Group B. However, Group A reported significantly higher pain interference ($p < .001$), fatigue ($p = .003$), and decreased physical function ($p < .001$) than Group C.

Conclusions: The study informs how the impact of acquiring another condition after living with a LTPD differs among a general stroke population and those who are living with LTPD.

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Introduction

An increased number of people who have an early acquired or long-term physical disability (LTPD) are aging more than ever before.^{1,2} Similar to older adults without previous disability, individuals with LTPD may experience age-related comorbidities secondary to the aging process.^{1,3,4} One example of an age-related medical condition is a stroke.⁵ A stroke is a vascular event that can cause impairments that may affect overall physical function and psychological health.⁵

Existing evidence, while limited, supports that individuals with LTPD have been shown to be at higher risk of vascular comorbidities such as stroke compared to the general population.^{6–14} For

example, a longitudinal study of adults found that individuals with poliomyelitis had a significant increase in prevalence of a vascular condition, stroke, in comparison to a 2.4% prevalence of individuals without ($p < .001$).⁸ Not all studies identified the epidemiology of the vascular conditions. For example a study of individuals with spinal cord injury (SCI) had a higher risk of having a stroke than those without SCI ($p < .001$).⁹ Lastly, additional studies found individuals with multiple sclerosis (MS) may also experience stroke at higher rates when compared to individuals without MS.^{10–14}

In addition, despite the higher prevalence and increased risk of stroke among individuals living with LTPD, little is known about the additional impact of stroke on this group's health outcomes. Stroke is often a life-altering experience that has a negative physical, cognitive, and/or psychosocial impact, which could further complicate health issues, independence, participation, and quality of life of those who are aging with existing chronic conditions or disability.^{1,10} At the same time, people living with comorbidity may have the ability to self-manage their health and care that could

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minimize stroke related challenges. Resilience might play a role in mediating the impact of additional impairments from stroke, however, models of resilience has not been tested in those with LTPD.¹¹ The lack of understanding on how this group of individuals perceives their health, compared to other groups, limits provision of proper care and support they may need.

To add to the body of research on stroke and its impact among individuals living with LTPD, we compared health outcomes of individuals living with one of four long-term conditions associated with LTPD (MS, SCI, Muscular Dystrophy [MD] or Post-Polio Syndrome [PPS]) who had also experienced a stroke (Group A) to an age matched group of people with these conditions only (Group B), and a nationally representative sample of age-matched stroke survivors (Group C). In this cross-sectional group comparison study, we specifically aimed to describe demographic characteristics of each group and to compare self-reported psychological and physical function health outcomes. We hypothesized that the presence of stroke in the context of LTPD would lead to poorer physical function and mental health outcomes than the comparison groups.

Methods

Procedures and participants

Data for this study were obtained from two different databases. The first data base was a national survey of individuals aging with physical disability associated with MS, SCI, MD or PPS (*omitted for purpose of blind review*). It was conducted as longitudinal study and followed patient-reported health outcomes of these people aging with LTPD between 2008 and 2018 (*omitted for purpose of blind review*). To describe Group A and B, we used data from the sixth time point, collected between 2015 and 2016. The second database was the Patient Reported Outcomes Measurement Information System (PROMIS) database.¹² This PROMIS database is publicly available and includes health related data collected through web-based platforms with general population and populations living with multiple diseases as diagnosed by a physician.^{12,13} Group C used data collected between 2006 and 2007. All research activities were approved by the (*omitted for purpose of blind review*) Institutional Review Board.

Group A: LTPD + Stroke

Individuals were included in Group A if they reported a stroke after the diagnosis of their LTPD condition (i.e., MS, SCI, MD or PPS). Participants were asked, "have you ever been told by a doctor or other health professional that you had a stroke?" Participants who indicated a history of stroke were then contacted by study staff via telephone to confirm both the presence of stroke and that the stroke occurred sometime after the primary diagnosis of MS, SCI, MD or PPS. Calls were scripted to decrease bias and variability. Staff attempted up to three calls, each call was one week apart before individuals were considered lost to follow-up.

Group B: LTPD

A group of individuals who did not report a history of stroke but are aging with MS, SCI, MD or PPS were included in Group B. One to one matching method based on both gender and age was used to match participants in Groups A and B.

Group C: Stroke

Individuals were included in Group C if they answered "yes" to "have you ever been told by a doctor or other health professional that you had a stroke?" and if they had no other medical conditions. An age range of 65–74 was used as an additional inclusion criterion to match participants with Group A. Age range was used due to lack

of individual age data in the national database.

Measures

Demographic variables

Demographic variables included in the current study were age, gender, ethnicity/race, education level, and marital status. Time since diagnosis of the LTPD was only reported for Groups A and B.

Patient-reported outcomes measurement information System-29 (PROMIS-29)

PROMIS-29 is a self-reported health-related quality of life survey of multiple categories. In the analysis we used the PROMIS depression, fatigue, anxiety, pain interference, and physical function measures. Each measure has four questions and rated on a five-point scale. The questions on depression, fatigue, anxiety and pain interference all have a maximum score of 20, indicating the worst possible health quality. However, physical function is reverse, meaning that the higher score equals better function. These questions require the respondents to recall the last seven days.^{12,14} These measures have been found to be reliable and valid measures in multiple populations, which allows for comparisons across health conditions.^{12,15}

Data analysis

All analyses were completed with SPSS.²⁴ Case control matching for Groups A and B was performed using the FUZZY extension in SPSS. Demographics between the three groups were compared using chi square or *t*-tests. All were transformed into standardized scores for comparison across groups and settings. For the Group A to B analysis, paired *t*-tests were used and for the Group A to C analysis, independent samples Student's *t*-tests were used to compare group means separately on each of the PROMIS-29 outcomes. Statistical significance was determined using $p < .05$. When appropriate, effect sizes were calculated to describe the magnitude of any group differences.

Results

Demographics by group

Group A: LTPD + stroke

Of the 1,532 individuals who completed the survey, 56 reported a history of stroke. Of these 56, three were deceased, 19 could not be reached for confirmation, and one reported their stroke occurred prior to their primary diagnosis. This left a total sample of 33 individuals with MS, SCI, MD or PPS who reported onset of stroke after their primary diagnosis. The average age of this group was 65.9 years ($SD = 3.1$). Six individuals (18.2%) reported more than one stroke. The majority were diagnosed with either PPS (72.8%) or MS (36.4%). The mean years since diagnosis ranged from 16.6 to 21.3. See [Table 1](#) for additional demographic data of each group.

Group B: LTPD only

Of the 1,532 individuals, 33 people were selected to match Group A based on gender and age. The average age was 68.9 years ($SD = 8.1$). The majority (66.7%) were also diagnosed with PPS (39.4%) or MS (27.3%). The mean years since diagnosis ranged from 15.9 to 21.9, also noted in [Table 1](#).

Group C: stroke

The PROMIS database included 21,133 participants; however, number of responses varied across PROMIS measures. After participants ($n = 12,457$) with missing data were removed, 757

Table 1
Demographics for all groups.

Demographic characteristics		Group A: LTPD + Stroke (n = 33)		Group B: LTPD (n = 33)		Group C: Stroke (n = 182)	
		Mean (SD)		Mean (SD)		Mean (SD)	
Age		65.9 (3.1)		68.9 (8.1)		69.4 (2.9)	
Years since Diagnosis	Multiple Sclerosis	19.2 (13.5)		19.3 (13.6)		–	
	Post-polio Syndrome	16.8 (7.0)		15.9 (6.0)		–	
	Muscular Dystrophy	16.6 (11.9)		16.2 (11.0)		–	
	Spinal Cord Injury	21.3 (2.3)		21.9 (2.5)		–	
		Number	Percentage	Number	Percentage	Number	Percentage
Multiple Sclerosis		12	36.4	9	27.3	–	–
Post-polio Syndrome		12	36.4	13	39.4	–	–
Muscular Dystrophy		6	18.2	5	15.2	–	–
Spinal Cord Injury		3	9.1	6	18.2	–	–
Gender ^a	Female	21	63.6	20	60.6	74	40.7
	Male	12	36.4	13	39.4	108	59.3
Ethnicity/Race	White, Non-Hispanic	29	87.9	28	84.8	174	95.6
	Other, Non-Hispanic	2	6.1	4	12.1	4	2.2
	Black, Non-Hispanic	1	3.0	1	3.0	2	1.1
	Other, Hispanic	1	3.0	0	0.0	0	0.0
	White, Hispanic	0	0.0	0	0.0	2	1.1
Education	Advanced degree	11	33.3	8	24.2	34	18.7
	College degree	10	30.3	8	24.2	71	39.0
	Some college/Tech	9	27.3	8	24.2	39	21.4
	High school/GED	2	6.1	8	24.2	33	18.1
	Less than high school	1	3.0	1	3.0	5	2.8
Marital Status	Married	24	72.2	17	51.5	98	53.9
	Divorced	4	12.1	8	24.2	31	17.0
	Widowed	2	6.1	5	15.2	33	18.1
	Living with partner	2	6.1	2	6.1	6	3.3
	Never married	1	3.0	1	3.0	10	5.5
	Separated	0	0.0	0	0.0	4	2.2

Notes. ^a Group A and C difference significant at $p < .05$ using Chi square test; LTPD = Long Term Physical Disability.

individuals reported stroke. A total of 182 individuals met the age range of 65–74 years ($M = 69.4$ years; $SD = 2.9$). The gender composition significantly differed between Groups A and C ($p = .015$; Table 1), which portrayed a higher amount of females (63.6%) for Group A.

Comparisons of reported psychological and physical health outcomes between the LTPD + Stroke (Group A) and LTPD (Group B)

Table 2 displays the means and group comparison results between Groups A and B. None of the psychological and physical health outcomes significantly differed ($p \geq .05$). However, a moderate effect was found in pain interference between Group A ($M = 59.8$) and Group B ($M = 54.5$; $d = 0.58$) and Group A had a higher pain interference mean than Group B.

Comparisons of reported psychological and physical health outcomes between LTPD + Stroke (Group A) and stroke (Group C)

The means and group comparison results between Groups A and C are displayed in Table 3. There were no significant differences

between Groups A and C on depression nor anxiety. The t -test results indicated that Group A reported significantly higher pain interference ($p < .001$) and fatigue ($p = .003$) and significantly lower physical function when compared to Group C ($p < .001$). Effect sizes indicate a moderate effect on pain interference, fatigue, and physical function when Group A was compared to Group C.

Discussion

This comparison study adds to the limited literature on reported stroke occurring among individuals aging with LTPD, specifically MS, SCI, MD or PPS.^{6,8,9,16–20} As these individuals age, long-standing impairments associated with a primary diagnosis begin to interact with conditions typical of later adulthood, including stroke.

The first comparison shows that psychological and physical health outcomes of Group A did not statistically differ from Group B. Effect sizes for these comparisons were mostly in the small to moderate range, with the greatest difference being for pain interference ($d = .58$). The second comparison found that Group A reported higher pain interference, fatigue, and physical function outcomes when compared to Group C. However, depression and

Table 2
Independent samples mean scores, Student's t -tests, and effect sizes for LTPD plus stroke (group A) compared to LTPD only (group B).

Variables	Mean (SD)				Paired t -test		Effect size
	n	LTPD plus stroke (group A)	n	LTPD only (group B)	t value	p value	Cohen's d
Depression	33	53.5 (8.5)	32	49.6 (8.9)	1.643	0.129	0.447
Anxiety	33	50.9 (9.5)	33	49.6 (9.8)	0.909	0.371	0.134
Pain Interference	33	59.8 (8.0)	32	54.5 (10.2)	1.270	0.093	0.578
Fatigue	33	58.0 (9.5)	32	55.5 (11.7)	1.486	0.129	0.234
Physical Function	33	35.6 (7.8)	33	33.6 (8.2)	1.209	0.199	0.249

Table 3
Independent samples mean scores, Student's t-tests, and effect sizes for LTPD plus stroke (group A) compared to stroke only (group C).

Variables	Mean (SD)		n	Stroke only (group C)	Student's t-test		Effect size Cohen's <i>d</i>
	n	LTPD plus stroke (group A)			t value	p value	
Depression	33	53.5 (8.5)	114	51.1 (8.8)	1.603	0.119	0.277
Anxiety	33	50.9 (9.5)	146	49.5 (8.8)	0.832	0.412	0.152
Pain Interference	33	59.8 (8.0)	165	53.8 (10.3)	4.316	<.001	0.650
Fatigue	33	58.0 (9.5)	169	52.6 (10.4)	3.28	0.003	0.568
Physical Function	33	35.6 (7.8)	173	41.3 (8.8)	- 4.153	<.001	0.685

anxiety outcomes did not differ between the two groups.

The current study provides evidence to better understand how the impact of acquiring another condition (i.e., stroke) after living with a LTPD differs among the general stroke population and among those who are living with LTPD. We found that physical health symptoms (including fatigue and pain) were significantly worse for people with a history of stroke overlaying a long-term disability associated diagnosis. This difference emphasizes the multifactorial nature of disability, and suggests that for older adults with LTPD, symptoms and impairments associated with a long-term condition may be amplified by a new-onset condition like stroke in older age. For example, a person with paraplegia due to SCI may rely on upper body strength for transfers. Hemiplegia associated with a new stroke creates new limitations, as well as further fatigue and pain.

Unlike physical health differences, we found no reported differences in psychological health outcomes in either group comparisons. The mean scores of the depression and anxiety scales both were lower than 55, which indicates none to slight depression or anxiety.²¹ Although the literature on psychological states and LTPD is nuanced, in general people with the conditions studied here do report higher levels of depression and anxiety than the general population.^{22,23} However, previous research have found that older adults living with LTPD are highly resilient, which may mitigate the detrimental influences of symptoms such as pain and fatigue on perceived quality of life.²⁴

While people with existing LTPD may not perceive stroke as an additional burden, practitioners should acknowledge that people with LTPD and stroke are likely experience more fatigue, pain, and physical challenges than those presenting solely with stroke. Thus, it might be important for practitioners to be aware of the intersection of disability and aging, as these issues may be more prevalent among older adults. For example, practitioners as well as physicians may want to ask about pain and fatigue and complete a simple test of physical function during routine exams even if the person does not initially report these as problems. There might be a need for protective measures to decrease fatigue and pain interference and to improve physical function among individuals with LTPD plus stroke, while supporting positive emotions and development of resilience and self-efficacy.

There were limitations to the current study. First, Groups A and B had a small sample size. For the comparison of Group A to Group C, the group sizes were unequal and only age was used to match the two groups, resulting in a significant difference in gender composition. Age matching was also performed using age ranges rather than individual ages. Data for Groups A and C were also retrieved from two different database of which data was collected at different time points. A majority of the participants from both groups were non-Hispanic white, college educated, and married and therefore may not be generalizable to other groups, particularly those who may not have spousal support. Data on stroke types, lesion and severity, and time since stroke were not available. In addition, all data were self-reported and thus subject to individual bias.

Future research may investigate this specific population in a longitudinal analysis to determine if reported health outcomes show change over time, as they aged. Future investigation of community, social, and work participation and quality of life outcomes would also allow for further understanding of the larger impact of having a stroke among individuals with LTPD. Future research to improve the generalizability of the findings would be important.

Conclusion

The study found that individuals in Group A, who had a stroke while living with LTPD, experience negative impact on physical health but not psychological health when compared to individuals who had a stroke without an existing LTPD. These findings suggest the interaction of sources of disability in people with LTPD as they age. Future research should consider the impact physical function has on participation and quality of life as a follow up to this study or with a similar group of individuals living with multi-comorbidity. Findings may then be able to inform intervention development and clinical practice targeting stroke survivors with LTPD.

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Declaration of competing interest

No commercial party having a direct financial interest in the results of the research supporting this article has of will confer a benefit on the authors or on any organization with which the authors are associated.

Appendix A. Supplementary data

Supplementary data related to this article can be found at <https://doi.org/10.1016/j.dhjo.2020.100919>.

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