



Fall risk in stroke survivors: Effects of stroke plus dementia and reduced motor functional capacity

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ABSTRACT

Background: Despite extensive research on falls among individuals with stroke, little is known regarding the impact of neurological conditions with comorbid diagnoses and motor functional capacity on the risk of falls in these individuals. Hence, the purpose of this study was to determine the fall risk and the contribution of reduced motor functional capacity to fall risk in individuals with stroke, dementia, and stroke plus dementia.

Methods: Data from the National Health and Aging Trends Study (NHATS), a nationally-representative sample of Medicare beneficiaries, were analyzed for this cross-sectional study. The odds of self-reported falls within the past month in three subgroups of neurological conditions [stroke ($n = 751$), dementia ($n = 369$), and stroke plus dementia ($n = 141$)] were evaluated with a reference group of individuals with no stroke/dementia [i.e., controls ($n = 6337$)] using logistic regression models.

Results: The prevalence of a recent fall was significantly higher ($P < .05$) in the three neurological disorder groups compared with controls. After adjusting for sociodemographics, mobility device use, and other comorbidities (i.e., chronic disease, vision impairment, and major surgery), the odds of a recent fall were significantly elevated in individuals with stroke (odds ratio [OR] = 1.45), dementia (OR = 2.45), and stroke plus dementia (OR = 2.64) compared with controls. After further adjustment for the lower motor functional capacity, the elevated odds in individuals with stroke were attenuated (OR = 1.16); however, the odds remained significantly elevated in individuals with dementia (OR = 1.67) and stroke plus dementia (OR = 1.82).

Conclusion: Findings indicate that the odds for falls in stroke survivors are elevated in the presence of comorbid dementia. Further, lower motor functional capacity accounted for increased likelihood of a fall in individuals with stroke, but it was not sufficient to account for the increased likelihood of a fall in individuals with dementia or stroke plus dementia. Thus, interventions focusing on secondary prevention of dementia and improving motor functional capacity may reduce fall risk in individuals with stroke.

1. Introduction

Falls are a major cause of disability and death in older adults and represent a serious public health concern in the U.S. and worldwide. Stroke survivors are at higher risk for falls, and this risk persists even years after the stroke [1–4]. Moreover, individuals with stroke are also at higher risk of dementia [5], which in itself increases the likelihood of falls [6]. Thus, it is possible that when stroke and dementia exist as comorbid diagnoses, it could lead to a greater risk of falls than stroke or dementia alone. Further, while the etiologies and resulting sequelae of

stroke and dementia can differ, both conditions are associated with impairments of motor function [7], such as decreased muscle strength, difficulties with function, poor balance, etc., which are important constituents of fall risk. However, despite extensive research on falls among individuals with stroke, the impact of neurological conditions with comorbid diagnoses and motor functional capacity on the risk for falls after stroke is currently unknown. This information is critical because individuals with stroke and dementia have an accelerated rate of experiencing adverse health outcomes after a fall when compared with the general older adult population [8,9]. Hence, this study sought to

Abbreviations: OR, Odds Ratio; CI, Confidence Interval; NHATS, National Health and Aging Trends Study

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Table 1
Descriptive characteristics of study participants (n = 7598).

	Stroke (n = 751)	Dementia (n = 369)	Stroke and dementia (n = 141)	Controls (n = 6337)
	% (95% CI)	% (95% CI)	% (95% CI)	% (95% CI)
Age				
65–74 years	41.4 (37.0, 45.8) ^{D,S+D,C}	16.3 (11.1, 21.6) ^{S,C}	24.3 (17.6, 31.0) ^{S,C}	56.1 (54.9, 57.3)
75–84 years	39.6 (36.2, 42.9) ^C	43.0 (37.8, 48.2) ^C	39.4 (29.6, 49.2)	32.6 (31.7, 33.6)
85+ years	19.1 (15.9, 22.2) ^{D,S+D,C}	40.6 (35.9, 45.4) ^{S,C}	36.2 (28.1, 44.4) ^{S,C}	11.2 (10.5, 12.0)
Sex				
Male	43.6 (39.3, 48.0)	35.3 (30.5, 40.0) ^C	39.2 (29.2, 49.1)	43.7 (42.1, 45.4)
Female	56.4 (52, 60.7)	64.7 (60.0, 69.5) ^C	60.8 (50.9, 70.8)	56.3 (54.6, 57.9)
Race				
White, non-Hispanic	80.2 (77.5, 82.9)	72.9 (67.7, 78.1) ^C	75.5 (68.9, 82.2)	82.0 (80.3, 83.7)
Black, non-Hispanic	9.6 (8.0, 11.3)	10.9 (8.6, 13.1)	13.7 (9.2, 18.3) ¹	7.9 (7.1, 8.7)
Hispanic	6.2 (4.1, 8.4)	11.1 (6.8, 15.3)	9.9 (4.6, 15.1)	6.6 (5.6, 7.7)
Other, non-Hispanic	3.9 (2.2, 5.7) ^{S+D}	5.2 (2.6, 7.7) ^{S+D}	0.9 (0.3, 1.5) ^{S,D,C}	3.5 (2.6, 4.4)
Weight status				
Underweight	5.2 (3.3, 7.0) ^{D,S+D}	15.1 (10.8, 19.5) ^{S,C}	13.4 (7.6, 19.2) ^{S,C}	5.2 (4.3, 6.1)
Normal weight	30.4 (26.0, 34.8) ^D	44.0 (37.2, 50.8) ^{S,C}	38.8 (30.2, 47.3)	30.4 (29.1, 31.8)
Overweight	37.7 (33.9, 41.5) ^D	24.8 (19.5, 30.0) ^{S,C}	28.1 (19.6, 36.5)	36.9 (35.5, 38.4)
Obese	26.7 (22.2, 31.2) ^D	16.1 (11.8, 20.4) ^{S,C}	19.8 (12.3, 27.2)	27.5 (26.0, 29.0)
Married				
Yes	47.2 (42.8, 51.6) ^{D,C}	37.0 (31.4, 42.6) ^{S,C}	41.6 (32.7, 50.4) ^C	56.5 (55.0, 58.0)
No	52.8 (48.4, 57.2) ^{D,C}	63.0 (57.4, 68.6) ^{S,C}	58.4 (49.6, 67.3) ^C	43.5 (42.0, 45.0)
Education				
Less than High School	29.3 (25.3, 33.3) ^C	37.3 (31.4, 43.2) ^C	39.0 (26.8, 51.2) ^C	20.1 (18.4, 21.8)
High School graduate	27.3 (23.2, 31.5)	31.4 (25.4, 37.4)	37.3 (28.5, 46.1)	27.3 (25.8, 28.8)
Beyond High School	43.3 (39.2, 47.5) ^{D,S+D,C}	31.3 (25.1, 37.4) ^{S,C}	23.8 (13.1, 34.4) ^{S,C}	52.6 (50.3, 54.9)
Chronic diseases				
Yes	97.5 (95.9, 99.0) ^C	95.0 (91.9, 98.2) ^C	98.1 (96.4, 99.8) ^C	88.9 (88.1, 89.7)
No	2.5 (1.0, 4.1) ^C	5.0 (1.8, 8.1) ^C	1.9 (0.2, 3.6) ^C	11.1 (10.3, 11.9)
Mobility device use				
Yes	44.3 (40.5, 48.1) ^{S+D,C}	53.6 (46.8, 60.5) ^{S+D,C}	72.3 (64.8, 79.8) ^{S,D,C}	20.0 (18.9, 21.0)
No	55.7 (51.9, 59.5) ^{S+D,C}	46.4 (39.5, 53.2) ^{S+D,C}	27.7 (20.2, 35.2) ^{S,D,C}	80.0 (79.0, 81.1)
Vision impairment				
Yes	77.4 (73.8, 81.0) ^C	75.1 (69.1, 81.1) ^C	70.6 (62.2, 79.0) ^C	71.9 (70.9, 73.0)
No	22.6 (19.0, 26.2) ^C	24.9 (18.9, 30.9) ^C	29.4 (21.0, 37.8) ^C	28.1 (27.0, 29.1)
Major surgery				
Yes	76.3 (72.6, 79.9) ^C	67.8 (63.0, 72.6) ^{S+D,C}	80.5 (74.0, 87.0) ^{D,C}	58.3 (56.9, 59.8)
No	23.7 (20.1, 27.4) ^C	32.2 (27.4, 37.0) ^{S+D,C}	19.5 (13.0, 26.0) ^{D,C}	41.7 (40.2, 43.1)
Balance/coordination problems				
Yes	48.8 (44.3, 53.3) ^{D,S+D,C}	67.1 (62.2, 71.9) ^{S,C}	76.6 (67.3, 85.8) ^{S,C}	23.6 (22.2, 25.0)
No	51.2 (46.7, 55.7) ^{D,S+D,C}	32.9 (28.1, 37.8) ^{S,C}	23.4 (14.2, 32.7) ^{S,C}	76.4 (75.0, 77.8)
Fatigue				
Yes	62.7 (58.9, 66.5) ^C	66.9 (61.1, 72.7) ^C	71.8 (63.3, 80.4) ^C	41.0 (39.4, 42.6)
No	37.3 (33.5, 41.1) ^C	33.1 (27.3, 38.9) ^C	28.2 (19.6, 36.7) ^C	59.0 (57.4, 60.6)
Bothered by pain				
Yes	60.5 (55.7, 65.4) ^C	64.8 (59.3, 70.3) ^C	64.9 (58.2, 71.6) ^C	51.5 (49.8, 53.2)
No	39.5 (34.6, 44.3) ^C	35.2 (29.7, 40.7) ^C	35.1 (28.4, 41.8) ^C	48.5 (46.8, 50.2)
Physical capacity				
Low	60.7 (57.0, 64.5) ^{D,S+D,C}	81.5 (76.6, 86.3) ^{S+D,C}	92.8 (87.9, 97.6) ^{S,D,C}	31.8 (30.4, 33.3)
Medium	23.6 (20.5, 26.8) ^{D,S+D,C}	9.3 (5.4, 13.2) ^{S,C}	2.7 (0.0, 6.6) ^{S,C}	31.0 (29.5, 32.5)
High	15.6 (12.6, 18.7) ^{S+D,C}	9.2 (5.8, 12.7) ^C	4.5 (1.2, 7.8) ^{S,C}	37.2 (35.7, 38.6)

CI, confidence interval; chronic disease includes heart attack, heart disease, high blood pressure, arthritis, osteoporosis, diabetes, lung disease, or cancer (not including skin cancer).

D Different compared with dementia, $P < .05$.

S+D Different compared with stroke plus dementia, $P < .05$.

S Different compared with stroke, $P < .05$.

C Different compared with controls, $P < .05$.

determine the fall risk (i.e., the prevalence and odds of a fall) and the contribution of reduced motor functional capacity to fall risk in individuals with stroke, dementia, and stroke plus dementia.

2. Materials and methods

2.1. Participants

Data from the 2011 (round 1) National Health and Aging Trends Study (NHATS) were used for this study. NHATS utilized a multistage survey design, sampling Medicare beneficiaries aged 65+, with over-sampling of individuals aged 90+ and non-Hispanic Black individuals.

Briefly, round 1 utilized a stratified three-stage design that included (1) selection of 95 primary sampling units (i.e., individual or groups of counties), (2) selection of 655 secondary sampling units (i.e., ZIP codes or ZIP code fragments for sampled primary sampling units), and (3) selection of beneficiaries for sampled secondary sampling units. Information pertaining to NHATS study design, methodology, and survey instrumentation (e.g., methods, validation) is available from <https://www.nhats.org/>. The primary exposure variable was the presence of neurological disorder(s), which included individuals with stroke, dementia, and stroke plus dementia. Individuals without stroke or dementia served as a reference population (i.e., controls). Stroke (self-report) and dementia (42% self-report, 58% proxy-report) were

determined during the in-person or telephone interview based on whether the sampled person (or their proxy) was ever told by a doctor that they had that disorder. The prevalence of stroke and dementia in our sample was 9.7% and 4.9%, respectively, which are similar to previous national reports of similar age groups [10,11]. Exclusion criteria were missing data on variables relating to stroke, dementia, or a recent fall within the past month ($n = 647$). Of the 647 individuals with missing data, 468 were missing because these individuals resided in a nursing home, and the NHATS did not administer the sampled person interview in the nursing home setting. Another 168 completed the facility questionnaire, but did not complete the sampled person interview. Data were assumed to be missing at random for the remaining 11 individuals. The NHATS study protocol was approved by The Johns Hopkins University Institutional Review Board.

2.2. Outcome measure

The outcome variable was a fall (yes/no) within the past month. In the NHATS, falls were defined as “any fall, slip, or trip in which you lose your balance and land on the floor or ground or at a lower level.”

2.3. Covariates

Covariates were chosen based on their relevance to fall risk, stroke, and dementia, and their availability in NHATS. Sociodemographic variables included age (categorized as 65–74 years; 75–84 years; 85+ years), sex (male; female), race (White, non-Hispanic; Black, non-Hispanic; Hispanic; Other, non-Hispanic), weight status as determined by body mass index (categorized as underweight [$< 18.5 \text{ kg/m}^2$], normal weight [$18.5\text{--}24.9 \text{ kg/m}^2$], overweight [$25.0\text{--}29.9 \text{ kg/m}^2$], and obese [$> 30 \text{ kg/m}^2$], marital status (married [yes/no]), and education (less than High School; High School graduate; Beyond High School). We also adjusted for mobility device use in the past month (yes/no) and various comorbidities such as chronic disease (an indicator [yes/no] for at least one of the following conditions: heart attack, heart disease, high blood pressure, arthritis, osteoporosis, diabetes, lung disease, or cancer [not including skin cancer]), vision impairment (an indicator [yes/no] for any of the following: blind, vision aid use, or unable to see across the street), and major surgery (an indicator [yes/no] for any of the following: knee surgery, hip repair or replacement, cataract surgery, back or spine surgery, or heart surgery at any point in their life). Motor function variables included balance/coordination problems, pain, and fatigue within the past month, as well as physical capacity. The NHATS measured all of these motor function variables except the physical capacity using a YES/NO answer (i.e., presence or absence of a problem) (Table 1). The physical capacity was assessed using validated procedures, which queried individuals about their ability to perform 6 pairs of less and more challenging activities, as described previously [12]. Briefly, these activities included whether the individual could walk 3 (less challenging) or 6 (more challenging) blocks; lift and carry 10 (less challenging) or 20 (more challenging) pounds; bend over (less challenging) or kneel down (more challenging); reach up over head without holding on (less challenging) or put a heavy book on a shelf overhead (more challenging); use fingers to grasp small objects (less challenging) or open a sealed jar (more challenging). Low physical capacity was defined as those who were unable to do any of the less challenging activities. Medium physical capacity was defined as those who were able to do less challenging but not more challenging activities. High physical capacity was defined as those who were able to do all of the more challenging activities.

2.4. Statistical analysis

All participants (stroke [$n = 751$], dementia [$n = 369$], stroke plus dementia [$n = 141$], and controls [$n = 6337$]) and data for this study were from the first round of the NHATS (2011). All analyses were

performed in Statistical Analysis Software (SAS version 9.4 [SAS Institute, Inc., Cary, NC]) using sample weights according to NHATS specifications. The data were weighted to account for the complex survey design, adjust for oversampling, survey nonresponse, and post-stratification, and allow for generalizability of the survey responses to the population represented by the sample. All statistical analyses were performed with 2-sided confidence intervals (CI) and $P < .05$ to determine statistical significance. Group differences were tested using chi-square tests. Logistic regression was used to determine the odds of a fall within the past month by group (reference: controls). Model 1 adjusted for sociodemographic variables. Model 2 adjusted for the variables in Model 1 and motor function variables. The interactions between group and sociodemographic variables were individually tested, and if not significant, were excluded from the models.

3. Results

Descriptive data are presented in Table 1. Of the 1261 individuals that had a stroke and/or dementia, 47 had missing data (assumed to be random) on at least one sociodemographic or motor function variable ($< 4\%$ of the sample with a neurological disorder). Of the 6337 controls, 157 had missing data (assumed to be random) on at least one sociodemographic or motor function variable ($< 3\%$ of the control participants). Among the four groups, there were significant differences ($P < .05$) for sociodemographic factors, mobility device use, and comorbidities (Table 1). Individuals with neurological disorders had poorer motor functional capacity compared with controls as determined by balance/coordination problems (all, $P < .05$), fatigue (all, $P < .05$), pain (all, $P < .05$), and physical capacity (all, $P < .05$). Individuals with dementia and stroke plus dementia had poorer motor functional capacity compared with individuals with stroke as determined by balance/coordination problems and physical capacity (all, $P < .05$). Individuals with stroke plus dementia had lower physical capacity compared with individuals with dementia ($P < .05$).

The prevalence of a fall within the past month was 17.0% for stroke, 25.5% for dementia, 31.0% for stroke plus dementia, and 8.8% for controls. The unadjusted odds were significantly elevated in all three neurological disorder groups compared with controls (odds ratio [OR] = 2.12–4.67, all $P < .05$). After adjusting for the sociodemographic variables, mobility device use, and other comorbidities (i.e., chronic disease, vision impairment, and major surgery), the odds remained significantly elevated in all three neurological disorder groups (OR = 1.45–2.64, all $P < .05$). After further adjusting for the motor function variables (model 2), the odds were attenuated in individuals with stroke (OR = 1.16; 95% CI = 0.88–1.53); however, the odds remained significantly elevated in individuals with dementia (OR = 1.67; 95% CI = 1.19–2.33) and stroke plus dementia (OR = 1.82; 95% CI = 1.14–2.89) (Table 2).

4. Discussion

In a large, nationally-representative sample of older adults, we found that individuals with stroke, dementia, and stroke plus dementia had an increased likelihood of a recent fall compared with individuals without neurologic disorders. Further, we found that accounting for motor functional capacity attenuated the elevated odds of a recent fall in individuals with stroke, but not among individuals with dementia or stroke plus dementia. These findings suggest that reduced motor functional capacity is an important factor contributing to the increased fall risk in individuals with stroke; however, other factors may further explain the increased likelihood of falls among individuals with dementia and stroke plus dementia. In addition to functional loss, age-related fall risk reflects a multifaceted etiology across multiple cognitive domains, including executive function, attention, visuospatial ability, and memory [13–15]. Thus, it should come as no surprise that physical function domains may not fully explain the increased

Table 2
Prevalence and multivariable logistic regression for the association with fall in the past 1 month.

	Prevalence (n = 7598)	Unadjusted (n = 7598)	Model 1 (n = 7480)	Model 2 (n = 7394)
	%	OR (95% CI)	OR (95% CI)	OR (95% CI)
Controls	8.8	Reference	Reference	Reference
Stroke	17.0	2.12 (1.70, 2.65)	1.45 (1.12, 1.87)	1.16 (0.88, 1.53)
Dementia	25.5	3.55 (2.65, 4.76)	2.45 (1.78, 3.38)	1.67 (1.19, 2.33)
Stroke and dementia	31.0	4.67 (2.92, 7.47)	2.64 (1.62, 4.30)	1.82 (1.14, 2.89)
Age				
65–74 years			Reference	Reference
75–84 years			0.96 (0.79, 1.15)	0.94 (0.78, 1.13)
85+ years			0.82 (0.61, 1.09)	0.82 (0.62, 1.09)
Sex				
Male			Reference	Reference
Female			0.89 (0.76, 1.05)	0.80 (0.68, 0.95)
Race				
White, non-Hispanic			Reference	Reference
Black, non-Hispanic			0.64 (0.53, 0.78)	0.67 (0.56, 0.81)
Hispanic			0.80 (0.55, 1.17)	0.71 (0.47, 1.05)
Other, non-Hispanic			0.88 (0.53, 1.45)	0.90 (0.54, 1.50)
Weight status				
Underweight			0.92 (0.61, 1.39)	0.90 (0.59, 1.37)
Normal weight				
Overweight			0.92 (0.70, 1.2)	0.93 (0.71, 1.23)
Obese			0.93 (0.70, 1.22)	0.87 (0.65, 1.17)
Married				
Yes			0.93 (0.77, 1.13)	1.00 (0.83, 1.21)
No				
Education				
Less than High School			Reference	Reference
High School graduate			0.74 (0.61, 0.89)	0.82 (0.67, 1.00)
Beyond High School			0.67 (0.56, 0.81)	0.78 (0.65, 0.95)
Chronic diseases				
Yes			1.48 (1.01, 2.18)	1.04 (0.71, 1.54)
No			Reference	Reference
Mobility device use				
Yes			3.14 (2.64, 3.74)	1.62 (1.26, 2.08)
No			Reference	Reference
Vision impairment				
Yes			1.2 (0.94, 1.52)	1.05 (0.82, 1.35)
No			Reference	Reference
Major surgery				
Yes			1.29 (1.03, 1.61)	1.10 (0.88, 1.38)
No			Reference	Reference
Balance/coordination problems				
Yes				3.65 (3.00, 4.43)
No				Reference
Fatigue				
Yes				1.12 (0.92, 1.37)
No				Reference
Bothered by pain				
Yes				1.49 (1.20, 1.85)
No				Reference
Physical capacity				
Low				1.41 (1.00, 1.99)
Medium				1.12 (0.83, 1.52)
High				Reference

OR, odds ratio; CI, confidence interval.

Model 1: $\log_e\left(\frac{fall}{1-fall}\right) = \beta_0 + \beta_1(group) + \beta_2(age) + \beta_3(sex) + \beta_4(race) + \beta_5(weight\ status) + \beta_6(marital\ status) + \beta_7(education) + \beta_8(chronic\ disease) + \beta_9(mobility\ device) + \beta_{10}(vision\ impairment) + \beta_{11}(major\ surgery)$.

Model 2: $\log_e\left(\frac{fall}{1-fall}\right) = \beta_0 + \beta_1(group) + \beta_2(age) + \beta_3(sex) + \beta_4(race) + \beta_5(weight\ status) + \beta_6(marital\ status) + \beta_7(education) + \beta_8(chronic\ disease) + \beta_9(mobility\ device) + \beta_{10}(vision\ impairment) + \beta_{11}(major\ surgery) + \beta_{12}(balance\ and\ coordination) + \beta_{13}(fatigue) + \beta_{14}(pain) + \beta_{15}(physical\ capacity)$.

likelihood of falls among individuals with cognitive impairments and dementia. The findings help to identify at-risk subpopulations and highlight the complexities of the association between neurological disorders and falls in older adults.

Our findings of an increased likelihood of falls in older adults with stroke or dementia are consistent with previous studies [6,15–17]. There are a variety of factors that contribute to increased fall risk in the older adult population, including demographics (e.g., age, sex, race)

[18,19], medical history (e.g., prior injuries, surgeries, pain, arthritis, diabetes, neurological disorders, cognitive dysfunction) [15,19–25], increased health care needs (e.g., medical comorbidities, medications) [17,26], prior history of falls [18,27–30], physical impairments [24,29], and environmental factors [30]. Older adults with neurological disorders may have increased fall risk in part because of their complex health care needs [6,16,17]. However, an important constituent of fall risk is motor function, which is impaired in individuals with stroke and/

or dementia [6,7,31,32]. Further, older adults with neurological disorders have altered compensatory mechanisms in response to external perturbations [33]. These factors may help to explain their heightened fear of falling [32,34], which collectively increases their fall risk. In the current study, we found that after accounting for the lower motor functional capacity, the increased odds of a recent fall were attenuated in individuals with stroke, but not among individuals with dementia or stroke plus dementia. This finding is clinically important because motor function preservation through exercise intervention has been shown to reduce falls in older adults with dementia [35,36]; although, the effects of such exercise interventions to improve balance and falls in stroke survivors are somewhat equivocal [37–42].

To the authors' knowledge, this is the first study to show an increased likelihood of falls in older adults with both stroke and dementia. Evidence from recent studies indicate a greater prevalence of post-stroke dementia in the first year following stroke, with rates of dementia further increasing with severity of stroke and recurrent stroke [5,43]. Thus, it is possible that the greater odds of falls in those with both stroke and dementia could be partly because of greater sensorimotor issues (e.g., physical disability, pain, fatigue, etc.) caused by a major or recurrent stroke. Unfortunately, we were not able to determine whether dementia was pre- or post-stroke or the number of strokes and its severity. Nevertheless, we found that the fully-adjusted odds of a recent fall in individuals with dementia and stroke plus dementia were higher than stroke alone suggesting that cognitive and sensorimotor problems that are specific to dementia may contribute to the added risk. Thus, interventions focusing on improving brain health and secondary prevention of dementia are critical for reducing fall risk in individuals with stroke [44–46]. Further, interventions for fall prevention may benefit from tailored efforts based on the presence of stroke, dementia, or stroke plus dementia.

There are also some limitations to this study. First, because of the cross-sectional design, we were unable to determine causality or directionality in the exposure-outcome associations, as well as minimize unmeasured confounding. Second, it is unknown if older adults with pre-stroke dementia have a higher fall risk than post-stroke dementia. Third, data were reported by the respondent and are subject to bias or misreporting; however, most variables had a recall period of ≤ 1 month. Fourth, disease severity and age of onset, as well as the condition-specific health care needs (e.g., medications) were not available for analysis. Finally, we did not adjust for environmental factors and prior history of falls, which are significant risk factors for a recent fall [27–30]. We intentionally did not adjust for these factors because the presence of multiple falls is more prevalent in individuals with neurological conditions [47] and accounting for this factor would artificially attenuate the fall risk in these individuals. Similarly, individuals with neurological conditions, particularly those with dementia, may have greater difficulty in navigating through environmental barriers and hence, we believe that it is important not to account for these factors to completely capture how the presence of dementia increases the odds of a recent fall in stroke survivors.

5. Conclusions

In summary, the results of this study indicate that odds of a recent fall are elevated in stroke survivors in the presence of dementia. Further, motor functional capacity accounts for the increased likelihood of falls in individuals with stroke, but not necessarily among individuals with dementia or stroke plus dementia. Thus, interventions focusing on secondary prevention of dementia and improving motor functional capacity may reduce fall risk in individuals with stroke. The findings also emphasize the importance of clinician awareness and collaboration with advocacy groups and community stakeholders to advance community-based programs and prevention initiatives to minimize falls in older adults with neurological conditions, such as stroke and/or dementia.

Declarations of interest

None.

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