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EXAMINING THE RELATIONSHIP BETWEEN FALLS SELF-EFFICACY AND POSTURAL SWAY IN COMMUNITY-DWELLING OLDER ADULTS

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McCarty K., et. al. The most common cause for both fatal and nonfatal injuries for older adults in the U.S. is experiencing a fall. Researchers are interested in identifying variables which may help predict a person's likelihood of falling to create targeted, preventative initiatives. Previous research has explored the relationship between psychosocial and biophysical fall predictors on fall outcomes but rarely explores the ontological lens which surrounds how these finding are interpreted. The purpose of this study was to further examine the relationship between falls self-efficacy and postural sway, in community-dwelling, aging adults (*N*=107, mean age 73.8, + 7.95, female 80) to bring a more robust understanding of fall risk assessment using a Biopsychosocial (BPS) perspective through the International Classification of Functioning model (ICF). The Modified Falls Efficacy Scale measured fall self-efficacy and the BTrackS balance assessment system measured postural sway. A moderate negative correlation was found between falls self-efficacy and eyes open postural sway (r = -.403, p < .001.), indicating that as a person's self-efficacy score increases, their sway decreases, in line with previous studies. Participants experienced overall high self-efficacy, stellar balance performance for their age group, and low self-reported falls, leading one to wonder what variables cause the decline in performance and competence and/or contribute to a fall in such a group. Using a BPS perspective through the ICF, researchers suggest further exploration into the role that ableism and fear of disability play in the decline, and the responsibility of clinicians to disrupt anti-ableist narratives within rehabilitation and research.

Key Words: fall risk, postural sway, older adults, community physical activity, ableism

INTRODUCTION

According to the Center for Disease Control and Prevention (Center for Disease Control and Prevention [CDC], 2020), the most common cause for both fatal and nonfatal injuries in adults, aged 65 or older, within the United States is experiencing a fall. This is largely due to the ramifications a fall might have for the older adult, such as lacerations, bone fractures, or traumatic brain injuries which may lead to disability. The World Health Organization (WHO) and Kellogg International Work Group on the Prevention of Falls by the Elderly define a fall as "…an unexpected event in which the participants come to rest on the ground, floor, or lower level" (Lamb et al., 2005, p.1619). Not only are those who fall once at a greater risk to fall again, but each fall experienced contributes to that individual's risk of an earlier death because of their increased limitations and decreased overall wellness (CDC, 2020). A person's confidence in performing activities of daily living (ADL) can also drastically change as a result of a fall and they may develop a fear of falling, which can lead to further reduction of movement and contribute to a

deterioration of health (Tinetti et al., 1994; Vellas et al., 1997). For this reason, researchers are interested in identifying variables which may help predict a person's likelihood of falling. If such variables are known, initiatives can be created specifically to target problem areas or weaknesses that may leave an older adult at more risk of a fall. Additionally, calls for interpreting findings through a social lens which examines the intersection of aging, disability, and ableism are present to further understand falls risk (Egan et al., 2017).

There are two distinct approaches to examining falls risk in research. Health behaviorists tend to focus on areas affecting a person's mental state, such as falls self-efficacy, whereas biomechanists are interested in assessing a person's actual physical performance, such as postural sway, to predict their falls risk. Falls self-efficacy is a person's confidence in not falling in specific situations and has been assessed most frequently by examining one's confidence in one's ability to perform ADLs without falling. It has been inversely related to fear of falling (Tinetti et al., 1990). Prevalence of fear of falling in older adults has been reported as high as 54% in community-dwelling individuals (Zijlstra et al, 2007) which makes it a huge area of interest for falls risk research. A person's postural sway, or balance, has also been explored by researchers interested in fall risk (Bergland et al., 2003; Stel et al., 2003). Balance is quantified by postural sway or the length of deviations in any direction away from a person's center of pressure. Poor balance can negatively affect a person's gait (Maki, 1997) by disrupting stabilizing mechanisms and cause an impact on their agility in navigating their surroundings, which can increase their risk of a fall. These are particularly important as they contribute to a person's success or failure in performing ADLs (Shumway-Cook & Woollacott, 2001). Balance deteriorates as a person ages (Konrad et al., 1999) which can have a direct impact on falls risk and must be considered in the equation of addressing falls in older adults.

Both variables, falls efficacy (Friedman et al., 2002; Li et al., 2003) and balance (Maki et al., 1994; Pajala et al., 2008) have been examined as fall predictors. For both variables, falls self-efficacy (Chandler et al., 1996) and balance (Brauer et al., 2000; Hill et al., 1999), previous studies failed to recognize these as independent predictors of a fall in older adults as they were pitted against one another in an effort to find which has the highest prediction accuracy. However, more contemporary findings indicate there is a relationship between the two and urge clinicians and researchers to develop strategies which include both (Kamide et al., 2019; Pua et al., 2017). Though a relationship has been established, limited literature explores the ontological lens which surrounds what is done with these findings.

Ontology pertains to the researcher's beliefs on the "nature of reality and its characteristics" (Creswell & Poth, 2016, p. 20). It is important to understand ontological lenses within research because they inform how data are analyzed and disseminated within a medical or rehabilitation setting (DeForge & Shaw, 2012; Egan et al., 2017). For instance, by assuming for and categorizing a person's limited functionality as a deficit and over emphasizing concerns of risk to physical safety, clinicians add to an oppressive 'othering' effect of their less mobile patients (Egan et al., 2017). This othering from the presumed 'norm' leads to assumptions of failing to age successfully, perpetuating ableist narratives and a narrowed view of what it means to successfully age (Gibbons, 2016). Failing to critique research and recommendations which are grounded in this biomedical model lens allows for ableist beliefs within an aging population. This also limits the ability of clinicians to get a holistic look at their patients' experience and unique needs (Egan et al., 2017), particularly with regards to falls and an assumption of what it means to have a fear of falling. This causes further harm by believing that a person is only successful when they are cured of their so-called ailments instead of embracing a disabled and/or older body for its strengths as is (Claire, 2017).

Clinically, health care professionals such as physical therapists, typically use a biomedical model lens (DeForge & Shaw, 2012) which may focus on strength and balance modalities to assess an older adult individual from falls. This is similar to researcher's single systems approach (mental state or physical performance) which may not be as effective as taking a holistic approach to find predictive factors (Hatala, 2012). A Biopsychosocial (BPS) perspective may provide a more robust way for both researchers and clinicians to examine self-efficacy and balance to

see how they interact to predict and measure outcomes in regard to falls empirically and clinically. Specifically, the International Classification of Functioning model (ICF) presents a formal framework that is rooted in the BPS perspective to clinically evaluate and treat an older adult who may have or is at risk for reoccurring falls. The ICF model incorporates an ontological lens, which takes into consideration both mental mind state and physical performance as well as other aspects like environment and body function and structure when examining the person (Roush & Sharby, 2011). Mental mind state would fall under the personal factors' category in the ICF and physical performance would fall under activity limitation. The comprehensive nature of this model led to its adoption by the American Physical Therapy association via The World Health Organization in 2008 (Roush & Sharby, 2011). This shift to the ICF model may have occurred because of the increasing awareness of how multiple factors interacting can affect clinical outcomes in a variety of contexts. The ICF also operates as a disability framework (Chan et. al, 2009) which must be considered when discussing how falls in the older adult population can be connected to disability, ableism, and how these concepts can play a role in designing interventions.

Continuing to find a relationship between falls self-efficacy and balance may further strengthen the need to implement BPS perspective through the ICF both empirically and clinically and can bring researchers and clinicians closer to finding the true predictive nature towards falls and discover more conclusive measures to preventing them. The purpose of this study was to examine the relationship between falls self-efficacy and postural sway in this population of community-dwelling adults, 60 years of age and older to strengthen understanding of the relationship and interpret results with an ontological lens of a BPS perspective through the ICF framework. As evidenced in previous findings, psychological states strongly affect physiological outcomes, it is hypothesized that there is an underlying relationship that will shed light on actual fall prediction and lead to better prevention practices.

METHOD

Participants

Adults aged 60 and over (*N*=107, mean age 73.8, ± 7.95, male 27, female 80), ambulatory, and community-dwelling, were recruited from several resident and non-resident, senior centers in southern California served by city-provided aging services. Demographic information is found in Table 1. Participants were part of a larger study evaluating a falls prevention exercise program fully described elsewhere (Levy et al., 2020) and baseline data among the initial piloted group, only, were used in the current study. Approval for this study was obtained from the university Institutional Review Board (IRB) for the protection of human subjects

Table 1

Demographic Information of Community-Dwelling Older Adults in San Diego County (N=107)

	N	%
Gender		
Male	27	25.2%
Female	80	74.8%
Education Status		
Less than 8th grade	1	.9%
Jr. High/Secondary school (9th grade)	2	1.9%
Some High School	10	9.3%
Completed High School	22	20.6%
Some college/vocational training	39	36.4%
Completed Bachelors	14	13.1%
Some graduate training	5	4.7%
Completed Graduate Degree	12	11.2%

Other	1	.9%
I do not want to answer	1	.9%
Marital Status		
Single	20	18.7%
Married	28	26.2%
Divorced	41	38.3%
Widowed	17	15.9%
Common Law	0	0%
Domestic Partner	0	0%
Separated	1	.9%
Other	0	0%
I do not want to answer	0	0%
	Mean	Std Dev
Age	73.82 yrs.	7.95
Average Eyes Open Balance	24.99 cm	11.96
Modified Falls Self-Efficacy Scale Score	9.24	1.55

Measures

All measures were conducted at the senior center at which each participant was recruited. Along with demographic information, they included the following:

Falls self-efficacy. The Modified Falls Efficacy Scale (MFES; Hill et al., 1996) is a 14-item scale to assess a participant's degree of confidence in performing daily activities without falling, both indoors and outdoors. It uses a Likert scale of 0-10, 0 being the least confident, 10 being the most confident in each given scenario. Scenarios included activities such as getting in/out of bed, light housekeeping, and crossing roads. The original Falls Efficacy Scale (FES; Tinetti et al., 1990) was an incomplete scale as it only measured fear of falling in indoor activities. The MFES expanded the scope of measuring a person's self-efficacy by including questions regarding outdoor activities. The overall score is calculated by finding the average of the 14 questions. As with the individual questions, a high score indicates confidence in performing activities without falling, whereas, a lower score indicates less confidence. Hill et al. (1996) found this measure to have internal consistency reliability (Cronbach's alpha = .95), one-week test-retest reliability (ICC = .95), and construct validity in differentiating between healthy older adults and those with a high falls risk.

Balance. The BTrackS balance assessment system is a portable device that measures a person's ground reaction forces (GRF) using sensors within the board, much like a force plate (O'Connor et al., 2016). The board's dimensions, inspired by the Nintendo Wii Balance Board, are 15.5" x 23.5" x 2.5" and it weighs only 13.5 lbs, making it easily transportable. For the purpose of this study, the BTrackS Balance Test (BBT) was performed. The BBT assesses a person's postural sway while in a quiet, double leg stance by using their GRF to calculate their center of pressure (CoP). The BTrackS estimates a person's initial CoP while they are standing on the board and tallies each centimeter their CoP deviates from the original point during the trial period. This information is then transmitted, via the board's direct-to-computer USB connection, to a custom computing software where the researcher can observe the participant's sway in real time (Figure 1). Postural sway for an individual trial is calculated as the sum of CoP deviations from the original point in centimeters. A low number indicates better postural sway and balance whereas, the higher the number, the poorer the balance.

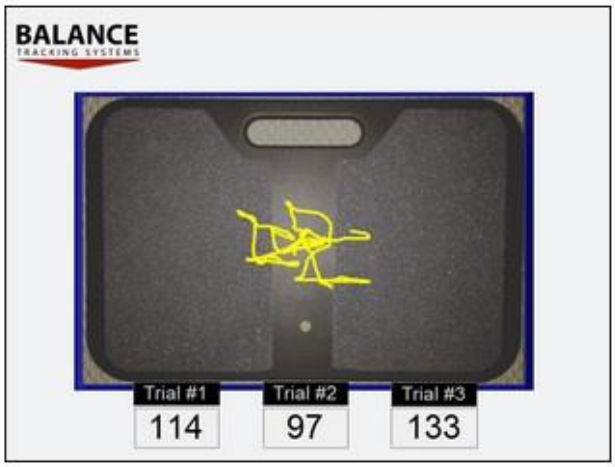

Figure 1: (BTS, n.d.)

Age-based normative values in postural sway summation allow for further understanding of analysis by comparing balance performance to others in the same age demographic (Goble & Baweja, 2018). In order to ensure the digital forces being calculated by the board are coming only from the participant's GRF and not from external forces, before executing the BBT, the BTrackS was calibrated for five seconds. Upon successful calibration and researcher's full explanation of the trial process with participant's verbal acknowledgement of understanding, participants were asked to step on the board and begin their trials in accordance with procedure validated by Levy et al. (2018). Three chairs were placed around the board; one to the right and left of the board and one at the front. Participants were instructed to use these chairs, if necessary, to catch themselves in the event that they lose their balance. Further, research assistants stood directly behind participants to spot them for the same reason. Six trials of 20 seconds each were performed by each participant with hands on their hips, legs shoulder-width apart, looking ahead and instructed to stand as still as possible. Three consecutive trials were conducted with the beginning and end of each trial indicated by a "beep" and the research assistants' verbal instruction. Between each trial, the participants were asked to step off the board for a 20 second rest period. Participant's scores were averaged across the three trials in each condition. In other words, the participant's average postural sway was calculated in the eyes open condition.

Procedures

Participants were recruited from resident and non-resident senior centers in a southern California county served by a local agency for the aging. Flyers, calls, and announcements were conducted by agency staff to gauge interest and schedule measurement times for those sites. Inclusion criteria included being of 60 years of age or older, ambulatory, and not having a heart condition, or being told by their doctor that they must not participate in moderate to strenuous physical activity. Researchers obtained this information on the day of data collection, in person, by verbal screening questionnaire. Informed consent was obtained prior to data collection in accordance with IRB standards. After signing, participants were taken through the BBT assessment by a single researcher and then completed a series of questionnaires that included falls self-efficacy. This process took roughly 30 minutes and was conducted at the senior activity center at which each participant was recruited.

Analysis

Pearson Product Moment Correlations were conducted to examine the relationship between falls self-efficacy and BBT eyes-open average scores in SPSS (vers.21) statistical software to examine the strength of the linear relationship between these two continuous variables.

Hierarchical regression analysis was performed to examine the predictive strength of falls self-efficacy on eyes open balance while controlling for the variable of age. This was done as age is a known factor affecting balance in older adults (Konrad et al., 1999). If the relationship remained significant after controlling for age, it would further support the correlation between falls self-efficacy and balance.

RESULTS

Correlation analysis (Table 2) found a moderate negative correlation between the eyes open balance condition and MFES score $r = -.403$, $p < .001$.

Hierarchical regression analysis revealed that age contributed significantly to the regression model $F(1,105) = 20.57$, $p < .001$ and accounted for 16.4% of the variation in eyes open balance.

Table 2

Correlation Analysis of Modified Falls Self-Efficacy Scale (MFES) Score and Average Postural Sway in the Eyes Open (EO) Condition (N = 107)

	MFES
Avg EO	-.403**

** Correlation is significant at the 0.01 level

The addition of the Modified Falls Self-Efficacy score was also significant $F(2, 104) = 18.52$, $p < .001$ and showed that falls self-efficacy and age, together, accounted for 24.8% of the variation in eyes open balance. When both variables were included in the regression, age and falls self-efficacy remained statistically significant predictors of open eye balance performance.

Table 3

Hierarchical Regression Modified Falls Self-Efficacy (MFES) Score on Average Postural Sway in the Eyes Open (EO) Condition Controlling for Age (N = 107)

	R Square	Standard Coefficients Beta	Significance
Age	.164	.326	.000
MFES	.248	-.324	.000

Dependent Variable: Avg EO

DISCUSSION

A moderate negative correlation found between falls self-efficacy and eyes open balance indicates that, as a person's self-efficacy score goes up, their balance score goes down. In essence, a person with high falls self-efficacy will have better balance in the eyes open condition. Conversely, if a person reports low falls self-efficacy, their eyes open balance will be lower. This finding is in line with previous research (Kamide et al., 2019; Lee et al., 2016; Pua et al., 2017; Schepens et al., 2012) indicating that psychological states strongly affect physiological outcomes. Additionally, in line with research done by Tinetti et al. (1994) and Vellas et al. (1997), after a person falls, their fear of falling grows, which can cause them to live more cautiously, more sedentarily. As a result, their mobility and function deteriorate, further affecting their balance ability. These findings add an important piece to the field as replication of previous work, particularly in non-clinical settings, and is a necessary step to improve the potential of broader applications of results within populations (Ainsworth, 2009; Knudson et al., 2012).

Interpreting these results using the BPS perspective through the ICF framework, researchers looked at the dynamic interaction between mental and physical domains within rehabilitation instead of looking only at one or the other. Interventions have been taking this multifactorial approach when creating programs to decrease risk for falls in the older adult population and have had success (Tripken et al., 2017). Schepens et al. (2012) found that not only was fall self-efficacy strongly positively correlated with higher levels of activity but there was a difference between balance confidence and falls self-efficacy. This shows the multifactorial implications of examining multiple domains, even within a given construct. This leads to the idea of what other factors may contribute to falls that may interact with self-efficacy (i.e., social support/culture and environment).

Additionally, the data reveal a different story when continuing to interpret the results with a BPS perspective through the ICF framework. Participants, overall, experienced low fear of falling (avg. 9.24 out of 10), stellar balance performance for their age group (Goble & Baweja, 2018), and low self-reported falls (*N*=18, 16.82%). This leads one to wonder what causes the fear in the first place. Lavedán et. al (2018) found that many factors (e.g., female gender, symptoms of depression) could contribute to a fear of falling but they do not explore a holistic understanding of that fear. While collecting data for the present study, researchers noted that participants often asked about their balance performance and whether they 'should be worried.' This led researchers to wonder why participants fear falling so much. Perhaps participants worried about

the fall or the aftermath and what that could mean for them. The definition of a fear of falling is '*a lasting concern about falling'* which leads to limiting activities (Tinetti & Powell, 1993). But, definitions of what is meant by 'a lasting concern' or, more precisely, what the underlying concern is (i.e., aftermath of fall), are unclear. Interpreting through the ICF, this concern is for lessened mobility and increased interdependence leading to disability. Most intervention strategies speak broadly about encouraging 'successful aging' but the line between a state of successful aging (Berridge & Martinson, 2018) to something different is not clear. Does falling and subsequently experiencing disability mean a person is no longer successfully aging? This would indicate that the underlying concern for which Tinetti & Powell (1993) refer is experiencing disability. Because of pervasive ableism that permeates our society, people develop a fear of becoming disabled (Rush et al., 2016) with a presumption that disability is "a fate worse than death" (Nario-Redmond, 2019, p. 61). However, many disabled adults lead rich lives into mature adulthood (Molton & Yorkston, 2017), which leads one to wonder why the fear of becoming disabled is so great.

As practitioners, we have a responsibility to confront our ableist assumptions and go beyond traditional research narratives (Minkler & Fadem, 2002, Egan et al., 2017) to dissect why the consequences of a fall (i.e., disability) are so terrible as to develop a fear which has the potential to fundamentally change a person's home and social habits (Deshpande et. al, 2009). It is important for future research to intentionally design methods which address ableism in the context of the fear of falling. We must embrace the shift from a biomedical model to the BPS perspective through the ICF framework down to our implicitly held bias of disability and what it means for aging adults.

Limitations include relying on self-report measures and sampling. Individual bias may be present, such as participants failure to correctly remember their history of falls, and/or misconception of what counts as a fall. Within a population of ambulatory, community dwelling older adults, there were not many who self-reported experiencing a fall, which was initially viewed as a limitation. For this reason, it could be necessary to find a more expansive group of older adults, such as those living in nursing homes or under other supervised care, to find a higher incidence of falling, to better represent an older adult population, and to look for possible mediating effects between falls self-efficacy and balance, as well as how ableism could play a role in this relationship. However, in the present study this data was useful in exploring result interpretation through a BPS perspective through the ICF framework lens.

CONCLUSION

Based on the information presented, there is a moderate relationship between falls self-efficacy and balance in the eyes open condition. These findings are in-line with others and provide an important replication of results which further strengthen the understanding of variables contributing to falls. The present study adds a progressive interpretation of these findings with a lens identifying how ableism could play a role in this field. Future research with the intent to find fall prediction factors should be mindful to include other potential risk factors to further strengthen the ability to predict falls, including where ableism could affect a fear of falling and interventions to combat it. Further, future research should explore this relationship by targeting a more expansive group of older adults living in varied conditions, such as nursing homes and other supervised care. Additionally, researchers should target groups with known history of falls to better compare their psychological and physical variables to those of non-fallers in relation to perception of disability. The findings in this study contribute to the conversation of using an integrative, more holistic, and anti-ableist approach both empirically and clinically to find fall prediction factors that may inevitably lead to better intervention outcomes in the older adult population.

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