ADVANCING THE SOCK TEST FOR SITTING BALANCE: A COMPARISON WITH THE BARTHEL INDEX OF ACTIVITIES OF DAILY LIVING IN OLDER ADULTS

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DEDICATION

This dissertation is dedicated to my sons, Christopher, and Jonathan Tullier, who have been on my long education journey since they were born—also dedicated to my grandsons, Jack and Liam Tullier, who have begun their own learning adventures.

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ABSTRACT

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The objective of this study was to determine whether a correlation existed between scores on the Sock Test for Sitting Balance (STSB) and items on the Barthel Index (BI) for activities of daily living. The STSB and BI scores of older adults from independent living and assisted living communities were compared. No difference in STSB scores emerged between the independent living and assisted living communities. Results showed a significant relationship between the STSB score and the following BI scores: self-feeding ($p < .05$) and bathing, dressing, urinary incontinence, and stair mobility ($p < .01$). The results indicated that the STSB did not differentiate between the independent living and assisted living communities. However, a significant correlation emerged between the STSB score and the BI items of self-feeding, bathing, dressing, urinary incontinence, and stair mobility in older adults living in independent living and assisted living communities.

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CHAPTER I

INTRODUCTION

Effective and dynamic sitting balance forms a foundation for human occupations. Many daily tasks—dressing, grooming, bathing, and toileting—require good sitting balance. A person needs dynamic balance to reach and turn a lamp off, bend over and tie their shoes, fold clothes, clean their feet in a shower, and pass food at the dinner table. Sitting balance requires the use of a person's neurological, visual, vestibular, and musculoskeletal systems, which together impact a person's functional ability.

Few researchers have written about sitting balance, but many have investigated standing balance. For example, Saeys et al. (2013) conducted a randomized controlled trial in a stroke rehabilitation hospital, and several standing balance measurements contributed to their findings. Jung et al. (2014) similarly studied trunk instability following a stroke. The authors investigated the effects on trunk control, proprioception, and balance of weight-shift training on an unstable surface in a sitting position. In their randomized control study, Jung et al. relied on three outcome measures corresponding to standing balance, even though the researchers had identified sitting position and balance as worthy of study.

Some researchers investigating sitting balance, such as Lazennec et al. (2013), found that lumbar–pelvic–femoral balance influences sitting balance, and injuries to these parts of the body thus affect sitting balance. Ochi et al. (2015) associated musculoskeletal conditions such as arthritis and arthroplasty with sitting balance issues. Although these researchers provide insight into the bio-mechanical impact of decreased sitting balance, they do not address the way such difficulties affect function. Sitting balance represents a significant aspect of an individual's activities of daily living (ADLs). Consequently, occupational therapists need information regarding sitting balance as it applies to the tasks in which people engage daily.

Researchers using the Sock Test for Sitting Balance (STSB) have reported compelling findings. Strand and Wie (1999) used the STSB to evaluate activity limitations in patients with musculoskeletal pain. Parker (2011) found that the STSB reliably measures both sitting balance and attention. Nicholson (2012) established norms for movement time during the functional task of donning and doffing socks, and Franc (2018) established concurrent and discriminant validity of the STSB, deeming the test a valid measure of sitting balance in acute care.

Few researchers have published balance research on older adults with a sitting balance focus—even fewer have published research on sitting balance as it relates to occupational therapy. Horak (2009) explained that at one time, researchers assumed that balance control consisted of a set of reflexes that triggered responses based on visual, vestibular, or somatosensory factors. The author added that researchers have increasingly found that the environment, task, and anticipation of the task play significant roles in balance. A person's nervous system must process a stimulus-rich and continuously changing environment, requiring ongoing integration of sensory information to update their estimate of self-motion. For older adults to function in the world with its great variety of environments and situations, they need a powerful yet flexible postural control system that enables them to move from sitting to standing, take steps, respond to slips or trips, and predict and avoid obstacles. Sensory, vestibular, and inputs affect balance and thus influence ADL performance in older adults (Horak, 2009).

Statement of the Problem

Researchers have shown that the risk of developing posture control problems increases with age due to increased vulnerability to causative factors, such as strokes and falls (Ambrose et al., 2013; Bateni, 2012; Monteith et al., 2015; Schmid et al., 2012). Although numerous studies have illuminated posture problems in older adults, scrutiny of journals revealed a deficiency of studies on sitting balance in older adults. The dearth of studies focusing on sitting balance in older adults who have experienced health problems that led to sitting balance difficulties aroused my interest in exploring STSB because this test incorporates an ADL. I wanted to know whether a correlation existed between the STSB and self-care function in older adults.

Strand and Wie (1999) studied the application of doffing and donning a pair of socks in persons with lower back pain. Parker (2011) compared two age groups of adults and two different methods, and Franc (2018) tested the validity of the STSB with other balance assessments. However, the STSB still needed validation with a functional assessment grounded in occupational-based theory or practice (Gorman et al., 2014; Oh et al., 2013).

Statement of the Purpose

In this study, I aimed to determine the relationship between the individual items of the Barthel Index (BI) of ADLs and the STSB in assisted living and independent living groups. I also investigated whether a difference existed in older adults' STSB scores between the two groups of participants.

Specific Aims

My primary aim in this study was to identify any relationship between sitting balance, as measured via the STSB, and function, as measured via the BI. This study contributes to an emerging body of knowledge regarding sitting balance measures in persons living in assisted and independent living communities. I aimed to achieve the following objectives:

1. Explore the relationship between STSB and BI scores in older adults in assisted living and independent living communities.

2. Determine whether a difference exists between older adults in assisted living communities and those in independent living communities concerning sitting balance, as measured by the STSB.

CHAPTER II

BACKGROUND AND SIGNIFICANCE

This chapter provides a review of the existing literature relevant to this study. Balance is complex and involves the visual perception of depth, velocity, and motion. It also involves the somatosensory system, including proprioception and exteroception, and the vestibular system's inner ear. Balance and function are intrinsically linked because a person's balance depends on the tasks performed and their environmental contexts.

Significance of the Study

Lazennec et al. (2013) found that older adults have an elevated risk of posture-related problems because of several factors, including age and incidents of falls and illness. Cabanas-Valdes et al. (2016) reported that the risk of sitting balance dysfunction increases with age, and related limitations in existing literature indicated there were costly drawbacks for occupational therapy and physical therapy practices. Monteith et al. (2015) argued that acute care practice for older adults in assisted living settings required more research into those diagnosing and managing sitting balance dysfunctions. Evidence has been notably limited regarding sitting balance measures. Therefore, the findings of this study contribute to an emerging body of knowledge concerning sitting balance in connection with functional tasks.

Incidence of Sitting Balance Dysfunction

Sitting balance dysfunction presents a problem for many older adults, inhibiting their ability to perform ADLs and thus negatively affecting their lives. The National Institute of Deafness and Other Communication Disorders (2018) stated that over 33,000,000 American adults had balance problems in 2008, the majority of whom were older adults. Incidents rose steadily after 2008. Sitting balance problems constitute a growing proportion of all balance dysfunction in the United States, especially among older adults. The National Institute of Deafness and Other Communication Disorders also indicated an alarming shortage of incident reports and statistics on balance disorders, especially sitting balance disorders.

In their Reasons for Geographic and Racial Differences in Stroke study, which included 8,096 middle-aged and older American adults, Diaz et al. (2016) showed that the sedentary lifestyles of most Americans increased their risk of developing balance problems. Palmer et al. (2018) examined the sitting activities and sedentary behavior of older Americans and found that sedentary lifestyles increased postural imbalance challenges in this group. Pereira and Scheicher (2018) studied postural imbalance in the United States and attributed balance challenges to old age and physical accidents (e.g., falls) that occur while performing ADLs. According to Pereira and Scheicher, the World Health Organization projected the average age to increase dramatically, predisposing the population to balance dysfunctions, including those involving sitting balance. According to the authors, these projections indicate that all age categories will experience a 35% rise in balance problems by 2050, and incidents among older adults aged 65–84 years will grow by 164%. Pereira and Scheicher highlighted that the worldwide population of those aged 85–99 years would grow by 301%, and the population of centenarians would rise by 746%.

Despite searching existing literature, I found an alarming lack of data on balance dysfunctions, including sitting balance dysfunctions, in the United States—not only among older people but also among those in other age groups. Among older adults, a postural imbalance prevails and leads to falls, a source of significant health problems.

Sitting Balance and ADLs

Sitting balance affects the performance of ADLs, such as showering, grooming, toileting, and dressing. For older adults, sitting balance plays a critical role in daily life. However, complications associated with advancing age and the vulnerability of older adults to illnesses such as dementia, stroke, cerebral palsy, and scoliosis compromise sitting balance. For instance, Vaughn and Schwend (2014) associated scoliosis with sitting balance problems, and Yun and Kim (2014) associated cerebral palsy with sitting balance problems. Franc (2018), Oh et al. (2013), Ko et al. (2016), and French et al. (2016) associated stroke with sitting balance difficulties.

Cabanas-Valdes et al. (2016) conducted a randomized controlled study of sitting balance among older adults. They found that sitting balance influenced an individual's well-being because most of their activities depended on the ability to maintain a healthy postural balance. Simple activities such as wearing clothes depend on postural balance. Serra-Ano et al. (2012) examined sitting balance and its limits among older adults with paraplegia and found that sitting balance was critical to ADL performance. Some activities, such as washing and grooming, were typically performed personally—only a small percentage of participants (e.g., stroke or cerebral palsy patients) depended on assistance for such activities.

Serra-Ano et al. (2012) argued that sitting balance is a fundamental ability and that older adults with sitting balance dysfunction cannot perform ADLs. However, Seong Choe et al. (2018) asserted that an older adult with sitting imbalance in assisted care can improve if their imbalance is identified and they receive proper intervention measures. Gao et al. (2015) similarly argued that the postural well-being of older adults depends on a timely and accurate diagnosis of sitting balance problems so that early intervention can reverse those dysfunctions.

The existing work on sitting balance and ADL performance indicated the existence of a research gap regarding the relationships between sitting balance, the performance of ADLs, and standard tests for diagnosing sitting balance problems. King and Novak (2017) explored the use of bathroom assistive devices for improving safety during bath transfers. They found no biomechanical evidence to support clinical recommendations. Vertical grab bars mounted on side walls provided the greatest stability improvements during bathing and upon exit from a bathtub. The authors claimed wall mounts resulted in the safest transfers but added these transfers occurred while standing. Accessibility and placement of the bars were also important, with the vertical placement of one and the mounting of another on a back wall providing the best configuration. One limitation of King and Novak's study was the singular use of a bathtub rather than a shower and the exclusion of the use of shower or bath benches. The researchers also did not allow entry or exit strategies and investigated only uneventful balance transfers, not recoveries from falls.

Burghart et al. (2016) and Dunn et al. (2018) demonstrated the test–retest reliability of sway scores and their comparability to force-platform measures with adults. The researchers found that balance stance, foot placement, and visual conditions impacted balance.

Occupational therapists have explored the function of sitting among individuals in the acute phase of stroke recovery. Watabe et al. (2015) indicated that older adults can fall while sitting and while performing daily tasks, such as grooming, oral hygiene, dressing, showering, self-feeding, and toileting. Further, transitional movements such as getting onto a wheelchair and getting up from a bed often cause falls. According to Watabe et al., a person reaching for objects from a sitting position can compromise their balance and fall from sitting. Additionally, Quinn (2018) found that balance-related intervention led participants' ADL-associated sitting balance to improve over time. Although the results were not statistically significant, the results offer clinical relevance.

One of the leading health concerns for people over 60 years of age is falling and incurring physical injury or death. Gait and balance disorders are very common among older adults and are usually multifactorial in origin and measurement. Occupational therapists have often used the Timed Up & Go test or the Berg Balance Scale when assessing balance. For example, Martin (2018) used the Timed Up & Go test, the 30-s Chair Stand test, and the 4-Stage Balance test as outcome measures for balance when assessing the effectiveness of the Stepping On prevention program for older adults. Martin found a decrease in fear of falling but no decrease in fall risk. Martin’s failure to include an assessment of sitting balance while a person was engaged in an occupation limited the study.

Neurologists have confirmed that fear of falling connects to poor physical and psychosocial health. Fear of falling can lead to activity restriction, immobilization, and confinement in a home or institution. When a person changes their gait, they increase their risk of falling—especially when they increase their step width, which can be a compensatory adaptation to fear of falling. Donoghue et al. (2013) highlighted the importance of treating underlying health impairments and preventing the transition from fear of falling to activity restriction.

Yuan-Yang et al. (2014) found the sitting-to-standing subscale of the Berg Balance Scale to be the most sensitive for evaluating functional independence. The authors explained this subscale cannot be used to examine the impact of sitting balance on function. Compared to older adults with a weak hand grip, older adults with a strong hand grip employ a strategy for standing up from a sitting position characterized by more trunk flexion and more dynamic use of the trunk during extension (van Lummel et al., 2018).

Dynamic balance is vital to the daily lives of older adults and has become an important issue. Although many balance tests have emerged, it has not become clear whether these tests measure the same construct and can differentiate between patients with different balance abilities. Researchers have tested three common dynamic balance tests: (a) one-leg jump landings, (b) posture perturbations, and (c) simulated forward falls (Steffen & Thorsten, 2018). Therefore, evaluation of sitting balance is critical to the safety of older adults and their ability to care for themselves.

The ability to be upright is essential for interaction with a variety of environments and for participation in ADLs; the ability to hold oneself upright requires interaction among multiple body systems to establish postural control (i.e., balance) and stable movement in multiple directions (Hassall et al., 2014; Horak, 2009). A strong relationship exists between sitting balance and level of self-care functioning (Gorman et al., 2014; Oh et al., 2013).

Neuroscience of Balance

Cognitive, musculoskeletal, psychosocial, and sensory systems help maintain balance during ADLs. Li et al. (2018) discussed the neuroscience of balance and asserted that numerous findings showed that it becomes more involved in postural control with age. According to Li et al., the neuroscience of balance involves motor tasks and continuous cognitive tasks. Berkman (2018) reviewed the neuroscience of balance and self-control and noted two opposing frameworks: bottom-up and top-down. Berkman (2018) further explained that the frameworks differ in their recognition of how bottom-up and top-down phenomena affect each other.

Although Berkman (2018) illuminated the neuroscience of balance, the researchers uncovered a plethora of dilemmas regarding the involvement of the brain in balance and postural control.

Wittenberg et al. (2017) supported the claim that dynamic and static postural and balance control have increasingly gained clinical and research attention due to competing hypotheses. Numerous researchers have argued that the neuroscience of balance control is convoluted, open to scientific and clinical speculation, and in need of further scientific research (Chang et al., 2016; Clark, Christou, et al., 2014; Clark, Rose, et al., 2014; Fujita et al., 2016; Goodworth et al., 2015; Holtzer et al., 2015; Huang et al., 2014; Koenraadt et al., 2014; Mierau et al., 2015). Although all of these authors explained the neuroscience of balance, they also maintained that sitting balance is a sophisticated motor–sensory and neural function that has thus far defied exhaustive explanation. My review of the existing literature uncovered the presence of competing neuroscientific hypotheses of sitting and general postural control. Despite their unsettled nature, the existing findings regarding the neuroscience of balance provided insights for this study.

Theoretical Background

Dynamic Systems Framework of Postural Control

Woollacott and Shumway-Cook (1990) first developed the dynamic systems framework of postural control by applying a systems approach to posture and focusing on the interaction of multiple systems in an ever-changing environment. In the dynamic systems framework, the authors build on concepts regarding movement control from earlier reflex-hierarchical models of motor control. The framework explains the dynamic relationship between a person’s central nervous and musculoskeletal systems when interacting with their environment. Motor patterns do not arise strictly from the central nervous system but develop from task characteristics and environmental demands to realize occupational goals (McColl et al., 2015).

Smith and Thelen (2003) contended that postural balance is not an independent ability that arises in the execution of a variety of ADLs. The balance control system responds differently to different activities and provides task-appropriate muscle reflexes to maintain balance. The activity performed, the nature of the environment, and the resources available to implement the activity all affect balance. People acquire postural skills through a combination of complex sensory and motor systems. Every individual must interpret sensory information to enhance balance and movement according to the demands of each task performed (Smith & Thelen, 2003).

Horak (2009) further developed the systems approach, creating the systems framework of postural control. This model includes six major components of postural control that depend on context and task: (a) biomechanical task constraints; (b) movement strategies; (c) sensory strategies (i.e., vision, vestibular, and somatosensory); (d) orientation in space, including internal representation of posture; (e) control of dynamics (i.e., control of the center of mass while the base of support changes); and (f) cognitive processing, which impacts reaction time and performance.

Haruyama et al. (2017) conducted a randomized controlled study and established that although people with neuronal dysfunction can be rehabilitated to independent living, it is important that they be able to control movement independently or with some limited help.

In contrast, Calvaresi et al. (2017) described assisted living as providing care and services to older adults and clients requiring supportive physical care to maintain their ADLs. Those in assisted living typically have poor sitting balance because they have low physical functioning.

Bowen et al. (2015) defined barriers to functional capacity in assisted living, noting decreased muscle strength as the primary hindrance to endurance and physical performance of ADLs. Dewar et al. (2015) found that a reduction in daily activity resulting from residing in assisted living centers leads to sitting balance dysfunctions, but exercise improves posture balance. Bowen et al. (2015) concurred with this finding and argued that independent living leads to increased functional capacity in older adults because they engage in routine activities that enhance their muscle strength, a pertinent functional factor for boosting sitting balance. According to Regan et al. (2016), participation in daily physical activities begins to decline after age 30, with the onset of a sedentary lifestyle. The STSB can measure sitting balance in both independent living and assisted living. However, this application of the STSB requires clear understanding of sitting balance as it relates to function for the two environments.

Occupational-Based Assessment and the Occupational Adaptation Framework

Standardized assessments comprise part of an evidence-based approach in occupational therapy (Hinojosa & Kramer, 2014). Occupational adaptation is the theoretical framework underlying the STSB. Schultz and Schkade (1997) developed the occupational adaptation framework while working as occupational therapists at Texas Woman's University in 1992. The occupational adaptation framework rests on the following assumptions:

- All occupations are holistic and involve sensorimotor, cognitive, and psychosocial systems (Schultz & Schkade, 1997). The STSB focuses on the functional task of donning a sock, involving a person's sensorimotor, cognitive, and psychosocial systems.

- When clients become more adaptive internally, they become more functional (Schultz, 2013). An occupational therapist assesses a person's level of adaptation through their occupational performance.
- A client generally discovers their own ability to adapt when they are challenged with occupational activities that have meaningful beginnings and ends and are process oriented (Schkade & Schultz, 1992). The STSB includes a functional task with a meaningful beginning and end and allows an occupational therapist to assess a client's adaptive response to balance challenges in a meaningful context.

Sitting Balance Measurements

The research on balance in the elderly has focused primarily on standing balance and, specifically, the effects of impaired standing balance on the risk of falling. A recent scoping review of 66 balance assessments included only eight with a sitting balance component (Sibley et al., 2015). Yet, many daily tasks—such as bathing, dressing, and toileting—occur while sitting. Therefore, a need existed for research that identifies measurements of sitting balance and the effect of changes in sitting balance on activities of daily living.

Current Assessments for Sitting Balance

The Trunk Impairment Scale developed by Verheyden et al. (2004) represents a standard technique for assessing sitting balance, especially in the rehabilitation of persons who have had a stroke. An and Park (2015), Cabanas-Valdes et al. (2016), and Suresh et al. (2017) tested the validity and reliability of the Trunk Impairment Scale for measuring and improving sitting balance with various balance dysfunctions, including Parkinson's disease and stroke, and ascertained that it is reliable. However, the Trunk Impairment Scale is not a function-based test; therefore, it does not equate trunk impairment or sitting balance with functional tasks. Further, Li et al. (2017) described the Trunk Impairment Scale and two other assessments, the Trunk Control Test and Postural Assessment Scale for Stroke Patients, as typical examples of clinical outcome measures for sitting balance. Li et al. (2017) further noted that these assessments are not function-based tests and that a need exists to include function as part of sitting balance assessments.

Gorman et al. (2014) discussed the Function in Sitting Test (FIST) as a way of measuring sitting balance. Sung et al. (2016) confirmed the reliability of the FIST as a tool for measuring sitting balance in people exhibiting no movement or restricted movement. The FIST involves an ordinal scale ranging from 0 (*dependent*) to 4 (*independent*), with the middle anchors relating to using the upper extremity or physical support. However, the FIST is not a function-based test. Its 14 items involve contrived tasks and do not consider the task environment. These tasks, while meaningful to an examiner, may have no meaning or importance to the person examined.

Tyson (2004) described the Brunel Balance Assessment. Tyson and Connell (2009) later examined ways to measure sitting balance, but they only looked at supported sitting balance, static sitting balance, and dynamic sitting balance. All other measures in the Brunel Balance Assessment are of standing balance. Birnbaum et al. (2016) recognized many ways to measure sitting balance. These researchers found 14 sitting balance scales containing dynamic tasks to measure the sitting balance of individuals following a stroke. No single scale had sufficient psychometric properties to enable Birnbaum et al. to recommend it for measuring sitting balance with stroke survivors.

Thompson et al. (2012) developed the Sitting Balance Scale, which consists of 11 items. The Sitting Balance Scale has good internal consistency (Cronbach’s alpha .76), with intra-rater reliability ranging from .96 to .99 for the total score and interrater reliability (Cronbach’s alpha

.87) in the good range. A Mann–Whitney *U* test revealed differences in performance scores between participants who had pathologies and those who did not. This test is not function-based, and although three of its items focus on sitting balance, the other items assess standing balance.

All these findings were crucial for this study because they represented the currently available assessments for sitting balance used in research and the clinic. As mentioned, the major drawback of these measures is that they lack occupational-based or functional aspects of sitting balance. Aligning occupation or function with assessment is a critical factor in assessment related to ADLs and the factors that contribute to success in daily living, such as sitting balance. (Franc, 2018).

The Sock Test for Sitting Balance

Strand and Wie (1999) presented a test of sock donning for evaluating activity limitations in patients with musculoskeletal pain. The scores obtained from the test reflected perceived limitations and restrictions of the musculoskeletal system. Simmonds (2002) included sock donning as one of nine tasks for assessing functional ability in acute care cancer patients. She included donning socks as part of a battery of tasks and did not use them in isolation to assess sitting balance.

Parker (2011) evaluated sock donning and doffing using the original version of the STSB, then known as the "sock test," in acute care rehabilitation. She used the time to measure the success of sock doffing and donning. Parker found that the test was a reliable measure of sitting balance and attention. Parker's results indicated that impaired cognition, upper extremity dexterity, and vision contributed to the time needed to complete the test, indicating that the test is a valuable measure for these variables when determining the functional ability of stroke patients. Nicholson (2012) established norms for movement time during the functional task of doffing socks using the same methods as Parker. Nicholson found no significant differences in older age groups between the forward flexion method and the cross-leg method.

Franc (2018) established concurrent validity and discriminant validity of the STSB. She found that it was a valid measure of sitting balance for individuals in acute care compared to age-matched community-dwelling peers. Although some researchers have examined the validity, reliability, and limitations of the test, only a couple have compared it with another test. This study is the first to include a comparison of the STSB with a function-based test—the BI.

CHAPTER III

METHODOLOGY

Research Design

The purpose of this study was to determine the relationship between the individual items of the BI of ADLs and the STSB in assisted living and independent living groups. I also hoped to determine whether a difference existed between the two groups in sitting balance in older adults as measured by the STSB.

According to Muhammad (2016), scientific inquiries cannot exist without tentative explanations or suppositions that attempt to illuminate the subject matter motivating the inquiry. The hypotheses in this study derived from four research questions regarding STSB and sitting balance in older adults with and without sitting balance challenges. The research questions and their associated null and alternative hypotheses were as follows:

1. Is there a significant inverse relationship between STSB score and overall BI score?

   $H1_0$: There is no significant relationship between STSB and BI scores.

   $H1_a$: There is a significant inverse relationship between STSB and BI scores.

2. Is there a relationship between function, as measured by individual items on the BI, and STSB score in older adults in independent living and assisted living communities?

   $H2_0$: There is no significant relationship between function, as measured by individual items on the BI, and STSB score.

   $H2_a$: There is a significant relationship between function, as measured by individual items on the BI, and STSB score.

3. Is there a significant difference between the assisted living and independent living communities about the STSB score?

   $H3_0$: There is no significant difference in STSB score between individuals in independent living communities and those in assisted living communities.

   $H3_a$: There is a significant difference in STSB scores between individuals in independent living communities and those in assisted living communities.

4. Can performance on the STSB predict BI score in assisted living and independent living settings?

   $H4_0$: STSB score does not significantly predict BI score in either setting.

   $H4_a$: STSB scores significantly predict BI scores in both settings.

Research Methodology

This section describes the methodology used in this research and the data analysis. In this quantitative study, I used a convenience sample of two groups from assisted living and independent living communities in a cross-sectional research design (Jackson, 2015). Sandin and Smith (1990) used a convenience sample of patients who had strokes when measuring sitting balance with the BI of ADLs. Sinoff and Ore (1997) used a cross-sectional research design using the BI of ADLs to determine the efficacy of self-reporting in older adults. The convenience sample and the cross-sectional research design are used with the BI of ADLs.

Participants and Research Setting.

The participants in this study were older adults aged 65–99 years living in assisted and independent living communities. These participants resided in two different assisted living and one independent living community in the Dallas/Fort Worth area of Texas.

Many independent living communities for older adults in the Dallas/Fort Worth area of Texas resembled one another. They usually provided community security through gates, a check-in system, or both. Such communities usually provide weekly housekeeping services, two daily meals, and community activities. Activities address an extensive array of interests and are generally determined to some degree by the community members. These facilities typically also provide wellness and exercise programs, as well as transportation for community outings and medical appointments. The communities include a medical alert system and often a daily check-in process to ensure residents' well-being. Those residents living in an independent living community can get in their own car and go somewhere. They can also hire a caregiver if they feel they need assistance with any of their ADLs or Instrumental Activities of Daily Living (IADLs). Independent living residents must do their own laundry, administer their own medication, and shop for themselves. Often, family members offer assistance, such as picking up items the resident might need or loading their medication dispensers weekly (Brookdale Independent Living, 2022).

Assisted living communities resemble independent living communities, with several exceptions. Residents in assisted living facilities need some assistance in their daily care and have 24-hr nursing care available to them. Three meals are provided daily, and a medication aide administers their medication. Family or transportation assistance can take the residents off-grounds, but they do not leave the community on their own. Many residents also have a doctor or a doctor's assistant that sees them in their apartment in the community (Brookdale Assisted Living, 2022).

Quantitative Sample Size Calculations

I conducted a power analysis using G*Power, Version 3.1.9.7 to determine the sample size needed to obtain statistically significant results. For Research Questions 1 and 2, power analysis for correlation between the STSB and BI groups assumed a large effect size of .78 (Berg et al., 1992; Katz, 2003; Salbach et al., 2006; Sandin & Smith, 1990), power of .95, and alpha probability of .05. The analysis indicated a minimum sample size of 15. Concerning Research Question 3, a power analysis for an independent *t* test with the assisted living and independent living groups assumed an effect size of .62 (Kafri et al., 2019; Snyder, 2006), power of .95, and alpha probability of .05. The analysis indicated a minimum sample size of 23. To address Research Question 4, a power analysis for a linear regression between STSB and BI scores for the assisted living and independent living groups assumed an effect size of .35 (Berg et al., 1992; Kafri et al., 2019; Katz, 2003; Salbach et al., 2006; Sandin & Smith, 1990; Snyder, 2006), power of .95, and alpha probability of .05. The analysis indicated a minimum sample size of 20 per group (i.e., 40 in total).

Recruitment

I recruited participants for the study in two ways. First, I selected participants by coordinating with community staff members and placing custom brochures (see Appendix A) in common areas, such as on bulletin boards or at residents' apartments. The brochure provided a brief description of the study's general purpose and invited participation. As an incentive, I offered a free pair of hospital socks for each participant to enhance the likelihood of recruiting 50 participants. Second, community staff members provided referrals from each of the assisted living and independent living communities targeted. I screened each potential participant either over the phone or face-to-face (see Appendices B and C) and answered all their questions.

Inclusion and Exclusion Criteria

To participate in the study, an individual had to (a) be aged at least 65 years and no more than 99 years; (b) be able to read, speak, and write in English; (c) be able to follow verbal directions; (d) have had the physical ability to don and doff socks in the previous year; (e) have both of their lower extremities so they could don and doff a pair of socks. I excluded individuals from the study if they had any medical conditions that impaired vestibular function or were otherwise unable to sit independently without physical support for a short period of time.

Instrumentation

I collected demographic information—age, gender, weight, and any medical conditions—from every participant. I then used the STSB and the BI to collect data.

Sock Test of Sitting Balance

The STSB is a timed test in which a participant sits on the edge of a bed with both feet on the floor. The participant puts on a pair of socks and removes each sock. The time required to complete the task is recorded. Overall, the STSB's reported average time to complete the STSB without support ranges from 22–34 s (Franc, 2018; Parker, 2011).

Strand and Wie (1999) wrote about their study using the Sock Test. In their study they simulated the activity of putting on a sock for persons with low back pain. Their study included 337 participants. Weighted kappa was .79, CI [.50, 1.00], indicating the test had acceptable intertester reliability.

Simmonds (2002) wrote about a battery of performance tests one of which was the Sock Test. She was focused on investigating the psychometric properties that characterized physical function in patients with cancer. Her Sock Test involved the donning of a sock but not the doffing of a sock. In her study there were 38 who were aged 30-59 years old, and the mean time was 8.89 seconds to don one sock. Simmonds (2002) found test-retest reliability, and discrimination validity with the Sock Test.

Parker (2011) used data from 100 participants diagnosed with a cerebral vascular accident or transient ischemic attacks in an acute rehabilitation setting. Her analysis found that 88.9% had sitting balance and upper extremity dexterity difficulties. She found that the average time to complete the STSB was 34.1 s (*SD* = 20.3). Participants took 10–92 s to complete the test. A subset of six randomly selected participants was used to explore the test-retest reliability. For interrater reliability, $r = .918$ ($p = .010$) and $r = .986$ ($p \leq .005$). Intertester reliability analysis was completed with 16 randomly selected participants: ICC (2, 1) = .999, 95% CI [.998, 1.000], $p \leq .005$. Parker established that the test had high test-retest reliability and high interrater reliability. Parker used stepwise multiple regression analysis to show that sitting balance and attention could predict STSB time.

Nicholson (2012) conducted an experimental study to test sock donning and doffing speed in cross-legged and uncrossed positions in a normal population that included men and women. An independent samples *t* test indicated significant differences between age groups using the forward flexion method ($t = 2.395$, $p = .022$) but not the cross-leg method ($t = .394$, $p = .695$). Within each age group, no significant difference existed in the time needed for each method (older group: $t = -1.30$, $p = .10$; younger group: $t = .866$, $p = .80$). The results indicated that female participants were faster than male participants with the forward flexion method. Young adults performed faster than older adults in both positions. These results indicated that the STSB is dependable for evaluating sitting balance.

Franc (2018) sought to establish the validity of the STSB for assessing sitting balance in patients under acute care by therapists. Franc conducted a controlled test with 21 healthy participants in an acute care setting. The results indicated that the STSB is valid and reliable for measuring sitting balance; the test could differentiate outcomes of healthy individuals from those of hospitalized people. Franc found a significant relationship between STSB score and Adapted Functional Reach Forward results for all participants, $r_s(40) = -.382$, $p = .012$, but not the hospitalized cohort alone $r_s(19) = -.178$, $p = .440$. Franc established validity via a significant relationship between ranked STSB results and the level of independence on the bed–chair transfer subscale of the Functional Independence Measure, $r_s(19) = -.677$, $p = .001$, and levels of sitting balance on the Kansas University Sitting Balance Scale, $r_s(19) = -.614$ $p = .003$. The study's results also showed that the STSB could differentiate between hospitalized and healthy populations ($z = 2.377$, $p = .017$, $r = .37$).

BI of ADLs

The BI is an ordinal scale that assesses 10 areas: feeding, bathing, grooming, dressing, bowel control, bladder control, toileting, chair transfer, ambulation, and stair climbing. Each area is rated based on the assistance an individual needs to complete a task in that area. The BI is a free test instrument, and its purpose is to assess the ability of individuals with neuromuscular or musculoskeletal disorders to care for themselves. It takes about 20 min to administer the BI. For older adults, interrater/intra-rater reliability is fair to good, depending on the activity assessed (Richards et al., 2000). The BI has a ceiling effect at hospital admission and hospital discharge (de Morton et al., 2008). Regarding brain injury, the BI has adequate predictive validity. Admission score predicts discharge score: the lower the score, the greater the change with rehabilitation (Liu et al., 2004). Patients with chronic stroke had a minimal detectable change of 4.02 points (Hsieh et al., 2007). Uyttenboogaart et al. (2005) determined cutoff scores for patients with acute stroke: greater than 95 (sensitivity of 85.6% and specificity of 91.7%), greater than 90 (sensitivity of 90.7% and specificity of 88.1%), and greater than 75 (sensitivity of 95.7% and specificity of 88.5%). Hsueh et al. (2002) found an excellent correlation between the functional independence measure motor subscale and the 10 items of the BI at both admission and discharge ($r > .92$; ICC > 0.83) with acute stroke. There is also excellent concurrent validity between the modified BI and the Motricity Index ($.73 \leq r \leq .77$; Wade & Hewer, 1987).

Materials

The materials needed for the STSB include a hospital sock and the edge of a bed. The BI and STSB each required a data-gathering sheet.

Procedures

The Institutional Review Board approved this study (see Appendix D), and I obtained a letter of agreement from the research site before the study began (see Appendix E). I recruited a research assistant to assist with safety and prevent falls, and I asked this individual signed a confidentiality agreement (see Appendix F). This quantitative study used a convenience sample of two groups selected from assisted living and independent living in the Dallas, Texas, area, and I recruited from the Brookdale Senior living communities.

Scheduling, Covid Precautions, and Safety

Regardless of whether the participant resided in an assisted or independent living community at Brookdale Senior Living, I recruited them all in the same manner—using brochures posted in the residents' social areas and via communication from the staff at the Brookdale Senior communities. The potential recruits called and requested to participate, or I called the potential participant and explained the research study and asked if they wished to participate. Once an individual agreed to participate, I called each person to schedule an appointment for testing.

Prior to their appointment, I screened the participants (see Appendix B) for their age, their ability to put on and remove socks, their possession of both lower extremities, and the absence of a medical condition known to impair vestibular function. I also asked each participant about any recent COVID-19 exposure or symptoms using the screen for COVID-19 (see Appendix C). If the participant had no exposure to or symptoms of COVID-19 and met the study criteria, we agreed upon an appointment time at which I would arrive with a researcher assistant to gather data and conduct the study.

Testing Procedure

Upon arriving for the testing appointment, my assistant and I put on personal protective equipment and followed guidelines from the Centers for Disease Control and Prevention for avoiding the transmission of viruses, including the virus responsible for COVID-19. We followed the guidelines regardless of the COVID-19 vaccination status of each participant. Personal protective equipment included a barrier gown, a KN95 facemask, a face shield, and gloves worn by myself and my assistant. Participants also completed a screener questionnaire (see Appendix C) for COVID-19 upon arrival, as the time between the initial phone call and appointment could vary by several days.

I conducted the study as the primary researcher with the help of one assistant. I tested each client, and the assistant ensured participant safety. The assistant used standards of care for safety and stood either to the side of or behind the participant to prevent falls. Each participant reviewed and signed a consent form (see Appendix G), including a reminder that the participant could stop at any time without any repercussions. I recorded the participant’s demographic data (i.e., age, gender, weight, and medical history) prior to testing (see Appendix H).

For data collection, I randomly assigned participants to an order of test administration, having them complete either the STSB or the BI first. I followed the protocol for administering each test (see Appendices I and J). In addition, I administered a self-report instrument to collect numerical data, which I analyzed to support or refute the hypotheses, as Muhammad (2016) and Tofan et al. (2012) recommended. All participants were tested sitting at the edge of their beds, so they were sitting without support. The assistant stood to the side to ensure the participant did not lose balance.

For the STSB, I provided the following directions:

> For this test, I will be assessing your balance and the time it takes you to put on and take off a pair of socks. This is not a race. Put on the socks and remove them at your usual pace that is normal for you. I will start the stopwatch as soon as you take the socks from me and stop it when you have removed both socks. When I say "go," please put on each sock. Once they are both on, take them both off and set down the socks. Remember to go at your normal pace.

I then handed the hospital socks to the participant with one hand and said, "go," as I started the stopwatch with the other hand. Upon completion, I recorded the time taken to don and doff the sock. I also recorded the method used by the participant to don and doff the sock.

For each BI task, the participants sat or stood as dictated by the task. I stood in front of the participant, and the assistant stood by their side. I began the BI testing by explaining that the participant would be asked to do a variety of tasks. I asked the participant if they had any questions, then I administered the BI following standard protocol according to the standard procedures for that test. I determined the degree to which the participant could perform each task and then recorded the results (see Appendix J). I also recorded the appropriate score for each task based on the report or performance of each participant. I noted if a participant could not perform a task and assigned no points.

For the first task, I asked each participant whether they fed themselves independently or needed assistance—such as with cutting, spreading butter, or diet modification. Participants demonstrated moving a spoon in a bowl and up to their mouth. For the second task, I asked the participant whether they could bathe or shower independently or if they needed help—such as with getting clothing, starting, and adjusting water, getting in and out of the shower or bathtub, drying off, or getting clothes on and off. The participant demonstrated the ability to get clothing, get in and out of a bathtub, adjust the water, and dry off. For the third task, I asked the participant whether they brushed their teeth, combed their hair, washed their face, and (for men) shaved their faces independently or if they required assistance with these matters. Participants demonstrated the ability to perform oral hygiene, comb their hair, and wash and shave their faces. For the fourth task, I asked each participant to get their clothing (i.e., a top, bottoms, socks, and shoes). I asked the participant to don and doff a top, a pair of pants, a pair of socks, and a pair of shoes. I determined whether the participant could do this independently, was dependent, or could do at least half unaided. For the fifth task, I asked the participant whether they were incontinent, continent, or had occasional accidents with their bowels. For the sixth task, I asked the participant whether they were incontinent, continent, or had occasional accidents with their bladder. For the seventh task, I asked the participant to use the toilet. If the participant did not need to go to the toilet, I asked them to simulate going to the toilet. I determined whether the participant was dependent, independent with transfer on and off the toilet, dressing, and wiping, or if they needed some help but could do at least half alone. I asked each participant in the eighth task to transfer from bed to chair and back. I determined whether the participant was unable (i.e., had no sitting balance), needed major help (i.e., had one or two people give physical assistance but could sit), needed minor verbal or physical help, or was independent. For the ninth task, I asked the participant to walk or use their walker or wheelchair for 50 yds (46 m). I determined whether the participant was immobile or moved less than the requested distance, was wheelchair independent (i.e., able to propel themselves greater than the requested distance, including corners), walked more than the requested distance with the verbal or physical help of one person, or was independent and walked more than the requested distance with the optional use of any aid, such as a cane. In the 10th task, I asked the participant whether they could go up and down a flight of stairs independently, were unable to do so, or needed verbal or physical help or a carrying aid to do so. I observed the participant’s ability to go up and down stairs. If they had a walker or cane, I observed if they could manage that as well. After completing the assessment and data gathering, I thanked each participant for their time. I inquired if the participants had any questions before concluding.

CHAPTER IV

DATA ANALYSIS AND RESULTS

Data Analysis

Demographic data included age, gender, residence, and medical conditions. I analyzed these using descriptive statistical analysis (see Table 1). There were 50 participants, with 30 in independent living and 20 in assisted living communities. There were 18 female and 12 male participants from the independent living community and seven females and 13 males from the assisted living community. Participant ages ranged from 65 years old to 95 years old. The most common diagnosis among the participants was hypertension, with 19 having this medical condition in the assisted living group and 27 having it in the independent living group.

Table 1

Participant Demographics

Variables	Assisted living	Independent living
Total *N (50)*	20 (40%)	30 (60%)
Males	13 (26%)	12 (24%)
Females	7 (14%)	18 (36%)
Age ranges	65–94 years old	65–95 years old
Age means (SD)	83.7 (6.8)	80.8 (9.91)
Hypertension	19 (38%)	27 (54%)
Congestive Heart Failure	12 (24%)	13 (26%)
Diabetes	7 (14%)	3 (6%)
Osteoarthritis	13 (26%)	19 (38%)
Falls in the last year	10 (50%)	8 (26.66%)

The average time for the STSB was 35.8 seconds, ranging from 14.4 to 79.9 with standard deviation of 15.9 seconds. The average scores of BI were 88 ranging from 60 to 100 with standard deviation of 11.2 (see Table 2). This is close to Parker's (2011) STSB findings with acute hospitalized patients (mean of 34.10 s with a range of 10 to 92 s and a standard deviation of 20.29 on the STSB.

Table 2

Descriptive Statistics of all Participants in Assisted Living and Independent Living Communities

Statistic *(N =50)*	Sock Test for Sitting Balance (seconds)	Barthel Index of ADLs (Unit of measure)
Mean	35.8	88
Range	65.4	40
Minimum statistic	14.4	60
Maximum statistic	79.9	100
Standard deviation	15.9	11.2
AL Mean (SD)	38.8 (14.4)	83.2 (9.1)
IL Mean (SD)	33.8 (16.7)	91.2 (11.4)

Comparing the independent living community with the assisted living community participants, the mean for completing the STSB was 33.8 s for the independent living participants and 38.8 s for the assisted living participants. This represented a 5-s difference between the two groups.

To answer Research Questions 1 and 2, I used Pearson's r or Spearman's ρ to assess the relationship between STSB score and overall and individual BI scores. The assumptions for

Pearson's correlation are that (a) the two variables are measured at the continuous level, (b) there is a linear relationship between the two variables on a scatter plot, (c) there are no significant outliers, and (d) the variables are approximately normally distributed and have bivariate normality assessed with a Shapiro-Wilk test of normality (Field, 2013). The assumptions for Spearman's ρ are that (a) the two variables are measured on ordinal or interval scales (the BI is an ordinal scale, and the STSB is an interval scale) and (b) there is a monotonic relationship between the two variables (Field, 2009). A monotonic relationship exists when the variables increase together or one variable increases as the other variable decreases. Creating a scatterplot can reveal whether monotonicity exists (Field, 2013). Spearman's ρ is not overly sensitive to outliers, which means a valid result is possible even in the presence of outliers (Field, 2013). Outliers existed in the current data, so Spearman's ρ was used to answer Research Questions 1 and 2. I conducted data analysis using IBM SPSS, Version 25.

Findings

I answered the first research question using nonparametric data analysis because the STSB scores lacked a normal distribution (Field, 2013). Despite this, analysis using Pearson's *r* and Spearman's ρ yielded the same outcome. I created a scatterplot, which revealed monotonicity. The BI and the STSB had kurtosis and skewness within an acceptable range of -1 to 1. For Spearman's ρ, a statistically significant correlation existed between the STSB and BI, $r = -.637$ ($p < .001$). This negative correlation indicated that as STSB time increased, BI score tended to decrease, indicating lower function with ADLs. These findings supported a negative relationship between STSB and BI total scores. Spearman's ρ also revealed a statistically significant correlation between STSB and the number of falls, $r = .517$ ($p < .001$). This positive correlation indicated that as STSB time increased, the number of falls also increased.

I used Spearman's ρ to determine if a relationship existed between function, as measured by the individual items on the BI, and STSB scores of older adults in independent living and assisted living communities. This analysis corresponded to the second research question. A significant relationship ($p < .05$) existed between the STSB score and the BI self-feeding item. Significant relationships ($p < .01$) also existed between the STSB score and the BI items for bathing, dressing, bladder incontinence, and stair mobility (see Table 3). The longer the time taken on the STSB, the lower the BI score.

Table 3

Correlations Between the Sock Test for Sitting Balance and the Barthel Index

Variable	Spearman's ρ	*p* value
Self-feeding	-.318	.024
Showering	-.470	< .001
Dressing	-.654	< .001
Urinary incontinence	-.515	< .001
Stair mobility	-.464	< .001

To answer the third research question, I conducted an independent sample *t* test to determine whether there was a difference in STSB scores between the independent living and assisted living groups. Levene's test indicated equal variances between groups ($p = .575$). The *t* test indicated no significant difference between the independent living and assisted living participants, $t(48) = 1.096$, $p = .278$, $d = 0.32$. Cohen's *d* indicated that the means for the two groups were .32 standard deviations apart, which is a small effect size. As such, the difference between these two groups was not meaningfully large.

For the fourth research question, I used linear regression to determine whether STSB scores predicted BI scores. Examination of a Q-Q plot suggested homoscedasticity could be assumed. The Durbin–Watson statistic was 1.627 (within the acceptable range of 0 to 4), so the independence of observations could be assumed. The formular use for the linear regression was Y = 104.466 -.465 x STSB. The linear regression was statistically significant, $F(1, 48) = 37.54$, $p < .001$, $R^2 = .44$. This meant the STSB score predicted 44% of the BI score.

CHAPTER V

DISCUSSION AND IMPLICATIONS

Descriptive Findings

The focus of this study was to determine the relationship between the individual items of the BI of ADLs and the STSB in assisted living and independent living groups. I also hoped to determine whether a difference existed between the two groups in older adults’ sitting balance as measured by the STSB. This study answered both questions, showing a relationship between some items of the BI of ADLs and the STSB.

Data analysis revealed no statistical difference in STSB scores between the independent living and assisted living communities. Several possibilities could explain this lack of difference. Some participants in independent living communities have family or hire aides to come to their homes and help with ADLs such as dressing and showering. Therefore, these older adults are not as independent as someone who does not have a caregiver. This would suggest that more dependent older adults live in independent living than it appears because some receive assistance from caregivers. The demographic data gathered did not include this information. Also, one of the prerequisites for participation in the study was the ability to follow directions; therefore, those with significant dementia were not included in the study. If such individuals had been represented in the study, they might have lowered the STSB scores for the assisted living group.

It should be noted that Yi et al. (2020) found the BI for ADLs was not appropriate for assessing ADLs in persons with dementia. Their study suggested the BI items overlapped, such as bladder control and toileting. In addition, stair climbing, and mobility demonstrated narrow category thresholds. A correlation also existed between the STSB score and falls in the previous year. As the STSB score went up, so did the number of falls.

Comparison of STSB and the BI of ADLs

In comparing the STSB to the BI of ADLs, the STSB scores did not differentiate the independent living participants from the assisted living participants. This differed from Franc's (2018) findings, in which the STSB distinguished a hospitalized population from a nonhospitalized population. The current study showed that as the STSB time increased, BI scores decreased. The longer it took a participant to don and doff their socks performing the STSB, the less function the participant indicated on the BI of ADSL.

The STSB score predicted 44% of the BI scores (i.e., self-feeding, bladder incontinence, dressing, showering, and stair mobility). Significant relationships existed between the STSB score and the self-feeding, showering, dressing, bladder incontinence, and stair mobility items of the BI. This resembled Franc's (2018) finding that the STSB significantly related to the Adaptive Functional Reach-Forward. As the Adaptive Functional Reach-Forward scores improved, so did the STSB scores. Franc found a significant relationship between the STSB and the functional independence measure bed–chair transfer subscale and the Kansas University Sitting and Standing Balance Scale.

The longer it took participants to put on their socks, the more likely they were to have difficulties with the BI items of self-feeding, bladder continence, dressing, showering, and stair mobility. This current study indicated no statistical difference in STSB scores between the independent and assisted living communities. Some participants in independent living communities had assistance with ADLs, such as dressing and showering. This resulted in a higher number of dependent older adults living in independent living than expected due to the assistance they received from caregivers. This finding aligns with Parker's (2011) findings that as time increased with the STSB, so did impairments in cognition, upper extremity dexterity, and vision among participants.

An individual requires fine motor coordination to perform self-feeding, dressing, and sock donning and doffing. Lee et al. (2015) demonstrated that fine motor skills and cognitive therapy improved the Modified BI of ADLs scores. The Modified BI of ADLs includes all 10 of the subcategories of the BI. Individuals also need gross motor coordination for those tasks, but even more so for showering and stair mobility. Stolarz et al. (2020) found that older adults who participated in senior clubs had improved scores on the BI of ADLs.

Bladder incontinence can have a variety of causes, including weak pelvic floor muscles, damage to the pelvic splanchnic nerves derived from the S2–4 nerve roots, spicy and citrusy foods, and side effects of some medications. Muscle weakness may explain why bladder incontinence occurred more often among participants who took longer to don and doff socks. The BI cannot be used to differentiate between different kinds of urinary incontinence because it does not ask about the type of incontinence the person is experiencing. In addition, there existed a lack of literature regarding the BI and the subcategory measure of urinary incontinence.

Finally, the study supports the results of other research, showing a correlation between balance tools to function with the BI of ADLs. Winser et al. (2017) found a significant correlation between the BI and the Berg Balance Scale.

STSB and Occupational Adaptation

Habits and routines represent an important aspect of occupational therapy, and practitioners must assess a person's level of adaptation through occupational performance. The STSB provides a way of assessing a person's adaptive response (Schkade & Schultz, 1992). The test is process-oriented and has a beginning and an end (Franc, 2018). The test also has meaning for the person tested: The task of donning and doffing socks represents a part of everyone's daily routine. When clients become more adaptive internally, they become more functional (Schultz, 2013). Grajo and Boisselle (2019) stated that practitioners use occupational adaptation to carefully design activities that increase a sense of self and help individuals overcome environmental barriers.

A person expects to have mastery over their basic self-care. The ability to don and doff a pair of socks has meaning and purpose for most people. Through the process of adaptation, success can be repeated, allowing a sense of mastery and self-confidence to grow (Grajo & Boisselle, 2019). With the ability to don and doff socks successfully, a person can progress to doffing and donning shoes, which contributes to overall successful dressing. Completion of dressing can contribute to social engagements in the home and enables the individual to leave the house to engage in other tasks, such as grocery shopping. This ability to complete basic tasks and engage the environment and other people leads to an improved quality of life (Grajo & Boisselle, 2019).

Clinical Relevance to Occupational Therapy

Using a simple STSB, a therapist can determine whether a patient has a functional problem with dressing, stair mobility, self-feeding, and showering. Socks are readily available, and the test takes a minute or less. Applying the test in this way would allow more older adults to have dynamic sitting balance tested and give occupational therapists an indication of possible functional difficulties to assess further.

The STSB provides an opportunity for the occupational therapist to observe not only the person's ability to perform a functional task but also the person's level of adaptation at the beginning and end of the task (Franc, 2018). This may help the therapist further assess the person's neuroplasticity and ability to adapt to tasks and contexts (Grajo & Boisselle, 2019).

The STSB may also help the occupational therapist gain a better understanding of the older adult's resilience. For example, two of the participants in the current study had significantly low vision and took more than 23 s to don and doff socks. I observed that they had adapted to how they performed the task. In addition, they did not see their low vision as something that prevented them from doing tasks and interacting socially. Their view was that it was an obstacle they needed to overcome by doing the task differently. Grajo and Boisselle (2019) referred to this as increasing self-awareness and control over tasks to regain adaptive behaviors.

Limitations Related to the Study

In this section, I discuss the limitations of this study, including discussions of the sampling, research design, impact of limitations, and use of caregivers. One limitation of the study involved a convenience sample taken from my workplace at Brookdale Senior Living assisted living and independent living communities. This limitation affected the generalizability of the results to other assisted living and independent living communities. Participants had to agree to engage in the study, and as a result, bias may have occurred because those who chose not to participate may have rendered different results.

Another limitation of this study involved the use of a cross-sectional research design. One advantage of this design is that it captures data at a point in time. A cross-sectional design contained multiple variables at the time of data collection. The limitation was that I only tested participants one time instead of repeatedly. Therefore, the study's results may not be used to analyze behavior over time. It is also a limitation in that the timing of the snapshot may not be representative. This was a necessary limitation due to the risk of COVID-19, as access to the older adult population was highly restricted.

This study had an impact limitation. The assisted living and independent living communities I studied were in the Dallas metropolitan area. People in rural areas might have different participation levels than those in urban areas. This study occurred in one geographic area, so the finding does not necessarily apply to other areas in the United States. In addition, the participants came from similar socioeconomic backgrounds and financial resource levels that allowed them to live in independent and assisted living environments.

In a final limitation, I did not explore the possibility of participants having assistance with their self-care. Some participants who could don and doff socks had difficulty manipulating fasteners or getting tops over their heads or shirts around their backs. It would have been interesting to know whether a participant's STSB time increased if they also had assistance with self-care. Also, more could be learned about whether it would have mattered for the STSB scores to know for which aspects of self-care the participants obtained assistance.

Recommendations for Future Research

There remains a need to determine whether accounting for assistance with self-care makes a difference in the evaluation of independent living and assisted living groups. If there is a difference, occupational therapists would need to know that those in independent living communities with higher STSB scores may still require assistance with some ADLs. Further research is also needed to determine the frequency, duration, and type of caregiver assistance (e.g., dressing, toileting) and the impact of that assistance on the STSB scores. Replicating this study in other geographical locations would provide more data to facilitate generalization to other regions and rural areas. Last, because the data indicated that STSB scores correlate with the number of falls, researchers should seek to determine cutoff scores that indicate a risk of falls in older adults. Finally, more research is needed to study the STSB in terms of pre and post treatment changes. Such a study would employ a treatment of dynamic balance protocol. The participants would be pre-tested with the STSB and after the treatment would then be post-tested to determine the changes in dynamic sitting balance as detected by the STSB.

Conclusion

Completing the task of donning and doffing socks involves cognition, range of motion, strength, coordination, vision, tactile sensation, attention, and balance. In this study, I explored whether the STSB can differentiate between older adults who reside in independent living and assisted living communities. The STSB could not differentiate between these two communities, but this may have been because those with cognitive impairments were excluded from the sample or because some in independent living communities receive assistance, making it possible for them to live in an independent community. I also explored which items of the BI the STSB could predict and determined it predicted self-feeding, dressing, stair mobility, and showering, which together represent 44% of the BI of ADLs.

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APPENDIX A

FLIER FOR PARTICIPANTS

Kim Broussard, a student with Texas Woman's University is conducting research on sitting balance at Brookdale communities.

- Help us understand how balance affects self-care.
- May help to prevent falls in older adults.

- Is there a difference between the sitting balance of those living in Assisted Living and Independent Living?

To Participate

- Call **Kim Broussard at 469-879-1562**
- Participation is voluntary.
- Sign a consent form to participate.

APPENDIX B

PHONE SCREENING FORM

Date:

Participant age:

Able to put on and take off socks (circle one): Yes No

Have both feet (does not have a foot amputation) (circle one): Yes No

Does the participant have a medical condition that impairs vestibular function?

(Circle one): Yes No

APPENDIX C

SCREENING FORM FOR COVID-19

“Before we begin, I am going to ask questions to screen for covid19. Over the past 14 days have you had any of the following symptoms (check one, yes/no)?

Symptoms	Yes	No
Dry cough		
Shortness of breath		
Muscle aches		
Sore Throat		
Headache (flu like illness)		
Fatigue (flu like illness)		
Have you had close contact (less than 6 ft for more than 10 mins) with anyone who has COVID-19		
Do you have covid19?		
Have you been tested for covid19?		

If you have been tested for covid19 when was the last date of testing?

Date: ________________________

Covid19 test results (circle one): Negative Positive

Have you taken the Covid19 vaccine: Yes / No

If so which vaccine (if you know): ___________________

Date of 1st vaccine: _________________

Date of 2nd vaccine (if applicable): ___________________

APPENDIX D

INSTITUTIONAL REVIEW BOARD APPROVAL LETTER

Date: 8-31-2021

IRB #: IRB-FY2021-18
Title: Advancing the Sock Test For Sitting Balance: Comparison With the Barthel Index Of ADLS With Older Adults
Creation Date: 9-20-2020
End Date: 12-16-2022
Status: Approved
Principal Investigator: Kim Broussard
Review Board: TWU IRB - Houston
Sponsor:

Study History

Submission Type Initial	**Review Type** Expedited	**Decision** Approved

Key Study Contacts

Member Mary Frances (Francie) Baxter	**Role** Co-Principal Investigator	**Contact** mbaxter@twu.edu
Member Kim Broussard	**Role** Principal Investigator	**Contact** kbroussard2@twu.edu
Member Kim Broussard	**Role** Primary Contact	**Contact** kbroussard2@twu.edu

APPENDIX E

INSTITUTIONAL AUTHORIZATION AGREEMENT

BROOKDALE
SENIOR LIVING

Letter of Agreement to Participate on Research

Texas Woman's University Institutional Review Board
Houston campus
713-794-2480
irb-houston@twu.edu

Subject: Letter of Agreement for Brookdale Senior Living to Participate in Research

Dear Texas Woman's University Institutional Review Board:

This letter will serve as authorization for the Texas Woman's University (TWU) researcher, Kim Broussard, to conduct the research project entitled Advancing the Sock Test For Sitting Balance: Comparison With the Barthel Index of ADL's With Older Adults at Brookdale Senior Living communities as follows: Brookdale at Club Hill, 1245 Colonel Drive, Garland, Texas 75043; Brookdale at Lake Highlands, 9715 Plano Road, Dallas, Texas 75238; and Brookdale at Summer Ridge, 3020 Ridge Road, Rockwell, Texas 75032.

Brookdale Senior Living (the Facility) acknowledges that it has reviewed the protocol presented by the researcher. We understand this research will be carried out with sound ethical principles, that participant involvement in this study is strictly voluntary, and confidentiality of the participant's research data is ensured as described in the protocol. We accept and approve the protocol including the participant recruitment, participant consent, and data collection.
If we have any concerns or require additional information, we will contact the researcher and/or the TWU IRB office at 713-794-2480.

Sara Terry

June 30, 2021

Sara Terry — Date
SVP Resident and Family Engagement and Experience

APPENDIX F

ASSISTANT SIGNATURE FOR CONFIDENTIALITY AGREEMENT

Texas Woman's University
Human Participant Research

Confidentiality Agreement

Study Title: Advancing the Sock Test for Sitting Balance: Comparison with the Barthel Index of ADLs

Principal Investigator (PI): Kim Broussard, OTD, OTR

I the undersigned, _______Anna Gattis-Lyles________________________, hereby agree to the following conditions of confidentiality concerning all information that may be supplied to me by members of the study research team.

- I agree to keep strictly confidential all information that may be communicated to me verbally, in written form, or in any other form.
- I agree to take all precautions necessary to prevent knowledge of this information from reaching any unauthorized parties. I clearly understand that authorized persons are only those persons who are approved members of the research team.
- I will not use any information provided to me for any purpose other than that required by the PI/research team.
- I will not keep any copies, summaries, or transcripts of the confidential documents provided in any form and will return all such documents to the PI/research team upon completion of my duties.

Name: _________Anna Gattis-Lyles____________________________________

Anna D. Gattis-Lyles ______ 02.03.2021 ______
Signature Date

Kim Broussard, OTD, OTR ______ 2-3-21 ______
Principal Investigator Signature Date

APPENDIX G

INFORMED CONSENT FORM

TEXAS WOMAN'S UNIVERSITY (TWU)
CONSENT TO PARTICIPATE IN RESEARCH

Title: Advancing the Sock Test For Sitting Balance: Comparison With the Barthel Index Of ADLS With Older Adults

Principal Investigator: Kim Broussard, OTD, OTR…… kbroussard2@twu.edu
469-879-1562

Faculty Advisor: Mary Frances Baxter, PhD…………… mbaxter@twu.edu
713-794-2321

Summary and Key Information about the Study

You are being asked to participate in a research study conducted by Ms. Kim Broussard, a student at Texas Woman's University, as a part of her dissertation. The purpose of this study is to determine the relationship between individual items of the Barthel Index of Activities of Daily Living and the Sock Test for Sitting Balance in Assisted Living and Independent Living groups. We hope to determine if there is a difference between sitting balance in older adults in the two groups as measured by the Sock Test for Sitting Balance. This proposed study is to further advance the use of the Sock Test for Sitting Balance in Assisted Living and Independent Living communities. The total time commitment for this study will be about 0 minutes. Following the completion of the study you will receive a pair of hospital socks for your participation. The greatest risks of this study include potential loss of confidentiality and fatigue. We will discuss these risks and the rest of the study procedures in greater detail below.

Your participation in this study is completely voluntary. If you are interested in learning more about this study, please review this consent form carefully and take your time deciding whether you want to participate. Please feel free to ask the primary investigator any questions you have about the study at any time.

Description of Procedures

As a participant in this study, you will be asked to spend about 5 minutes of your time completing and information sheet of demographic data (consisting of age, gender, weight, and medical history), which the primary research will help fill out

_________ Initials
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with you; about 2 minutes completing the Sock Test for Sitting Balance and about 20 minutes completing the Barthel Index for Activities of Daily Living. The Sock Test for Sitting Balance is a timed test, and the Barthel Index for Activities of Daily Living is rated on a scale with how independent you are in performing ten self-care tasks. The testing will take place in the privacy of your home. If you reside in assisted living and want the primary investigator to notify the staff of our appointment and request no interruptions at that time, please request the primary investigator to make that notification. After the tests are completed the scores will be shared with you and their meaning if requested. You may stop or take a break at any time during the testing.

Potential Risks

You could fall while performing these tests, however, an assistant will be present, and the primary investigator has much experience giving both tests. The primary investigator's experience in giving the tests and the assistant will help to prevent any falls. The Sock Test for Sitting Balance is performed in a sitting position which minimizes the fall risk.

You may not like the results of your tests, but you do not have to request the results if you do not want to know them.

It is possible you may fatigue because of participating in taking these tests, but you may rest at any time. You may also go to the rest room as needed.

There is a possibility of being infected with covid19. To minimize this risk, the researcher and assistant will wear personal protective equipment (PPE) which will include, face mask, face shield, and gloves. You and the primary investigator and assistant will wash hands at arrival and departure. Your temperature and the primary investigator's and assistant's temperature will be taken. In addition, you will be asked a series of questions regarding covid19 symptoms, possible exposure, and information on covid19 vaccines you have taken. Please note that the primary investigator and assistant will be asked these screening questions before accessing the community where you reside. If you have any covid19 exposure, then there will be a 10 day wait period before we can reschedule another appointment. If you have symptoms you will need to get a covid19 test two times and test negative twice in a row before an appointment can be rescheduled.

________ Initials

You will be asked to wear a mask during your testing, if you do not have one, a mask will be provided to you.

Loss of confidentiality in that the data and test collection forms could be lost or stolen. Information from the tests and data will be entered into a computer and the computer files could be stolen or copied by persons not intended.

There is a potential risk of loss of confidentiality in all email, downloading and internet interactions. To protect from loss of confidentiality the tests and data forms will not ask for the participants' names or addresses.

Files will be stored in an encrypted form, computer where data will be stored will be password protected and all data will be destroyed within 5 years from the end of the study.

Confidentiality will be protected to the extent that is allowed by law. The researchers will try to prevent any problem that could happen because of this research. You should let the researchers know at once if there is a problem and they will help you. However, Texas Woman's University does not provide medical services or financial assistances for injuries that might happen because you are taking part in this research.

Participation and Benefits

Participation in this study is completely voluntary and you may withdraw at any time without penalty. Following the completion of the study you will receive a pair of hospital socks for your participation. If you would like to know the results of this study, we will email them to you.

Questions Regarding the Study

You will be given a copy of this signed and dated consent form to keep. If you have any questions about the research study, you should ask the primary investigator; their contact information is at the top of this form. If you have questions about your rights as a participant in this research or the way this study has been conducted, you may contact the TWU Office of Research and Sponsored Programs at 713-794-2480 or via e-mail at irb-houston@twu.edu.

____ ________

Signature Date

- If you would like to know the results of this study tell us what email address you want them to be sent:
- Email: _____________________________________

Institutional Review Board
Approved: April 19, 2021
TEXAS WOMAN'S UNIVERSITY

________ Initials
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APPENDIX H

DATA COLLECTION FORM

Code Name:	
Date:	
Residence:	Independent Living Assisted Living
Fall History (past 12 mos.)	
Medical Hx. (any neurological disorders)	
Vision (circle one if appropriate):	Macular Degeneration Glaucoma Diabetic Retinopathy Cataracts Hemianopsia Retinitis Pigmentosa Other:
Age:	Weight
Gender:	Female Male

APPENDIX I

SOCK TEST FOR SITTING BALANCE

Sock Test

Total time to don and doff slipper socks (seconds)______________________

OR Participant was unable to complete the Sock Test____________________

Method Participant used:

Cross leg___________

Forward bend___________

Other(describe)____

Testing script: **For this test, I will be assessing your balance and the time it takes you to put on and take off a pair of socks. This is not a race. Put on the socks and remove them at your usual pace that is normal for you. I will start the stopwatch as soon as you take the socks from me and stop it when you have removed both socks. When I say 'go', please put on each sock once they are both on take them both off. Remember to go at your normal pace***." The hospital socks will then be handed to the participant by the researcher with one hand and when the researcher says 'go' will start the stopwatch with the other hand.*

APPENDIX J

THE BI OF ADLS

Code Name: ____________________________ Date: ____________________________

Activity	Score
FEEDING	
0 = unable	
5 = needs help cutting, spreading butter, etc., or requires modified diet	
10 = independent	______
BATHING	
0 = dependent	
5 = independent (or in shower)	______
GROOMING	
0 = needs to help with personal care	
5 = independent face/hair/teeth/shaving (implements provided)	______
DRESSING	
0 = dependent	
5 = needs help but can do about half unaided	
10 = independent (including buttons, zips, laces, etc.)	______
BOWELS	
0 = incontinent (or needs to be given enemas)	
5 = occasional accident	
10 = continent	______
BLADDER	

0 = incontinent, or catheterized and unable to manage alone

5 = occasional accident

10 = continent ______

TOILET USE

0 = dependent

5 = needs some help, but can do something alone

10 = independent (on and off, dressing, wiping) ______

TRANSFERS (BED TO CHAIR AND BACK)

0 = unable, no sitting balance

5 = major help (one or two people, physical), can sit

10 = minor help (verbal or physical)

15 = independent ______

MOBILITY (ON LEVEL SURFACES)

0 = immobile or < 50 yards

5 = wheelchair independent, including corners, > 50 yards

10 = walks with help of one person (verbal or physical) > 50 yards

15 = independent (but may use any aid; for example, stick) > 50 yards ______

STAIRS

0 = unable

5 = needs help (verbal, physical, carrying aid)

10 = independent ______

TOTAL (0–100): ______