Differences in fear of falling and fall risk indicators among white and black older adults: a cross sectional study

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Research article

Keywords: Race, Fall Risk, Fear of Falling, Fall History, Older Adults, Gait Speed, Assistive Device

Posted Date: October 14th, 2019

DOI: https://doi.org/10.21203/rs.2.15996/v1

Abstract

Background Falling among older adults is common and can cause chronic health complications. This study investigated differences between White and Black community-dwelling older adults in fall history, fear of falling, and indicators of fall risk.

Methods All assessments and analyses were conducted in a clinical laboratory at Emory University in the Department of General Medicine and Geriatrics on 84 diverse community-dwelling older adults (White, n=37; Black, n=47). Statistical analyses included one-way ANOVA for continuous variables, the Fisher exact test for categorical variables, the Mann-Whitney-Wilcoxon test for ordinal variables, and an ordinal logistic regression model to examine which factors predicted fear of falling. Measures included fall history, fear of falling, and fall risk indicators. The Montreal Cognitive Assessment, Activities-Specific Balance Confidence Score, Gait Speed, Short Form 12 Physical Component Score and Mental Component Score, fear of falling and quality of life rating scales and demographics questionnaires were administered.

Results Falls history was not significantly different between groups. Black participants had significantly fewer years of education (p=.007), lower MoCA scores (p=0.002), and slower fast gait speed (p=0.032) than White participants. However, Black participants reported significantly less fear of falling (p=0.043). Race (Black/White) (p=<0.001), sex (p=0.028), preferred gait speed (p=0.036), and a dichotomous variable of use of assistive device for walking (p=0.023) were significant predictors of fear of falling in the logistical model.

Conclusions These factors may explain the observed differences in fear of falling observed between white and black groups in this study. This work offers an explanation of possible factors related to the well-documented yet poorly understood fact that while Black older adults have more risk factors for falling, White older adults tend to fall more frequently and are more afraid of falling.

Background

Every year, up to 30 percent of adults aged 65 and older fall, which can lead to chronic complications and a decreased quality of life (1). Approximately 2.8 million older adults are admitted annually to an emergency room due to fall-related injuries (2). Research from the Centers for Disease Control and Prevention indicates that after just one fall, older adults develop a fear of falling and perceive a higher risk of falling, which increases risk of falling (2). The National Council on Aging found that older people have increased mortality risk from falls and fall-related injuries (3). In 2016, one in four deaths among people aged 65 or older were from a fall-related injury (3). Death rates from falls and fall-related injuries were higher for those aged 85 and older. As the percentage of American people over the age of 65 increases, fall incidence and healthcare costs will increase (4).

Several factors are associated with fall risk among older adults. General health appears to be an important factor for both fall risk indicators and fear of falling (5). Older adults who use an assistive

device to walk and those with more chronic diseases are at an increased risk for falling (6). Additionally, polypharmacy, the use of multiple prescription medications by a single person to treat one or more conditions, is associated with greater fall risk among older adults (7). Some medications have side effects that increase fall risk. For example, older adults take more anti-depressants than any other age group, and taking anti-depressant medication is associated with falls. (8, 9) Additional factors associated with fall risk include cognitive function, a history of falling. Individuals with cognitive impairments are at an increased risk for falling, (10) and individuals who have fallen in the past are more likely to fall in the future (11).

Socio-demographic factors, including education level, physical activity level, and living alone are also associated with fall risk. Research suggests that increased fall risk is associated with lower education levels, because increased education leads to improved thinking and decision-making about health behaviors (12). Conversely, individuals with lower education levels may not have the opportunity to develop the same skills and behaviors, which could increase risk of falling (12). Evidence also suggests that Caucasian/white groups generally fall more than African American/black groups, (13) despite having on average fewer chronic diseases, (14) higher incomes, and higher educational levels (15). The decreased risk of falling among black populations has been hypothesized to be related to the fact that black older adults are less likely to live alone and that higher rates of motor disabilities combined with lower rates of physical activity among black populations might be protective against falls, as individuals who are less physically active might be less likely to participate in activities where they might fall (13). In fact, a large nationally representative longitudinal survey of 7,609 community-dwelling participants in the National Health and Aging Trends Study reported blacks had a 30–40% decreased fall risk as compared to whites. However, this phenomenon was not explained by differences in motor disability, physical activity, or living alone (13). Current understanding of differences in socio-demographic factors is insufficient to explain differences in fall risk, particularly in relationship to race.

Despite the morbidity and mortality risks associated with falls among older adults, no research currently exists that examines differences in fall risk indicators and fear of falling between white and black groups.Furthermore, black and minority older adults are historically underrepresented in scientific research; however, including them in research is crucial to a holistic understanding of falling among older adults. If factors that protect older black populations from falling can be better understood, interventions can be created to help decrease fall risk among all older adults. Given that fear of falling is a subjective measure that is associated with several factors that increase actual risk of falling, we were interested in exploring differences in fear of falling by race. Concurrent with previous research, we hypothesized that white older would fall more often than black older adults. Furthermore, we are interested in seeing if fall risk indicators such as an increased use of assistive device, number of prescriptions and comorbidities, number of falls experienced in the past year, and decreased education level would lead to a greater fear of falling. Therefore, due to literature suggesting that black older adults tend to have an increased number of chronic diseases and fall risk indicators, we hypothesized that black older adults would have a greater fear of falling.

The aim of this paper was to add to the current literature, which mostly examines factors associated with fall risk separately between races, by exploring fall risk factors and perceptions among races. A difference in fall rate among races is well-documented, but the reasons for these varying fall rates have yet to yield significant findings. The findings of this study may help elucidate reasons for the well-documented yet little understood differences in fall prevalence among white and black populations.

Methods

Ethics: The Institutional Review Board at Emory University School of Medicine and the Research and Development Committee of the Atlanta VA approved this work under IRB # IRB00060613 and IRB00080676. Participants provided written informed consent before participating. This study includes veteran and non-veteran participants. Veterans were recruited through the VA Informatics and Computing Infrastructure database. Recruitment for non-veteran participants included educational meetings, newsletters and foundation events, physician referrals, word of mouth, and outreach events. Interested individuals provided contact information to make an initial assessment appointment. All paper and electronic data files were coded and de-identified to maintain participant confidentiality.

Design: This cross-sectional study used retrospective secondary data analysis on data collected from participants who participated in two studies conducted between 2013 and 2017

Participants: Inclusion criteria for participants (n = 84; 64 women) was age older than 55 years, at least 12 years of education and a MoCA score>16. White participants (n = 37) averaged 69.13 years old (SD = 6.17), while black participants (n = 47) averaged 66.9 years old (SD = 6.17). On average, participants had 15 years of education, three comorbidities, and took three prescription medications. Participants represented diverse socio-economic and educational sectors of the population in metro Atlanta, GA (Table 1).

Table 1: Participant Characteristics

Variable	Sample (n=84)	Black (n=47)	White (n=37)	P-Value
	M ±SD (%)	M ±SD (%)	M ±SD (%)	
Age (Years)	69.0 ± 5.2	68.3 ± 5.1	70.0 ± 5.3	0.147
Sex (M/F)	20/64	11/36	9/28	
Years Education	15.1 ± 2.7	14.4 ± 2.5	16.0 ± 2.7	0.007*
Comorbidities	2.8±1.9	2.87 ± 1.7	2.8 ± 2.0	0.886
Prescriptions	3.2 ± 3.1	2.7 ± 2.7	3.7 ± 3.4	0.159
Transportation [a]				0.216
Self	65 (77.4%)	34 (72.3%)	32 (86.5%)	
Family	7 (8.3%)	7 (14.9%)	1 (2.7%)	
Service	6 (7.1%)	4 (8.5%)	2 (5.4%)	
Public	7 (8.3%)	4 (8.5%)	3 (8.1%)	
Type of Housing				0.342
Own House	58 (69.1%)	30 (63.8%)	28 (75.7%)	
Senior Residence	26 (54.2%)	17 (36.2%)	9 (24.3%)	

Table 1: Participant Characteristics; values are presented as mean ± standard deviation unless otherwise noted

[a] People who selected multiple modes were counted multiple times

* Significant at the alpha=0.05 level

Fall Risk Indicator Measures: The following measures were administered to all participants in one session.

The Montreal Cognitive Assessment (MoCA) is a researcher-administered rapid screen for mild cognitive dysfunction that examines attention and concentration, executive function, memory, language, visuoconstructional skills, conceptual thinking, calculations, and orientation.(16) MoCA scores range from 0–30. Scores >26 indicate normal cognition, scores between 18 and 25 indicate mild cognitive impairment, and scores <18 indicate more severe cognitive impairment. (17) A score of 16 was selected as the cut-off value for inclusion in this study because individuals a score of less than 16 were presumed to be less likely to be community-dwelling.

Preferred Gait Speed has been shown to reflect health and functional status among older adults. (18) Preferred, backward, and fast-as-possible (fast) gait speeds are measured to find average gait speed (m/s) for each type of walk. Slower gait speeds are associated with disease severity, mobility and fall risk. Participants are timed with a stopwatch walking at preferred, as fast as possible and backwards for 20 feet to determine meters walked per second.

Short-Form 12 (SF–12) is a self-rated 12-item measure of general health and measures eight key domains: physical functioning, role limitations due to physical health problems, bodily pain, general health, vitality, social functioning, role limitations due to emotional problems, and mental health. Physical

Component Scores (PCS) and Mental Component Scores (MCS) ranging from 0–100 (0 = lowest level of health, 100 = highest level of health) are obtained (19).

Additional Factors Associated with Falling: In addition to completing a comprehensive demographics questionnaire, participants were asked about the following variables associated with falls:

- Number of Falls experienced in the past year
- Number of Prescriptions
- Years of Education
- Number of Comorbidities

Fear of Falling *Indicator Measures:*

The Activities-Specific Balance Scale (ABC) is a 16-item self-reported measure where participants rate their confidence to maintain their balance during common activities. Confidence is rated from 0%–100% (0% = “no confidence,” 100% = “completely confident”) (20).

Fear of Falling and Quality of Life: Participants were assessed for fear of falling and quality of life through single item questions:

- How worried about falling are you? (7-point Likert scale ranging from 1 = “not at all” worried to 7 = “extremely” worried) (21).
- In general, how would you rate the quality of your life? (7-point Likert scale ranging from 1 = “very low” to 7 = “very high”) (22).

Data Analysis

Data were analyzed for normality. Descriptive analyses were performed on all characteristics and outcome variables to obtain item means and standard deviations. One-way Analysis of Variance (ANOVA) was used for continuous variables (age, MoCA, ABC, gait speed and education). One-way ANOVAs based on negative binomial regression were performed for continuous variables that were not normally distributed (number of falls in past year, number of prescription medications and number of comorbidities). For categorical variables (e.g., sex), the Fisher exact test was used. For ordinal variables (fear of falling single item, and use of assistive device), the Mann-Whitney-Wilcoxon test was used. Alpha was set at 0.05.

Ordinal logistic regression was performed to determine factors that predicted fear of falling to ascertain that the group difference remained. The Backward stepwise procedure was used to be parsimonious with the predictor variables given the limited number of observations. The Akaike information criterion (AIC) was used to determine the criteria for retention in the model, wherein the preferred model would have the minimum AIC value. The statistical package R version 3.4 was used for all analyses.

Results

Table 1 describes sample characteristics. All participants had at least a high school education, but black participants had on average, 2.5 years less than white participants. Given that years of education were significantly different between groups, education was controlled for in the logistic model (Table 3). The black and white groups were not significantly different in any other measured socio-demographic category.

Fast gait speed and MoCA were significantly different between black and white participant groups, with black participants having slower fast gait speeds and lower average MoCA scores (Table 2). No other fall risk indicators were different between groups. White participants reported being more afraid of falling than black participants ($p = 0.043$). There were no significant differences between groups in quality of life or balance confidence (Table 2).

Table 2: Differences by Race in Fall Risk Indicators and Fear of Falling

Variable	Group	N	Mean	SD	Tests Statistic	P-Value
Forward Gait Speed[1]	White	37	1.17	0.2	F=3.628	0.060
	Black	44	1.06	0.29		
	Overall	81	1.11	0.26		
Backward Gait Speed[1]	White	37	0.83	0.24	F=1.59	0.211
	Black	44	0.75	0.3		
	Overall	81	0.79	0.27		
Fast Gait Speed[1]	White	37	1.63	0.37	F=4.748	0.032*
	Black	44	1.44	0.4		
	Overall	81	1.52	0.4		
SF12: Physical Composite Score[1]	White	36	47.37	12.48	F=0.992	0.322
	Black	47	49.9	10.61		
	Overall	83	48.8	11.46		
SF12: Mental Composite Score[1]	White	36	51.44	8.79	F=0.036	0.849
	Black	47	51.82	9.14		
	Overall	83	51.66	8.94		
Number of Falls[2]	White	35	0.54	1.01	Z=0.501	0.617
	Black	45	0.44	0.76		
	Overall	80	0.49	0.87		
Prescription Medications[2]	White	36	3.67	3.41	Z=1.408	0.159
	Black	43	2.72	2.68		
	Overall	79	3.15	3.05		
Use of Assistive Device[3]	White	37	0.3	0.66	W=904	0.669
	Black	47	0.34	0.67		
	Overall	84	0.32	0.66		
MoCA[1]	White	37	26.19	3.23	F=9.87	0.002*
	Black	44	23.77	3.62		
	Overall	81	24.88	3.63		
ABC Average[1]	White	36	89.03	12.31	F=0.251	0.618
	Black	40	86.87	23.05		
	Overall	76	87.89	18.66		
Fear of Falling[3]	White	37	2.41	1.39	W=661	0.043*
	Black	47	1.89	1.49		
	Overall	84	2.12	1.46		
Quality of Life[3]	White	37	5.7	1.04	W=893.5	0.828
	Black	47	5.64	1.4		
	Overall	84	5.67	1.25		

Table 2: Differences by Race in Fall Risk Indicators and Fear of Falling; results are presented by mean ± standard deviation, and separated by White, Black, and Overall (whole sample)

[1]One-way ANOVA analysis for normally distributed continuous variables was performed

[2] One-way ANOVA based on negative binomial regression analysis for non-normal continuous variables was performed

[3]Mann-Whitney Wilcoxen test for ordinal variables was performed

* Significant at the alpha=0.05 level

The ordinal logistic regression model with dependent variable, fear of falling, and backward selection method examined different factors which might explain the significant difference in fear of falling by racial group (Table 3). Variables that remained significant in the final model included race (Figure 1), sex (Figure 1), gait speed (Figure 2), and use of an assistive device for walking (Table 3).

Table 3: A Model for Factors Influencing Fear of Falling among all Participants^

Variable	Coefficient	SD	t-value	p-value
Race	2.965	0.794	3.736	0.0002*
Sex (M/F)	-2.051	0.934	-2.196	0.0281*
Age	-0.098	0.064	-1.522	0.128
MoCA	-0.179	0.117	-1.531	0.126
Forward Gait Speed	5.009	2.382	2.101	0.036*
Backward Gait Speed	-5.799	2.422	-2.394	0.017*
Comorbidities	0.32	0.201	1.59	0.112
Assistive Device (Y/N)	-4.154	1.826	-2.275	0.023*
Assistive Device (Sometimes)	0.606	1.501	0.403	0.687
Years of Education	-0.313	0.164	-1.909	0.056

Table 3: A Model for Factors Influencing Fear of Falling among all Participants; an ordinal logistic regression was performed to determine which factors predicted fear of falling

* Significant at the alpha=0.05 level

^ Backward selection method was used to determine which factors remain in the final model

Among black and white older adult populations with similar baseline characteristics, the fall risk factors of gait speed and cognitive ability differed between the two populations. White participants were more worried about falling on the single-item screening measure. This finding was in spite of the fact that Black participants had significantly slower fast-gait speed and lower MoCA scores, which would have suggested that black participants are at a higher risk for falls than white participants.

In contrast to the single item assessing fear of falling, black and white participants did not differ significantly on average ABC score. The ABC measures both vestibular and non-vestibular balance, as well as functional mobility (23). Although decreased functional mobility and impaired balance increases risk of falling, there is a subtle difference in asking people how confident they are that they can keep their balance under various circumstances compared to asking people “How worried are you about falling?” Perhaps the participants do not engage in the scenarios covered by the ABC scale such as walking on an icy sidewalk, or perhaps confounding factors such as use of an assistive device for walking, impede the ability of the ABC to predict how worried someone will be about falling. The ABC is not designed to measure fear of falling but functional dis/ability, whereas the single-item “fall worry” rating scale question has this explicit purpose.

Despite the differences in risk factors and fear of falling, black and white participants did not differ significantly in number of falls in the past 12 months. While literature suggests that white older adults tend to fall more often than black older adults, (14) this difference was not observed in our sample.

Race, sex, gait speed, and use of an assistive device were predictive of fear of falling in the regression model, suggesting that the contributions of these combined factors may interact to partially explain fear of falling. The suggestion that multiple factors contribute to fear of falling may help explain why it has been difficult to elucidate race-based differences in being worried about falling in studies that sought to isolate fall risk factors.

Sex: Although not examined in this sample, sex differences in falling and in fear of falling have been documented in other studies, suggesting that there are differences in where people fall (indoor vs. outdoor) between men and women, and that women are nearly twice as likely as men to be injured when they fall indoors (24). Additionally, women are more likely to be worried about falling (25). The results of our regression analysis are consistent with this literature in that sex is an important factor for predicting fear of falling.

Race: Racial differences in health have been well documented, with significant health disparities among black populations observed for all-cause mortality, heart disease mortality, cancer mortality, female breast cancer mortality, diabetes mellitus mortality, motor vehicle crash mortality, tuberculosis case rate, and syphilis case rate (26). It remains unclear why white populations fall more frequently than black populations, given the many differences observed in black populations where blacks have poorer health outcomes than white counterparts. Our study suggests that white participants may also have greater fear of falling than black participants, but our data are insufficient to explain this observed difference.

Gait Speed: Gait speed is associated with fear of falling in older adult populations (27). People who are at risk of falling tend to have slower gait speeds; however, by walking more slowly, fall risk is mitigated (28). One study examining the relationship between sex and gait speed in older adults found that differences in gait speed and sex are not significant when adjusted for the height of the participant (5). Our study did not measure participant height, and therefore the association between gait speed and fear of falling may be confounded by participant height and other physical characteristics that were not examined. More focused research is needed to understand the interaction between sex and gait speed in the production of fear of falling. However, since fall risk is associated with slower gait speed, (28) it would stand to reason that people who are more afraid of falling walk more slowly to compensate for greater fear of falling.

Use of Assistive Device: Literature suggests that black older adults are more likely to use an assistive device than white older adults (29). People who have a fear of falling have been shown to compensate for this fear by using an assistive device, often a cane (11). In a large nationally-representative study, use of an assistive device for walking was not found to be associated with greater incidence of falls (11). Studies also suggest that people who use an assistive device for walking are more likely to be injured when they fall (30). A study examining fear of falling among blacks versus whites who all use assistive devices is needed to determine the nature of the relationship between race, fear of falling, and use of an

assistive device. However, it is likely that the findings in our study are consistent with other studies showing that using an assistive device is indicative of greater fear of falling, regardless of race or ethnicity.

Limitations: The greatest limitation to our study is that we did not have qualitative information exploring individual factors that influenced fear of falling. This information would have allowed for more nuanced exploration of socio-cultural factors that cause white participants to be more afraid of falling than black participants. Indeed, given that the higher fall rate among white older adults has been well document and researched extensively but remains unexplained, asking participants to describe their fear of falling may provide the “missing link” needed to identify important variables influencing both fear of falling and fall risk differences between races. Additionally, larger samples are needed to confirm the findings of this study. Analyzing differences in fear of falling by sex, education level, physical function and cognitive function would be helpful for determining to what extent factors other than race influence fear of falling.

Conclusion

While differences in race, sex, gait speed, and use of an assistive device for walking may contribute to the understanding why some older adults are more afraid of falling than others, this study highlights the need to explore the root causes of fear of falling between racially different populations. Moving forward, additional qualitative questions including “What are your concerns about falling?” and “What do you think would happen if you experienced a fall?” would help clarify the nuances of being worried about falling so that differences in fear of falling between racial groups might be more easily understood.

Abbreviations

The Montreal Cognitive Assessment (MoCA); Activities Specific Balance Scale (ABC); Short Form–12 (SF–12); Analysis of Variance (ANOVA); Akaike information criterion (AIC)

Declarations

Ethics: The Institutional Review Board at Emory University School of Medicine and the Research and Development Committee of the Atlanta VA approved this work under IRB # IRB00060613 and IRB00080676. Participants provided written informed consent before participating. This study includes veteran and non-veteran participants. Veterans were recruited through the VA Informatics and Computing Infrastructure database. Recruitment for non-veteran participants included educational meetings, newsletters and foundation events, physician referrals, word of mouth, and outreach events. Interested individuals provided contact information to make an initial assessment appointment. All paper and electronic data files were coded and de-identified to maintain participant confidentiality.

Consent for Publication: Not Applicable

Availability of data and materials: The datasets generated and/or analyzed during the current study are not publicly available due to the fact that the study is ongoing but are available from the corresponding author on reasonable request.

Competing Interests: The authors declare they have no competing interests.

Funding: Department of Veterans Affairs R&D Service Career Development Awards E7108M and N0780W, and Parkinson's Foundation grant number PF-PLA–1706 supported this work.

The funding agencies played no role in the design of the study and collection, analysis, and interpretation of data or in writing the manuscript.

Author's Contributions:

Allison A. Bay assisted with literature reviewing, data collection, designing the research question, prepared the dataset, and was a major contributor in writing the manuscript.

Smrithi Ramachandran performed background literature reviews and was a major contributor in writing the manuscript. Hayley A. Silverstein assisted with data collection and was a major contributor in writing the manuscript. Jiayang Song advised on statistical methods and completed the statistical analysis. Ariel R. Hart and Ariyana Bozorg collected the data analyzed in this study. Madeleine E. Hackney is the P. I. and oversaw all aspects of the production of this manuscript. All authors read and approved the final manuscript.

Acknowledgements: Department of Veterans Affairs Career Development award N0870W supported ME Hackney. We acknowledge the Emory Center for Health in Aging. This study was also supported by the Undergraduate Research Partners Program at the Emory University College of Arts and Sciences.

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Figures

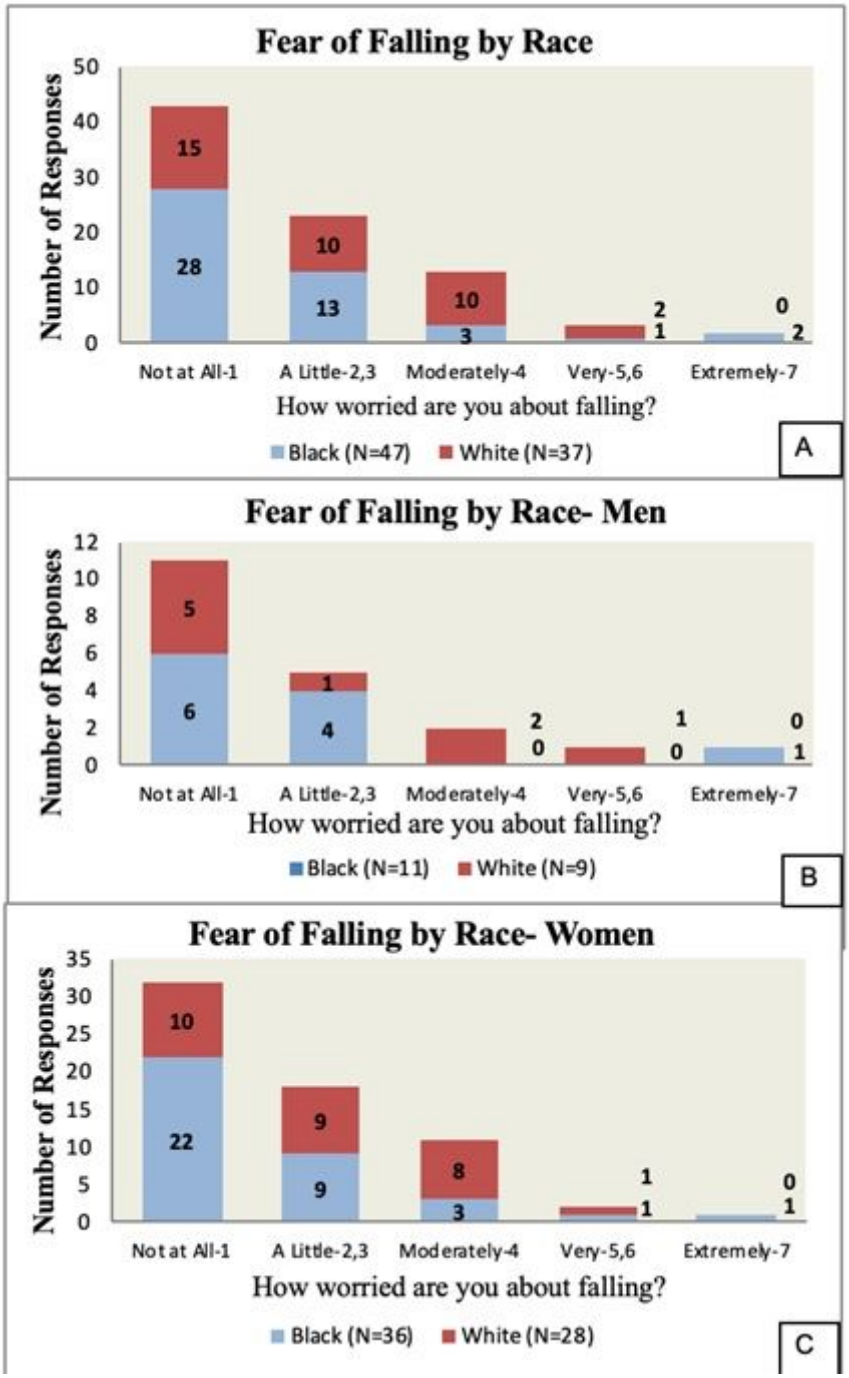

Figure 1

Fear of Falling by Race and Sex

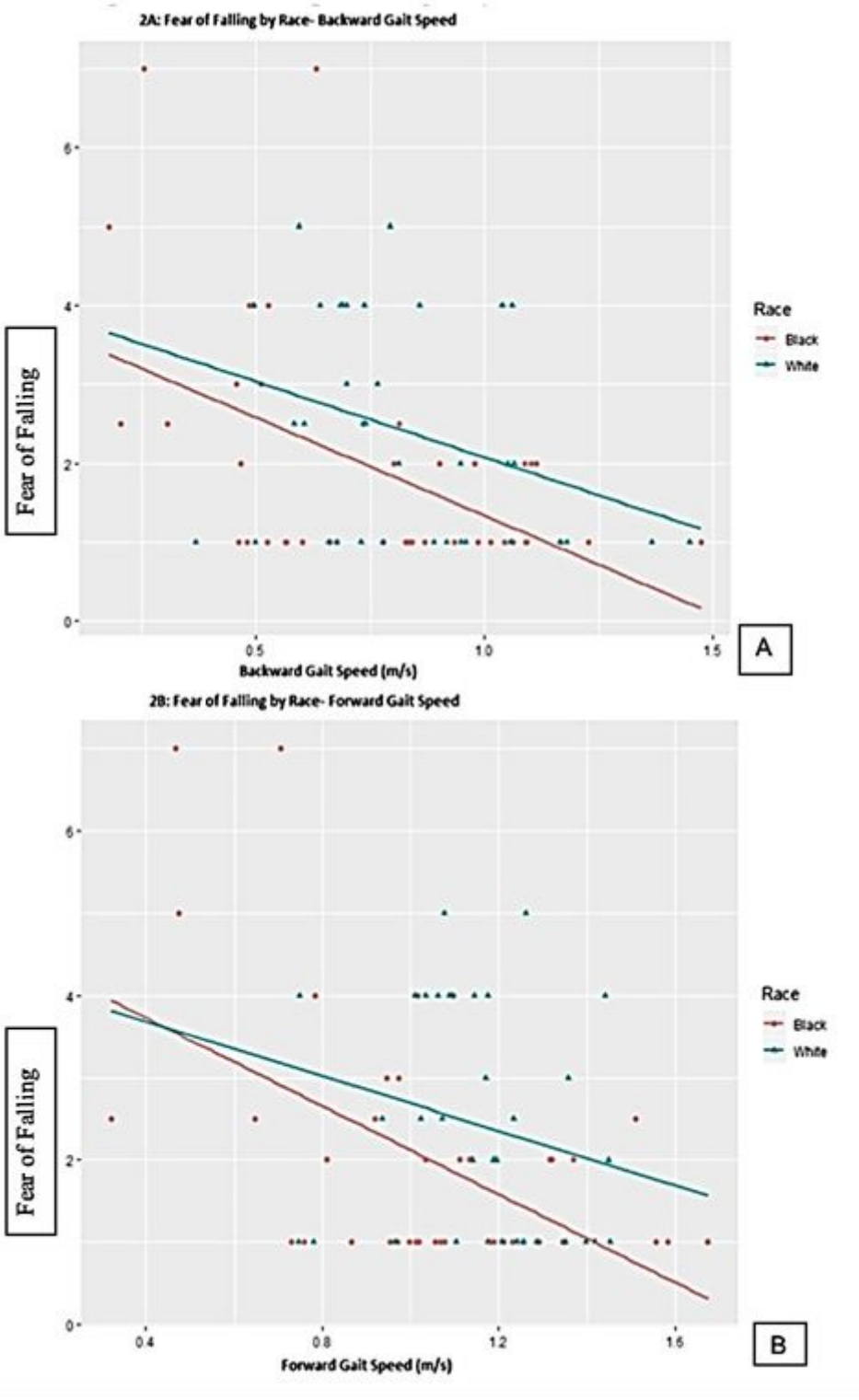

Figure 2

Gait Speed and Fear of Falling by Race A: Scatterplot of responses to fear of falling by race and backward gait speed (m/s) B: Scatterplot of responses to fear of falling by race and forward gait speed (m/s)