

Stroke Severity among Men and Women Acute Ischemic Stroke Patients in the Telestroke Network

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Keywords

Ischemic stroke · Sex differences · Risk factors · Outcomes · Elderly patients

Abstract

Introduction: This study investigates gender differences among stroke patients treated in the telestroke network using specific risk factors that contribute to stroke severity.

Methods: We examined gender differences in stroke severity among 454 patients hospitalized with acute ischemic stroke (AIS). The logistic regression model was used to predict clinical risk factors associated with stroke severity in men and women AIS patients. **Results:** In the adjusted analysis among women patients, increasing age (odds ratio [OR] = 1.05, 95% CI: 1.017–1.085, $p = 0.003$) and higher heart rate (OR = 1.031, 95% CI: 1.005–1.058, $p = 0.021$) were associated with worsening neurological functions, while direct admission (OR = 0.191, 95% CI: 0.079–0.465, $p < 0.001$) was associated with improving neurologic functions. Among men, hypertension (OR = 3.077, 95% CI: 1.060–8.931, $p = 0.039$) and higher international normalized ratio (INR) (OR = 21.959, 95% CI: 1.489–323.912, $p = 0.024$) were associated with worsening neurologic functions, while Caucasian (OR = 0.181,

95% CI: 0.062–0.526, $p = 0.002$) and obesity (OR = 0.449, 95% CI: 0.203–0.99, $p = 0.047$) were associated with neurologic improvement. **Conclusion:** Increasing age and heart rate in women, hypertension and greater INR in men contribute to worsening neurologic functions. There is a need to develop strategies to improve the care of both men and women in the telestroke network.

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Introduction

In an untreated control population, women ischemic stroke patients present with worse functional outcomes than men [1, 2], but when treated with a tissue plasminogen activator (rtPA), no difference in outcomes was reported [3]. Another study found that men are three times more likely to present with improved functional outcomes with rtPA treatment than women [4]. In general, the observed gender differences have been attributed to several factors such as age [5, 6], comorbidity [7, 8], pre-stroke functional status [9, 10], and stroke severity [7, 11].

While several studies have confirmed that women have increased severity of stroke compared to men [12–

14], most of the existing studies on gender and stroke have been carried out in the non-telestroke setting [12, 13, 15]. Whether the existing gender differences in stroke severity can be replicated in the telestroke setting is yet to be investigated. Therefore, the relationship between telestroke technology, stroke severity, and specific risk factors that contribute to gender differences is not fully understood.

There is more difficulty for patients who live in rural or medically underserved communities to obtain the appropriate care that matches current clinical practice recommendations [16]. While intensive stroke management is associated with improved care [17], many rural physicians have limited access to the resources or technology to offer ongoing support to their patients [18]. Access to subspecialties such as stroke neurologist is also minimal in most rural communities, as is access to transportation to and from medical appointments [19]. Therefore, a retrospective data analysis of specific factors that contribute to stroke severity and related gender differences in the telestroke network is an important step to identify comorbidities that can be managed to improve stroke care for men and women stroke patients in the telestroke network.

Methods

Study Population

The Institutional Review Board of the PRISMA Health Institutional Committee for Ethics approved this study (approval number: 00052571). We identified all patients ≥ 21 years of age treated in the telestroke network in January 2016 and June 2020 with a neurologist-confirmed diagnosis of AIS in the Neuro-Direct telestroke network. This telestroke has been described in previous studies [20, 21]. Briefly, the Neuro-Direct is the telestroke network at the Greenville Health System. It is the hub's main telestroke network, networking with 7 different spokes in the rural areas to provide acute stroke care to overcome the lack of expertise and resources and includes prehospital and/or in-hospital services. The Greenville Health System is a tertiary referral center and serves as the hub for the telestroke network as it has a comprehensive stroke team. It is staffed 24 h per day, 7 days per week by vascular neurologists and emergency department physicians experienced in acute stroke care.

Manual review of charts was carried out to extract variables from the Neuro-Direct registry to assess data points for stroke patients. Patients' medical records were reviewed by trained abstractors to confirm the diagnosis of AIS. For each case, trained abstractors used standardized forms to record data on patient demographics, medical history, and medications using patient charts or electronic medical records. The race or ethnicity was categorized as Caucasian, Black, Hispanic, or others. Data on patients that present within 24 h of symptom onset of an AIS based on relevant brain MRI or CT lesions were included in the analyses. Specific

examples of these lesions include early signs of ischemia (loss of gray/white matter distinction, hypodensity, or sulcal swelling) or middle cerebral artery hyperdensity. The registry has been described in previous studies [22, 23]. We collected data-specific characteristics including atrial fibrillation/atrial flutter, coronary artery disease, carotid stenosis, depression, diabetes, drug or alcohol use, dyslipidemia, family history of stroke, congestive heart failure, hypertension, migraine, obesity, prior stroke, prior TIA, prosthetic heart valve, peripheral vascular disease, chronic renal disease, sleep apnea, and history of smoking. In addition, we collected demographic variables including age, race, gender, ethnicity, BMI, and baseline National Institutes of Health Stroke Scale (NIHSS) score. Data on the degree of stroke severity according to the NIHSS score were collected on admission before thrombolysis. We used the initial or baseline NIHSS scores taken during admission to analyze stroke severity in male and female patients treated in the telestroke. The baseline NIHSS score is reported to represent an important predictor of initial severity before treatment. Patients with an NIHSS score ≤ 7 at the time of admission are reported to be more likely to make positive neurologic progress, whereas AIS patients presenting with an NIHSS score > 7 are more likely to experience worsening neurologic outcomes after a hemispheric stroke [8]. Moreover, findings from existing studies [10, 24, 25] reveal that there is a strong predictive value of early NIHSS scores, which will improve early identification of neurologic functional deficits in hemispheric stroke patients, both in non-telestroke and telestroke settings.

Patients' ambulatory data were recorded as undocumented (0), patients not able to ambulate (1), able to ambulate with assistance (2), and able to ambulate independently (3). These data were tracked and collected on admission, during admission, and after discharge. Improvement in functional outcome was calculated by taking their ambulation score at discharge and subtracting their ambulation score on admission. This method of scoring has been described in a previous study [26].

Statistical Analysis

Analysis of differences in the frequency of categorical variables was determined using the χ^2 test, while Student's *t* test was used to evaluate continuous variables. We determined different demographic and risk factors associated with an NIHSS > 7 or an NIHSS ≤ 7 dependent on gender. The binary logistic multivariate analyses were used to determine independent predictors of worsening neurologic function (NIHSS > 7) or improving neurologic function (NIHSS ≤ 7). We performed a post hoc-adjusted analysis (logistic regression) using the backward selection method to determine demographic and clinical risk factors associated with worsening or improving neurologic function. This approach allowed all the variables that we chose, approaching significance, to be initially included in the model. Odds ratios (ORs) were used to predict the odds of worsening or improving neurologic function for men or women based on specific demographics and risk factors.

Stroke severity was based on NIHSS score stratification and the dependent variable in the regression model. The demographic and risk factors for men and women were included as the primary independent variables in the regression model. The odds of presenting with a worsening neurological function (NIHSS > 7) or improving ability (NIHSS ≤ 7) were analyzed separately for the men and women. Multicollinearity and interactions among independent variables were determined using Hosmer-Lemeshow test.

Table 1. Demographic and clinical characteristics of an NIHSS score >7 and ≤7 in ischemic stroke patients in the telestroke stratified by gender

Characteristic	Women		p value	Men		p value
	NIHSS ≤7	NIHSS >7		NIHSS ≤7	NIHSS >7	
Patients, n	146	81		134	80	
Age group, n (%)						
<50 years	35 (24.0)	7 (8.6)	<0.001*, a	17 (12.7)	11 (13.8)	0.305
50–59 years	19 (13.0)	10 (12.3)		32 (23.9)	20 (25.0)	
60–69 years	43 (29.5)	18 (22.2)		40 (29.9)	19 (23.8)	
70–79 years	32 (21.9)	19 (23.5)		35 (26.1)	17 (21.3)	
≥80 years	17 (11.6)	27 (33.3)		10 (7.5)	13 (16.3)	
Age, years, mean ± SD	61.59±15.32	70.91±14.7	<0.001*, b	63.25±11.86	64.22±14.09	0.603
Race, n (%)						
Caucasian	120 (82.2)	64 (79.0)	0.275	120 (89.6)	56 (70.0)	0.001*, a
Black	24 (16.4)	13 (16.0)		11 (8.2)	19 (23.8)	
Other	2 (1.4)	4 (4.9)		3 (2.2)	5 (6.3)	
Hispanic ethnicity, n (%)	2 (1.4)	2 (2.5)	0.546	3 (2.2)	2 (2.5)	0.903
BMI, mean ± SD	29.94±7.1	28.8±8.17	0.276	29.65±5.84	29.87±7.9	0.818
Medical history, n (%)						
Atrial fib	13 (8.9)	23 (28.4)	<0.001*, a	7 (5.2)	7 (8.8)	0.313
Coronary artery disease	34 (23.3)	24 (29.6)	0.294	49 (36.6)	36 (45.0)	0.223
Carotid artery stenosis	5 (3.4)	3 (3.7)	0.913	8 (6.0)	5 (6.3)	0.934
Depression	22 (15.1)	14 (17.3)	0.662	16 (11.9)	9 (11.3)	0.879
Diabetes	56 (38.4)	27 (33.3)	0.452	52 (38.8)	36 (45.0)	0.373
Drugs or alcohol	3 (2.1)	2 (2.5)	0.839	5 (3.7)	6 (7.5)	0.227
Dyslipidemia	65 (44.5)	40 (49.5)	0.482	74 (55.2)	45 (56.3)	0.884
Stroke family history	19 (13.0)	12 (14.8)	0.705	12 (9.0)	7 (8.8)	0.959
Heart failure	11 (7.5)	13 (16.0)	0.046*, a	5 (3.7)	15 (18.8)	<0.001*, a
Hypertension	101 (69.2)	69 (85.2)	0.008*, a	101 (75.4)	70 (87.5)	0.032*, a
Migraine	9 (6.2)	1 (1.2)	0.083	2 (1.5)	0 (0.0)	0.272
Obesity	80 (54.8)	38 (46.9)	0.255	72 (53.7)	32 (40.0)	0.052
Previous stroke	34 (23.3)	20 (24.7)	0.812	27 (20.1)	20 (25.0)	0.407
Previous TIA (>24 h)	13 (8.9)	11 (13.6)	0.272	15 (11.2)	7 (8.8)	0.569
Prosthetic heart valve	1 (0.7)	0 (0.0)	0.455	1 (0.7)	1 (1.3)	0.711
Peripheral vascular disease	7 (4.8)	9 (11.1)	0.075	8 (6.0)	6 (7.5)	0.661
Chronic renal disease	5 (3.4)	5 (6.2)	0.334	6 (4.5)	4 (5.0)	0.861
Sleep apnea	4 (2.7)	1 (1.2)	0.459	7 (5.2)	2 (2.5)	0.337
Smoker	40 (27.4)	13 (16.0)	0.053	44 (32.8)	29 (36.3)	0.610
Medication history, n (%)						
HTN medication	89 (61.0)	63 (77.8)	0.010*, a	90 (67.2)	58 (72.5)	0.414
Cholesterol reducer	62 (42.5)	33 (40.7)	0.801	72 (53.7)	32 (40.0)	0.052
Diabetes medication	40 (27.4)	22 (27.2)	0.969	42 (31.3)	28 (35.0)	0.581
Antidepressant	24 (16.4)	15 (18.5)	0.691	15 (11.2)	6 (7.5)	0.379
Laboratory values, mean ± SD						
Total cholesterol	177.58±46.27	173±43.24	0.481	159.44±40.26	165.05±43.3	0.344
Triglycerides	156.19±94.63	127.65±109.73	0.048*, b	141.49±74.52	144.35±113.02	0.825
HDL	42.22±12.26	45.71±12.81	0.053	35.97±10.77	37.36±10.41	0.361
LDL	107.5±38.2	103.75±32.78	0.473	99.58±35.2	102.78±37.73	0.537
Lipids	6.46±1.75	6.47±2	0.979	6.34±1.67	6.66±1.86	0.206
Blood glucose	140.66±81.54	153.51±89.42	0.285	130.12±55.81	143.16±84.18	0.180
Serum creatinine	1.02±1.02	0.94±0.35	0.531	1.15±0.42	1.3±1.08	0.239
INR	1.02±0.15	1.08±0.31	0.104	1.03±0.13	1.11±0.26	0.040*, b
Vital signs, mean±SD						
Heart rate	78.43±13.36	85.23±18.7	0.002*, b	74.99±14.39	76.87±17.05	0.391
Blood pressure systolic	143.32±25.74	148.64±27.28	0.146	148.69±22.89	150.37±22.1	0.602
Blood pressure diastolic	77.23±16.55	79.37±17.73	0.364	83.66±16.15	80.95±15.5	0.232
Ambulation status prior to event, n (%)						

Table 1 (continued)

Characteristic	Women		p value	Men		p value
	NIHSS ≤7	NIHSS >7		NIHSS ≤7	NIHSS >7	
Ambulate independently	143 (97.9)	73 (90.1)	0.032 ^{*,a}	132 (98.5)	74 (92.5)	0.092
Ambulate with assistance	0 (0.0)	3 (3.7)		1 (0.7)	1 (1.3)	
Unable to ambulate	2 (1.4)	2 (2.5)		1 (0.7)	2 (2.5)	
Not documented	1 (0.7)	3 (3.7)		0 (0.0)	3 (3.8)	
Ambulation status on admission, n (%)						
Ambulate independently	52 (35.6)	3 (3.7)	<0.001 ^{*,a}	53 (39.6)	6 (7.5)	<0.001 ^{*,a}
Ambulate with assistance	49 (33.6)	13 (16.0)		37 (27.6)	11 (13.8)	
Unable to ambulate	10 (6.8)	51 (63.0)		3 (2.2)	43 (53.8)	
Not documented	35 (24.0)	14 (17.3)		41 (30.6)	20 (25.0)	
Ambulation status on discharge, n (%)						
Ambulate independently	96 (65.8)	15 (18.5)	<0.001 ^{*,a}	103 (76.9)	22 (27.5)	<0.001 ^{*,a}
Ambulate with assistance	42 (28.8)	32 (39.5)		27 (20.1)	26 (32.5)	
Unable to ambulate	7 (4.8)	23 (28.4)		2 (1.5)	20 (25.0)	
Not documented	1 (0.7)	11 (13.6)		2 (1.5)	12 (15.0)	
rtPA administration	97 (66.4)	56 (69.1)	0.678	93 (69.4)	58 (72.5)	0.631
First care received, n (%)						
Emergency department	34 (23.6)	29 (35.8)	0.051	33 (24.6)	25 (31.6)	0.266
Direct admission	110 (76.4)	52 (64.2)		101 (75.4)	54 (68.4)	
Improved ambulation, n (%)	63 (43.4)	40 (56.3)	0.075	62 (47.0)	36 (52.2)	0.483

* p value <0.05. ^a Pearson's χ^2 test. ^b Student's t test.

Table 2. Risk factors that were associated with an NIHSS score >7 for the ischemic stroke population of women in the telestroke

Variables	B value	Wald	OR	95% CI		p value
				lower	upper	
Increasing age	0.049	8.674	1.05	1.017	1.085	0.003*
Migraine	-2.095	2.939	0.123	0.011	1.35	0.086
INR	1.452	2.346	4.271	0.666	27.38	0.126
Heart rate	0.031	5.293	1.031	1.005	1.058	0.021*
Direct admission	-1.655	13.327	0.191	0.079	0.465	<0.001*

Backward stepwise model based on likelihood ratio was applied. Model assumptions were fulfilled. Multicollinearity and interactions among independent variables were checked, and no significant interactions were found. Hosmer-Lemeshow test ($p = 0.428$), Cox & Snell ($R^2 = 0.215$). Asterisk indicates significance.

ORs at 95% confidence intervals (95% CIs) of outcome measures were considered, and the significance level was set at the probability level of 0.05. The overall correct classification percentage and area under the receiver operating curve (ROC) were determined to analyze the logistic regression model's sensitivity, specificity, and accuracy. We performed all statistical analyses using the Statistical Package for Social Sciences version 26.0 for Windows (SPSS, Chicago, IL, USA).

Results

A total of 454 AIS patients were identified in this study, and 233 patients were women while 221 patients were men. The demographic and risk factors of patients with improving or worsening neurological function stratified by gender are presented in Table 1. Women with an NIHSS score >7 were older (70.91 ± 14.7 vs. 61.59 ± 15.32) and presented with higher rates of atrial fibrillation (28.4

Table 3. Risk factors that were associated with an NIHSS score >7 for the ischemic stroke population of men in the telestroke

Variables	B value	Wald	OR	95% CI		p value
				lower	upper	
Caucasian	-1.709	9.857	0.181	0.062	0.526	0.002*
Hypertension	1.124	4.276	3.077	1.06	8.931	0.039*
Obesity	-0.801	3.935	0.449	0.203	0.99	0.047*
Cholesterol reducer	-0.751	3.242	0.472	0.208	1.069	0.072
INR	3.089	5.061	21.959	1.489	323.912	0.024*

Backward stepwise model based on likelihood ratio was applied. Model assumptions were fulfilled. Multicollinearity and interactions among independent variables were checked, and no significant interactions were found. Hosmer-Lemeshow test ($p = 0.949$), Cox & Snell ($R^2 = 0.200$). Asterisk indicates significance.

vs. 8.9%), heart failure (16.0 vs. 7.5%), hypertension (85.2 vs. 69.2%), and use of hypertension medications (77.8 vs. 61.0%). Moreover, women with worsening neurological functions presented with lower serum triglycerides (127.65 ± 109.73 mg/dL vs. 156.19 ± 94.63 mg/dL) but higher heart rate (85.23 ± 18.7 bpm vs. 78.43 ± 13.36 bpm). This group differed significantly on ambulation status before the event, admission, and discharge. Men with an NIHSS score >7 were less likely to be white (70.0 vs. 89.6%) and presented with higher rates of heart failure (18.8 vs. 3.7%), hypertension (87.5 vs. 75.4%), and higher international normalized ratio (INR) (1.11 ± 0.26 vs. 1.03 ± 0.13). This group differed significantly on ambulation status upon admission and discharge.

In the adjusted analysis for women patients, increasing age (OR = 1.05, 95% CI: 1.017–1.085, $p = 0.003$) and heart rate (OR = 1.031, 95% CI: 1.005–1.058, $p = 0.021$) were associated with worsening neurological functions, while direct admission (OR = 0.191, 95% CI: 0.079–0.465, $p < 0.001$) was associated with improving neurologic functions (Table 2). The ROC curve for the predictive power of the regression model is presented in Figure 1. The discriminating capability of the model was strong, as shown by the ROC curve, with the area under the curve = 0.791 (95% CI: 0.718–0.864, $p < 0.001$). For men (Table 3), hypertension (OR = 3.077, 95% CI: 1.060–8.931, $p = 0.039$) and higher INR (OR = 21.959, 95% CI: 1.489–323.912, $p = 0.024$) were associated with worsening neurologic functions. Caucasian men (OR = 0.181, 95% CI: 0.062–0.526, $p = 0.002$) with obesity (OR = 0.449, 95% CI: 0.203–0.99, $p = 0.047$) were more likely to be associated with neurologic improvement. As presented in Figure 2, the predictive power of the logistic regression was strong. The area under the curve is 0.755 (95% CI: 0.673–0.837, $p < 0.001$).

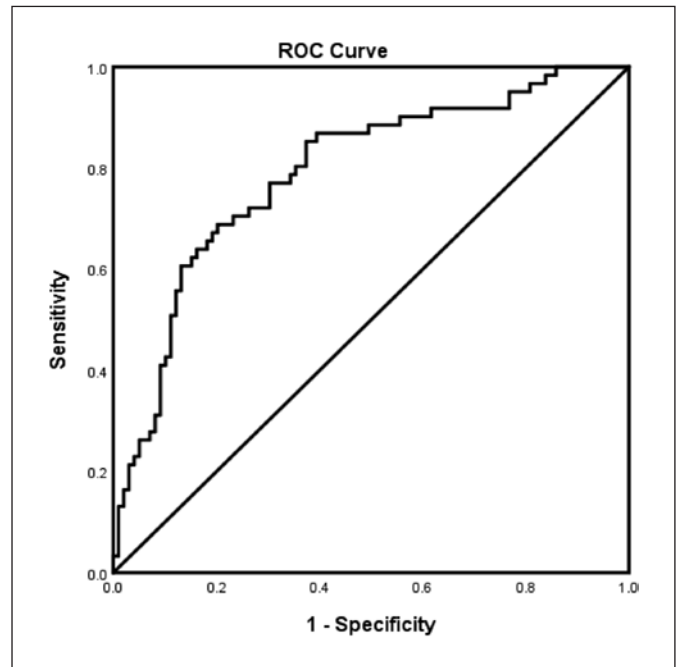


Fig. 1. ROC curve associated with prediction of an NIHSS >7 for AIS population of women in the telestroke. Higher area under the curve (AUC) values in ROC analysis indicate better discrimination of the score for the measured outcome. Classification table (overall correctly classified percentage = 73.8%) and area under the ROC curve (AUC = 0.791, 0.718–0.864) were applied to check model fitness.

Discussion

Three major findings arise from this study. First, we found that more women were treated in the telestroke compared with men. Second, in the adjusted analysis, in-

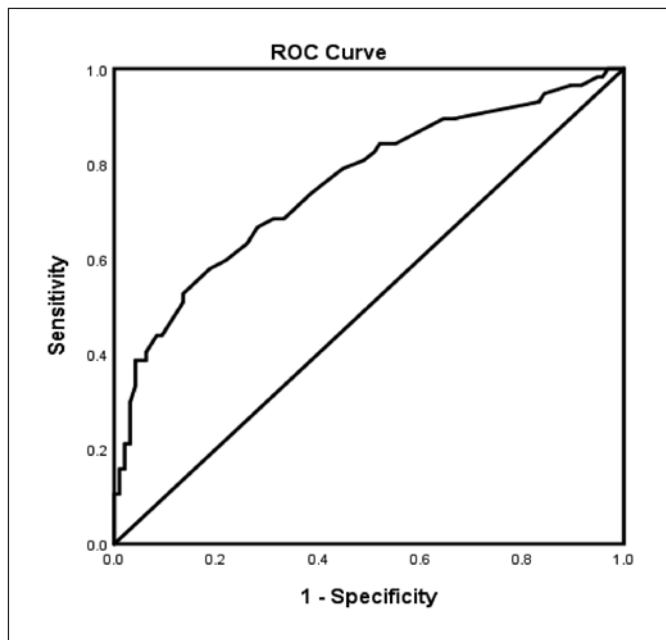


Fig. 2. ROC curve associated with prediction of having an NIHSS >7 for AIS population of men in the telestroke. Higher area under the curve (AUC) values in ROC analysis indicate better discrimination of the score for the measured outcome. Classification table (overall correctly classified percentage = 73.2%) and area under the ROC curve (AUC = 0.755, 0.673–0.837) were applied to check model fitness.

creasing age and heart rate were associated with worsening neurologic functions in women. Third and in contrast, hypertension and higher INR were associated with worsening neurologic functions in men. Our finding that increasing age was associated with worsening neurological functions is supported by other finding in older patients, especially those >80, that present with a combined range of comorbidities, including carotid artery stenosis, hypertension, and previous stroke conditions [27]. There were more women stroke patients with ages >80 than men patients with ages >80 in our study. Existing studies [28, 29] support the finding that a stroke population age structure with more women older than 80 suffers more severity. The total number of strokes is higher, and the outcomes are worse among women. This is due to women typically living longer and stroke risk increasing with age [28–30]. In addition, women present with more severe neurologic impairments following a stroke and are less likely to receive acute stroke therapies and have worse functional outcomes after hospitalizations [31]. A significant benefit of the telestroke network is that it provides a high quality of acute stroke care, including diagnostic

procedures, management of stroke comorbidities, and access to allied health assessments than in control hospitals [32]. Therefore, identifying specific comorbidities that contribute to the initial stroke severity in men and women is necessary to help improve the efficiency of the telestroke network in the care of stroke patients. Additionally, this is necessary to determine specific risk factors that can be managed to eliminate disparities and improve stroke care for all patients, irrespective of gender. The current study assessed gender differences in stroke severity in the telestroke network using risk factors, and our results were consistent with previous studies in the non-telestroke setting in that severity of stroke is greater in women >80 years old.

In general, gender differences regarding traditional stroke risk factors have been reported in previous studies within non-telestroke settings [2, 12, 33]. Findings reveal that hypertension, diabetes mellitus, atrial fibrillation, and high cholesterol level are important modifiable stroke risk factors, while smoking, alcohol consumption, and obesity are all important modifiable lifestyle risk factors [34]. Women are more likely to present with hypertension, diabetes mellitus, and obesity [12, 35]. In contrast, men are more likely to present with a history of heart disease, myocardial infarction, peripheral arterial disease, current smoking, and alcohol consumption [5, 6, 36, 37]. Our current study found that women presenting with AIS with increased heart rate treated in the telestroke network were associated with worsening neurologic functions. Additionally, AIS with hypertension and higher INR were associated with worsening neurologic functions.

We observed that direct admission was associated with improved neurologic functions in women, while Caucasian patients and obesity were associated with improved neurologic functions in men. Our finding that Caucasians and direct admission for treatment were associated with improving neurologic functions is consistent with other studies that show that Caucasian stroke patients [10] and direct admission [38] were associated with improved functional outcomes. In addition, our finding of an association between obesity and improving neurologic functions is similar to other studies on ischemic stroke [39, 40], coronary artery disease, and congestive heart failure [41, 42]. However, this finding needs to be cautiously interpreted, as we used a data analytical approach that does not allow the randomization of our data collection. Therefore, the need for well-designed randomized controlled trials analyzing the effects of weight reduction on stroke severity in men and women will be necessary for future studies.

There are several limitations to this study. First, all our patients were from rural telestroke networks, and our data cannot represent all stroke patients. Second, we did not collect information regarding several important stroke conditions, including prestroke dependency, time from stroke onset to hospital admission, and post-treatment NIHSS scores. Third, our stroke severity was based on initial NIHSS scores and neurologic functions. The timeline of NIHSS score assessment in acute stroke may be an important correlation of the outcome, and in this study, the measure was obtained within 24 h. Although this is common in data sets using administrative data, it limits generalizability. Nevertheless, the significance of the NIHSS score for stroke outcome models is well-recognized for assessing stroke severity [43]. Third, we did not collect data on cardioembolic stroke, large or small vessel stroke. Therefore, we could not determine whether women presented with more cardioembolic stroke or that men presented with a large or small vessel stroke in our sample.

Generally, women are more likely to present with comorbidities of atrial fibrillation [25] and hypertension [26], whereas men are more likely to present with congestive heart disease and diabetes [27]. While existing studies [25–27] reveal evidence of a gender difference in stroke symptoms, past clinical history and comorbidities in the non-telestroke setting, how these may contribute to stroke severity and possible gender difference in the telestroke setting is not fully understood. A significant benefit of the telestroke network is that it provides a high quality of acute stroke care, including diagnostic procedures, management of stroke comorbidities, and access to allied health assessments than in control hospitals. Therefore, identifying specific comorbidities that contribute to the initial stroke severity in men and women is necessary to help improve the efficiency of the telestroke network in the care of stroke patients. Moreover, this is necessary to determine specific risk factors that can be managed to eliminate disparities and improve stroke care for all patients, irrespective of gender in the telestroke network. In our study, we observed that increasing age and heart rate in women, while hypertension and higher INR in men were associated with increased stroke severity in patients in the telestroke network. Our findings indicate a gender difference in stroke severity among AIS patients treated in the telestroke setting.

Conclusion

We observed significant gender differences in stroke severity, and older women with a higher heart rate are more likely to have a severe stroke. This finding explains why more women are reported to experience severe stroke outcomes. Gender is not an independent risk factor of stroke outcome but rather contributes to increased stroke severity in women. Therefore, elderly women AIS patients are a crucial population that should be assisted with managing their risk factors for better care in the telestroke network.

Acknowledgment

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Statement of Ethics

This is a retrospective data collection using de-identified data. This study was granted an exemption from requiring written informed consent and was approved by the Institutional Review Board of PRISMA Health Institutional Committee for Ethics (approval number: 00052571).

Conflict of Interest Statement

The authors have no conflicts of interest to declare.

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Author Contributions

Nicolas Poupore, Camron Edrissi, and Thomas I. Nathaniel designed the concept, experimental design, and data analysis, while Nicolas Poupore and Camron Edrissi did all data analysis and table development. Mareshah Sowah, Jonah Joffe, Donovan Lewis, Teanda Cunningham, Carolyn Breana Sanders, Krista Knisely, and Chase Rathfoot critically revised the drafts, interpreted the results, and read and approved the last version of the manuscript.

Data Availability Statement

The retrospective datasets are available by request from the corresponding author of this paper.

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