IMPROVING OUTCOMES THROUGH PATIENT EMPOWERMENT AT TRANSITION OF CARE: A FALL PREVENTION PROGRAM FOR STROKE SURVIVORS

by

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DEDICATION

This practice inquiry is dedicated to stroke survivors who strive daily to move, adapt, and thrive. It is my hope that this work will facilitate empowerment to do so safely, mindfully, creatively, and well.

I share with you now an excerpt for the poem, *The Ponds*, by Mary Oliver (1992):

“Still, what I want in my life
is to be willing
to be dazzled—
to cast aside the weight of facts

and maybe even
to float a little
above this difficult world.
I want to believe I am looking

into the white fire of a great mystery.
I want to believe that the imperfections are nothing—
that the light is everything—that it is more than the sum
of each flawed blossom rising and falling. And I do.”
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ABSTRACT

BACKGROUND: Stroke survivors fall 7 times more annually than same-aged healthy adults; and most fall within the first 2 to 6 months post stroke after transition of care home from the acute setting. These falls cause hip fractures and other bodily injury, further compounding post-stroke mobility, fear of falling, social isolation, and social dependence while collectively yielding poorer outcomes at greater financial burden.

PROBLEM: To date, no fall prevention program has targeted stroke survivors as they prepare for transition of care home from the acute setting.

PURPOSE: The purpose of this practice inquiry is to develop an evidence-based fall prevention program aimed at empowering acute stroke survivors preparing for transition of care home from the acute setting.

METHODS: An extensive literature review was synthesized to assess post-stroke falls epidemiology, contributing factors, potential consequences, and the current status of ameliorative interventions. A modified conceptual framework based upon the Science of Unitary Human Beings, theories of health empowerment, cognitive plasticity, and cognitive reserve was created to synergistically inform fall prevention program development. Literature review synthesis and modified conceptual framework collectively informed subsequent construction of a mixed theory-outcome-activities approach logic model to systematically guide proposed program implementation and evaluation plans.
RESULTS: A novel evidence-based empowerment-focused fall prevention program was developed for acute stroke survivors preparing for transition of care home from the acute setting.

CONCLUSION: The multi-interventional Patient Empowerment at Transitions of Care Fall Prevention Program for Stroke Survivors inspires a paradigm shift in the way stroke professionals and survivors view recovery and inherent survivor potential. The proposed fall prevention program is informed by a solid theoretical foundation and rigorous literature review of high-level evidentiary support. Moreover, existing dynamic funding opportunities promote subsequent program implementation and evaluation facilitated by Patient-Centered Outcome Research Institute grant pursuit.

KEY WORDS: Advanced Practice Registered Nurse, Care Coordination, Empowerment, Fall, Fall Prevention, Multi-interventional, Patient-Centered Outcome Research Institute, Stroke, Stroke Survivors, Transition of Care.
CHAPTER 1: INTRODUCTION AND CONCEPTUAL FRAMEWORK

Every 40 seconds, someone in the U.S. suffers a stroke (Centers for Disease Control and Prevention [CDC], 2013; Go et al., 2013). An estimated 795,000 individuals suffer a stroke annually, while an additional 4 million individuals are projected to suffer a stroke by the year 2030 (CDC, 2013; Go et al., 2013). Stroke is the 4th leading cause of death responsible for 1 of every 19 deaths in the U.S (CDC, 2013; Go et al., 2013).

Every 4 minutes another American dies from stroke (CDC, 2013; Go et al., 2013).

Approximately 45% of Medicare-recipient stroke survivors return directly home post-discharge from an acute care facility, while 31% are discharged to skilled nursing facilities and 24% to inpatient rehabilitation facilities (Go et al, 2013). Approximately 32% of homeward bound stroke survivors use home health care services (Go et al., 2013). Though the U.S. spends an estimated $38.6 billion yearly on direct stroke-related health care, medications, and labor losses, too few home-dwelling stroke survivors receive outpatient rehabilitation (CDC, 2013; Go et al., 2013).

Strokes are a leading cause of long-term disability in the U.S. (CDC, 2013; Go et al., 2013). At 6 months post-discharge, an estimated 50% of stroke survivors are hemiparetic, while 30% are unable to walk unassisted, and 26% are dependent in activities of daily living (ADLs; Go et al., 2013; Kelly-Hayes et al., 2003). Additionally, an estimated 46% of stroke survivors have cognitive deficits, 35% have depressive symptoms, and 19% have aphasia (Go et al., 2013; Kelly-Hayes et al., 2013).
Problem Overview

Considering the synergistic impact and persistence of these post-stroke disabilities, it is not surprising that related mobility and stability issues negatively affect stroke survivors. This practice inquiry focuses upon the related problem of falls among stroke survivors. The following overview will highlight the background, significance and statement of the problem, as well as the problem’s significance to nursing, advanced nursing practice, and adult-gerontology acute care nursing.

Background, Significance, and Statement of Problem

Stroke survivors fall 7 times more annually than same-aged healthy adults (Go et al., 2013; Weerdesteyn, de Niet, van Duijnhoven, & Geurts, 2008). The majority of stroke survivors fall within the first 2 to 6 months post-stroke after transition of care (TOC) from the acute setting (Batchelor, Hill, Mackintosh, & Said, 2010; Mackintosh, Hill, Dodd, Goldie, & Culham, 2005; Wagner, Phillips, Hunsaker, & Forducey, 2009).

These falls cause hip fractures and other bodily injury, further compounding post-stroke mobility, fear of falling, social isolation, and social dependence (Akosile, Fabunmi, Umunnah, & Okey, 2011; Kerse et al., 2008; Mackintosh, Goldie, & Hill, 2005; Ramnemark, Nyberg, Borssen, Olsson, & Gustafson, 1998; Schmid, Kapoor, Dallas, & Bravata, 2010; Schmid & Rittman, 2007). Collectively, these effects yield poorer outcomes for over 46% of stroke survivors who have fallen, imposing a greater financial burden to survivors, their families, and society (Mackintosh, Hill, et al., 2005).

To date, no fall prevention program has targeted stroke survivors at TOC as they prepare for discharge from the acute care setting into the home. A fall prevention
program aimed at empowering stroke survivors at TOC and within the first 6 months post-stroke may have the potential to improve survivor outcomes.

**Significance to Nursing Practice**

Initiatives to improve care coordination across the care continuum provide an opportunity for nursing practice to lead transformational change within the health care. Coordination of care is not a new nursing practice (ANA, 2012). Patient-centered care coordination is a core nursing competency and professional standard (ANA, 2012).

Hence, nursing professionals play substantial roles in care coordination to improve health care delivery (ANA, 2012). Nurses not only participate in coordination of care on all levels, they design and implement care coordination systems (ANA, 2012).

**Significance to Advance Gerontological Nursing Practice.** The mean age of stroke onset ranges from 70 to 76 years old and is progressively increasing throughout the developed world (Shiue, 2011). Consequently, stroke-related issues are of concern to the older adult community (Shiue, 2011).

The following advanced practice nursing skills and functions are critical to improved gerontologic outcomes: communication skills; interpersonal skills; dynamically contextual critical thinking skills; specialized gerontologic knowledge; patient and family assessment; physical and environmental assessment; ongoing discharge needs assessment; direct clinical care provision; patient and caregiver self-management promotion; patient, family, and staff, education; interdisciplinary team leadership; and interprofessional collaboration facilitation (Bourbonniere & Evans, 2002; Gray-Micelli & Quigley, 2012). Synergistically, skills and functions contribute to the
high quality and evidenced-based care delivered through advanced gerontologic nursing practice, particularly that relate to fall prevention among acute stroke survivors (Bourbonniere & Evans, 2002; Gray-Micelli & Quigley, 2012).

Care coordination yields improved outcomes at lower costs, particularly for older adults transitioning from the acute to the home setting (ANA, 2012; Lim, Foust, & Van, 2012). For example, the Gundersan Lutheran Health System’s (n.d.) care coordination model, developed to reduce readmission of their most critical patients, resulted in a reduction of $6.5 million in health care charges within the first year of implementation and an additional $3 million in year two (ANA, 2012). When these patients were appropriately managed, subsequent admissions were less frequent, critical, and lengthy (ANA, 2012, Gundersan Lutheran Health System, n.d.).

Involvement of Advance Practice Registered Nurses (APRNs) is often needed to maintain health outcomes among acute, chronic, and complexly ill older adults (ANA, 2012). The ANA (2012) stresses that collaboration is a critical component to improve TOC. APRNs are uniquely prepared to facilitate collaboration throughout the continuum of care.

Considering such, the ANA (2012) urges professional organizations and practice leaders to identify and implement patient-centered and support system-inclusive care coordination opportunities. The ANA (2012) also urges professional practices to explore nurse-led TOC coordination models. Moreover, the Community-based Care Transitions Program (CCTP), created by Section 3026 of the Affordable Care Act (ACA), aims to improve TOC quality and reduce readmissions through testing and funding of transitional
care programs implemented for community or acute-care based settings (Centers for Medicare & Medicaid Services, 2013). Therefore, a window of opportunity with funding incentives currently exists for APRNs to serve as transformational leaders of TOC improvement initiatives.

One tool that can assist APRNs in TOC-related program development, implementation, and evaluation is a logic model (W.K. Kellogg Foundation, 2004). Simply defined, the basic logic model (see Figure 1) is a systematic way to illustrate how a program will accomplish the developer’s intent (W.K. Kellogg Foundation, 2004). Specifically, the program logic model visually links theoretical assumptions, required inputs, activities, outputs, outcomes, and long-term impacts of a program (W.K. Kellogg Foundation, 2004).

![Figure 1: Basic Logic Model](image)


The W.K. Kellogg Foundation (2004) created a logic model development guide to assist a variety of program developers in basic program planning. Various versions of logic models exist and may be used by the APRN and other health care professionals to
facilitate thinking, planning, communication, implementation, and evaluation of program objectives (W.K. Kellogg Foundation, 2004). For example, the CDC’s Division for Heart Disease and Stroke Prevention (CDC, DHDSP, n.d.) created a similar guide to assist stroke specialists in developing and using a logic model for stroke prevention programs. Consequently, this guide can also inform logic model development for other stroke-related programs.

Logic models provide stakeholders with a road map of resources and events necessary to attain desired results (W.K. Kellogg Foundation, 2004). Furthermore, program mapping provides the opportunity to visualize how human and financial investments contribute to ultimate program goal attainment (W.K. Kellogg Foundation, 2004). Ultimately, logic model use can bring program ideas to life so that all stakeholders can clearly conceptualize program implementation and facilitate success (W.K. Kellogg Foundation, 2004).

**Conceptual Framework**

A conceptual framework is a rational, thematic, and explanatory network of interrelated supporting abstractions assembled to clarify the relationships among them (Polit & Beck, 2012). Dynamically interactive theoretical nursing frameworks and theories of aging inform the conceptual framework supporting this practice inquiry.

**Theoretical Nursing Frameworks**

According to nursing theorist Martha E. Rogers’ (1992), a solid theoretical foundation identifies nursing as a science and an art and requires a methodical abstract system from which to draw unifying principals and hypothetical generalities. Accordingly,
it is of paramount importance to formally present the theoretical nursing frameworks from which the unifying principals of this practice inquiry are derived.

**Rogers’ Science of Unitary Human Beings.** Rogers’ (1992) Science of Unitary Human Beings views nursing as a science with a unique body of knowledge and a pandimensional worldview based upon a conceptual system of science, principles, and theories. The art of nursing lies within the profession’s creative use of nursing science for human advancement (Rogers, 1992).

One key tenet of the Science of Unitary Human Beings informing this practice inquiry is Rogers’ (1992) postulation of aging as a “continuously creative process” of change in which individuals knowingly participate, rather than a decompensation that individuals forcibly endure (p. 32). Rogers views disease and pathology as value terms utilized when individuals manifest undesirable characteristics. Birth, life, death and accompanying health- and age-related changes are inevitable. Rather than viewing these health- and age-related changes along a continuum of progressive decline, Rogers views them as fuel for a continuously creative process of aging.

According to Rogers (1992), individuals are greater than the sum of their parts. Rogers’ homeodynamic principle of integrality further expands upon this concept by acknowledging that humans and their environments are continuous, mutually integral, and fundamentally connected. This is applicable to stroke recovery in that survivor empowerment can be facilitated through recognition and utilization of environmental resources to successfully adapt to post-stroke changes. Furthermore, Rogers stressed that nurses must study individuals in ways that enhance their humanity. This can be
accomplished through well-being and health promotion from wherever a survivor is within their creative process of aging.

Collectively, these tenets can inform a paradigm shift in the way stroke care professionals view stroke recovery and accordingly care for stroke survivors. Stroke survivors are more than the sum of their post-stroke parts. Though strokes are recognized as unwanted disease-related or pathological events, they may also be viewed as opportunities to continuously adapt to creative, albeit unwelcomed, processes of aging.

**Shearer’s Theory of Health Empowerment.** Nelma Shearer’s (2009) theory of health empowerment (see Figure 2) is partially based upon Rogers’ (1992) Science of Unitary Beings, particularly the related principle of integrality. The theory of health empowerment emphasizes purposeful participation in a process of self and environmental change to recognize health patterns and engage inner health resources (Shearer & Reed, 2004). Shearer (2009) notes that health empowerment results from personal and socio-contextual resource recognition and promotes health through purposeful participation in goal attainment. Theoretical principles of the health empowerment theory note that empowerment is: continuously inherent within, an interrelational process between person and environment, an ongoing process of continuously innovative change, and expressive of a health pattern (Shearer, 2009).

Furthermore, empowerment is both a process and an outcome that is the transfer of power from one base to another (Shearer, 2009). Stroke care providers do not empower; rather, they facilitate the outcome of empowerment within stroke survivors (Shearer, 2009). Empowerment processes emphasize emancipation, liberation, and
energy sharing while shifting perspectives from perceived victimization to a more creative and proactive approach that cultivates survivor potential. During the empowerment process, the survivor optimizes self-transformation through relational processes of recovery, pattern recognition, engagement of inner resources, and personal-environmental change (Shearer, 2009).


When asked to express an overarching metaparadigmatic statement, Nelma Shearer (personal communication, November 12, 2011) stated that, “Nursing enhances
the environment which facilitates the inherent healing process optimizing the human health potential.” This philosophy informs and is infused throughout Shearer’s (2009, p. 8) Health Empowerment Intervention Framework pictured in Figure 2. Ultimately, Shearer (2009) notes that empowerment is central to a unitary perspective of human beings, yet is a process greater than any one theory can represent.

**Foundational Theories of Aging**

For years, nursing has utilized psychosocial theories to promote awareness of challenges faced by older adults (Lange & Grossman, 2010). However, these broad theories often lack specificity and the holistic perspective necessary to guide care of older adults with varying needs (Lange & Grossman, 2010). Hence, nursing must develop care models that incorporate concepts of aging (Lange & Grossman, 2010).

**Theories of Cognitive Plasticity and Cognitive Reserve.** Successful fall prevention post-stroke requires adaptation to associated pathological changes. Cognitive plasticity is the latent cognitive potential, or reserve, exercised during successful adaptation to challenges of aging (Willis, Schaie, & Martin, 2009). Stern’s (2002, 2009) theory of cognitive reserve proposes that cognitive plasticity is not fixed; rather, it evolves across the lifespan and is spared in the face of neural compromise, such as that attributable to a stroke.

This is relevant to stroke recovery in that individuals with higher cognitive reserve can better compensate for stroke-related pathology. Furthermore, though cognitive reserve is enhanced by literacy, education, occupational attainment, engagement in leisure activities, and use of social networks, even late reserve recruitment

Brickman et al. (2011) tested Stern’s (2002, 2009) theory of cognitive reserve by hypothesizing that individuals with more reserve could tolerate more small vessel pathology or white matter hyperintensity (WMH) than those with less. In a community-based study, 717 neurologically healthy older adults ($M$ age $= 79\pm5$ years) had a structural MRI, neuropsychological assessment, cognitive reserve evaluation, and algorithmic WMH quantification (Brickman et al., 2011).

Remarkably, older adults with greater reserve had significantly more WMH or small vessel disease (Brickman et al., 2011). Brickman et al. (2011) concluded that for all cognitive levels, older adults with more WMH or greater small vessel pathology, e.g. stroke survivors, possess higher cognitive reserve, suggesting they may better cope with pathology than those with lower reserve.

The theories of cognitive plasticity and cognitive reserve are suitable to inform gerontologic post-stroke rehabilitation and fall prevention research. Despite neural injury attributable to stroke, stroke survivors possess latent cognitive potential that can be engaged to successfully adapt to post-stroke-related challenges, such as fall risk.

Cognitive reserve and plasticity awareness promotion can facilitate empowerment among stroke survivors by acknowledging that stroke recovery requires methodical
enhancements in brain networks underlying certain behaviors or physical actions. However, this is not a process of decompensation or degradation; rather, it is the activation of a novel brain network. These successful adaptations correspond with Rogers’ (1992) theory of aging as a “continuously creative,” rather than a decompensatory, process (p. 32). Hence, individual differences occurring post-stroke can be conceptualized as opportunities to discover and employ novel neural networks, thus cultivating even greater cognitive reserve.

Purpose

The primary purpose of this practice inquiry is to develop an evidence-based fall prevention program aimed at empowering acute stroke survivors preparing for TOC into the home setting.

Aims

The specific aims to empower acute stroke survivors preparing for TOC into the home setting are to:

1. Develop a modified conceptual framework based upon the Science of Unitary Human Beings, theories of health empowerment, cognitive plasticity, and cognitive reserve to theoretically inform fall prevention program development.

2. Create a program implementation and evaluation plan through construction of a supporting mixed theory-outcome-activities approach logic model using W.K. Kellogg Foundation and CDC, DHDSP logic model development and use guides.
Definitions

Phrases foundational to this practice inquiry are further defined throughout the following sub-sections.

Stroke Survivor

A stroke survivor refers to a living individual who has suffered a stroke. The term *survivor*, rather than *victim*, is used to promote self-management and survivor empowerment as supported by Shearer’s Theory of Health Empowerment (2009).

Fall

A fall is defined as an event in which a survivor ended up on the floor or ground when they did not expect to (Taylor-Piliae, et al., 2014).

Near-Fall

A near-fall is defined as an event in which a survivor was able to recover their balance without falling (Taylor-Piliae et al., 2014).

Empowerment

Empowerment connotes active participation in goal attainment and subsequent well-being promotion through recognition and employment of personal and socio-contextual resources (Shearer, 2009).

Transition of Care

Transition of care (TOC) refers to the movement of a patient between health care practitioners, settings, and home throughout the course of their acute, sub-acute, and then chronic illness health management (Coleman & Berenson, 2004; Joint Commission
Enterprise, 2012). For example, acute stroke survivors proceed through a TOC as they are discharged from the acute setting into the home setting (Haynes, 2013).

TOCs pose a tactical challenge to continuity of care and related patient safety (Coleman & Berenson, 2004). Ineffective TOCs trigger adverse events, higher hospital readmissions, and poorer outcomes at increased costs (Joint Commission Enterprise, 2012). Ineffective TOCs may occur from and to all settings, especially during the TOC from the acute to home setting (Joint Commission Enterprise, 2012). Safe and effective TOCs improve overall outcomes and require extension of care beyond acute settings to reduce preventable complications, readmissions, and associated costs (Cykert, 2012).

Under the ACA, hospitals exhibiting unacceptably high readmission rates will suffer a penalty (Joint Commission Enterprise, 2012). Considering such, the Joint Commission Enterprise (2012) is conducting a three-year initiative to improve TOC effectiveness and provide safe, quality care in all settings. Related efforts extend beyond the limited reach of set standards, National Patient Safety goals, survey activities, and educational services by offering various interventions and resources designed to synergistically improve care coordination at TOCs (Joint Commission Enterprise, 2012).

**Care Coordination**

Care coordination serves to meet patient health needs over time through health services and related information management (American Nurses Association [ANA], 2012). Care coordination is the intentional organization of patient care activities between two or more care participants so that appropriate health care services may be delivered (ANA, 2012).
Summary

The problem of falls among stroke survivors is of significance and negatively affects survivor outcomes. Stroke survivors are at highest fall risk within the first 6 months after TOC from the acute to the home setting. Despite this increased risk, no fall prevention programs have been created to support stroke survivors throughout this vulnerable TOC phase.

APRNs have the knowledge, training, and skills to efficiently and effectively coordinate care throughout TOC. Additionally, a window of opportunity with funding incentives currently exists to facilitate APRN-led TOC improvement initiatives. Therefore, APRNs are optimally suited to facilitate a fall prevention program for transitional care stroke survivors aimed at outcome improvement through theoretically supported patient empowerment techniques and evidence-based interventions.
CHAPTER 2: PROBLEM EXPLORATION AND LITERATURE REVIEW

To develop an evidence-based fall prevention program aimed at acute stroke survivors preparing for TOC into the community setting, post-stroke falls epidemiology, contributing factors, potential consequences, and the current status of ameliorative interventions must be assessed. The following discourse further explores the problem of falls among stroke survivors. An extensive literature review will then be presented to synthesize the current status of fall prevention interventions targeting stroke survivors. Polit and Beck’s (2012, p. 28) Quick Guide to an Evidence Hierarchy of Designs for Cause-Probing Questions (see Figure 3) was used to assess the level of evidence informing this chapter’s development.

**Epidemiology**

Older community-dwelling stroke survivors have an increased risk for falls and associated injury, while female stroke survivors have an even greater risk for falls (Pouwels, et al., 2009; Ramnemark, et al., 1998).

Mackintosh, Hill, Dodd, Goldie, and Culham (2005) reported that 46% of stroke survivors fell within 2 months of discharge from rehabilitation. Wagner, Phillips, Hunsaker, and Forducey (2009) found that most stroke survivors fall at home and within the first 6 months post-stroke. Therefore, fall prevention programs targeting acute stroke survivors preparing for TOC into the community setting are critically needed (Batchelor et al., 2010).

**Contributing Factors**

Balance disturbances, mobility issues, disability, prior falls, and depression have been correlated with increased fall risk and occurrence (Jørgensen, Engstad, & Jacobsen, 2002; Kerse et al., 2008). Hyndeman, Ashburn, and Stack (2002) found repeat fallers to have reduced arm function and activities of daily living (ADL) ability. Balance loss, misjudgment, and foot drop were the most common reported causes (Hyndeman, Ashburn, & Stack, 2002). Taylor-Piliae et al. (2014) found that slipping, tripping, and rapid ambulation attempts were the most common self-reported fall triggers among community-dwelling stroke survivors (n = 89, M age = 79±5.5, 45% women, 70% ischemic stroke). Other stroke survivors (n = 181, M age = 70±10, 46% women, stroke type unspecified) have reported stooping or kneeling difficulty as a significant contributing factor (Mackintosh, Goldie, et al., 2005).
**Potential Consequences**

Kerse et al. (2008) conducted a level IV community-based prospective correlational study in which 1104 \( n \) stroke survivors were interviewed at 6 months post-stroke and found 37\% of stroke survivors reported a fall, 14\% of whom reported an injury, 3\% of which were fractures. Similarly, Pouwels et al. (2009) conducted a level IV case control correlational study that associated stroke with a two-fold increase in hip and femur fracture risk, particularly in patients with a recent stroke and those who are younger than 71 years of age. Factors positively associated with injury were female gender, European ethnicity, and pre-stroke dependence (Kerse et al., 2008; Pouwels et al., 2009). Factors negatively associated with injurious falls were normal cognition and higher activity levels (Kerse et al., 2008; Pouwels et al., 2009).

Ramnemark, Nyber, Borssen, Olsson, and Gustafson (1998) conducted a level IV correlational study of 1139 \( n \) acute stroke survivors and found that 9\% of survivors suffered from fractures, 84\% of which were attributable to falls. Fractures most often affected survivor’s paretic side and occurred at a mean onset of 24 months post-stroke (Ramnemark, et al., 1998).

Mobility issues often affect stroke survivors. Falls further comprise mobility through additional activity restrictions as measured by decreases in Functional Independence Measure (FIM) scores and Berg Balance Scale (BBS) Scores (Mackintosh, Hill, et al., 2005). Makintosh, Hill et al., (200%) noted that stroke survivors with poorer FIM scores needed greater rising assistance, while subjects with poorer BBS scores were more likely to fall in the morning and subsequently restrict their activity. Stroke
survivors with poor FIM and BBS scores were at greater risk to sustain a fall-related injury (Mackintosh, Hill, et al., 2005).

Closely related to mobility issues and fall status is fear-of-falling (FoF) development, which is associated with self-perceived post-stroke bodily change, actual increased fall risk, and a pervasive FoF (Akosile et al., 2011; Schmid & Rittman, 2007). FoF development is further heightened by a history of fall at stroke onset (Akosile et al., 2011; Schmid & Rittman, 2007).

Collectively, these potential consequences of falls among stroke survivors contribute to a cyclical and synergistic pattern of compounded injury, mobility loss, dependency, social isolation, decreased quality of life, and heightened FoF beyond that of the initial stroke. Hence, effective interventions for fall prevention among stroke survivors are critically needed (Batchelor et al., 2010).

**Fall Prevention Interventions for Stroke Survivors: A Literature Review**

A PubMed search for the MeSH Major Topic of term of “stroke” and Title/Abstract term of “fall” and a Cochrane Database of Systematic Reviews search for the Title, Abstract, Keywords of “stroke” and “fall” was conducted. Limitations included: English language, human subjects aged 18 years and older, publication years 2003 to 2013, level II or higher design, and fall-related primary outcome measures. A total of 9 level II interventional studies from PubMed (see Table 1) and 2 level I systematic reviews from the Cochrane Database of Systematic Reviews (see Table 2) were reviewed.
Demographic Overview of Studied Survivors

The mean age of survivors studied was 65 years old (range 55 to 74 years; see Table 1). Though gender demographics were not reported in one study (Sato, Iwamoto, & Honda, 2011), women comprised 46% of studied survivors (see Table 1). Ethnicity of studied survivors was not consistently reported throughout all studies (see Table 1). Studied survivors ranged from 2 months to 6 years post-stroke, while the majority of those were 2 to 4 years post-stroke (see Table 1). Though some studies did not report stroke classification, 42% to 78% of survivors were affected by an ischemic stroke (Cakar, Durmus, Tekin, Dincer, & Kiralp, 2010; Marigold, et al., 2005; see Table 1). Most survivors resided in a community setting, however 2 studies were conducted in a hospital or institutionalized setting (Sato, Iwamoto, Kanoko, & Satoh, 2005; Sato et al., 2011; see Table 1). Studies were completed in the following countries: Australia (n=2), Canada (n=1), China (n=1), Japan (n=2), Taiwan (n=1), Turkey (n=1), and the United States (n=2; see Table 1).

Study Designs, Methods, and Measures

Study designs consisted of randomized controlled trials (RCTs; n=6), an open-label RCT, a prospective longitudinal prevalence study and cross-sectional analysis of an RCT, a cross-sectional cohort comparison, and a within-subjects cross-over intervention (see Table 1). There were n=6 exercise studies, n=2 medication studies, and n=2 assistive-device studies (see Table 1). Outcome measures were variable throughout studies (see Table 1). Fall-related outcome measures included: fall incidence, fall rate or
falls per person, number of fallers, number of injuries, number of fall-related hospital admissions, and fracture incidence (see Table 1).

**Summary of Study Results and Conclusions**

**Exercise Studies.** Marigold et al. (2005) concluded that exercise programs improve postural reflexes, functional balance, mobility, and may lead to fall reduction in older stroke survivors (see Table 1). However, Dean et al., (2012) found that an exercise program focused on walking improvement, physical activity enhancement, and fall prevention enhanced mobility but had no effect on falls when compared to an exercise program focused on upper-limb and cognition functions (Dean et al., 2012; see Table 1).

Tilson et al. (2012) determined that fall risk is highest in survivors with severe walking impairment (<0.4m/s) if they receive home exercise and locomotor training within 2 months post-stroke (see Table 1). Additionally, Tilson et al., (2012) noted that Berg Balance Scale (BBS) assessment at 2 months post-stroke is useful for informing fall risk, yet does not account for multifactorial nature of falls (see Table 1). However, Batchelor, Hill, Mackintosh, Said, and Whitehead (2012) discovered no significant differences in fall-related outcomes between a multi-interventional fall prevention intervention group and a usual care (UC) control (see Table 1). Despite such, Tilson et al. (2012) emphasized that fall prevention requires a multifactorial risk assessment with concurrent mobility improving exercise interventions (see Table 1).

The efficacy of complementary and alternative exercise therapies upon fall prevention for stroke survivors was evaluated in two reviewed studies (see Table 1). Lau, Yip, and Pang (2012) found that whole body vibration (WBV) therapy was no more
effective that a dynamic leg exercises in reducing fall incidence (see Table 1).

Conversely, Taylor-Piliae et al., (2014) discovered both Tai Chi (TC) and SilverSneakers® (SS) improved aerobic endurance and are suitable for community-based post-stroke rehabilitation (see Table 1). Furthermore, Taylor-Piliae et al. (2014) found that TC was more effective in fall reduction than SS or UC (see Table 1). This study informs stroke researchers of the potential promise and clinical utility of low-cost alternative health therapies in stroke rehabilitation and fall prevention among transitional care stroke survivors.

**Medication Studies.** Interestingly, Sato, Iwamoto, Kanoko, and Satoh (2005) found that all studied survivors had Serum 25-hydroxyvitamin D deficiency (see Table 1). Sato et al. (2005) subsequently determined that vitamin D supplementation increased muscle strength, thereby decreasing fall incidence by 59% in elderly female stroke survivors (see Table 1). Later, Sato et al. (2011) concluded that elderly stroke survivors with hypercalcemia are at increased fall risk and that alendronate therapy may reduce falls and associated hip fracture (see Table 1).

**Assistive Device Studies.** Cakar, Durmus, Tekin, Dincer, and Kiralp (2010) discovered that posterior leaf spring (PLS) ankle foot orthoses (AFOs) in chronic hemiparetic stroke survivors with mild to moderate lower limb spasticity improved balance and decreased fall risk (see Table 1). Similarly, Hung, Chen, Yu and Hsieh (2011) deduced that anterior AFOs significantly improve the functional walking ability and fall efficacy of younger stroke survivors or those with low walking ability (see Table 1).
Challenges to Scientific Rigor. Recurrent challenges to scientific rigor among reviewed studies included potential recall ($n=7$) and sampling ($n=3$) biases. Other challenges included: learning ($n=1$), performance ($n=1$), and selection biases ($n=1$); a potential type II error ($n=1$); low intervention adherence ($n=1$); attrition ($n=1$); convenience sampling ($n=1$); an open-label RCT design ($n=1$); and a nonrandomized cross-over designs without counterbalancing ($n=1$). Additionally, generalizability was limited to a variety of older, chronic, independently or dependently ambulatory, institutional-, home-, or community-dwelling stroke survivors in Australia ($n=2$), United States ($n=2$), Canada ($n=1$), China ($n=1$), Japan ($n=2$), Taiwan ($n=1$), or Turkey ($n=1$; see Table 1).
<table>
<thead>
<tr>
<th>Reference</th>
<th>Study Design (Level)</th>
<th>Sample/Setting</th>
<th>Methods/Measures</th>
<th>Results/Conclusion(s)</th>
<th>Challenges to Scientific Rigor</th>
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<tbody>
<tr>
<td>Marigold et al. (2005)</td>
<td>Assessor blinded Randomized Controlled Trial (RCT; II)</td>
<td>Older chronic stroke survivors • $n=61$ • $M$ age=68 • Women=31% • $M$ time post-stroke=4 years • Ischemic=unspecified Setting: Community Country: Canada</td>
<td>IG ($n=30$): Agility training CG ($n=31$): Stretching and weight-shifting training Frequency/Duration: 3 times weekly/10 weeks; falls tracked over 1 year through falls diary Measures: BBS, Timed Up and Go, step reaction time, activities-specific Balance Confidence, Nottingham Health Profile, standing postural reflexes testing, and platform-evoked induced falls</td>
<td>Both groups improved in all measures. IG demonstrated &gt; improvement in step reaction time, postural reflexes, and had &lt; induced falls. Prospective community-based falls of IG $n=25$ versus CG $n=75$. Conclusion: Group exercise programs improve postural reflexes, functional balance, and mobility; may lead to fall reduction in older stroke survivors.</td>
<td>Internal Validity • Potential recall bias of self reported falls External Validity • Limited generalizability</td>
</tr>
<tr>
<td>Sato et al. (2005)</td>
<td>RCT (II)</td>
<td>Chronic stroke survivors with hemiplegia • $n=96$ • $M$ age=74 • Women=100% • $M$ time post-stroke=&gt;2 years • Ischemic=68% Setting: Institutional Country: Japan</td>
<td>IG ($n=48$): Ergocalciferol 1,000 IU CG ($n=48$): Placebo Frequency/Duration: Twice daily/2 years Measures: Falls per survivor; hip fracture incidence; nonparetic skeletal muscle strength</td>
<td>Serum 25-hydroxyvitamin D deficiency ($&lt;10$ ng/ml) in all survivors. Vitamin D supplementation enhanced levels, accounted for 59% fall reduction (95% CI=28-81%; $p=0.003$), and improved muscle strength. IG fracture $n=0$ versus CG fracture $n=4$. Conclusion: Vitamin D may increase muscle strength and decrease fall and hip fracture incidence in elderly female stroke survivors.</td>
<td>Internal Validity • Potential recall bias as witnessed or reported falls recorded by nurses providing care • Potential attrition bias with 85 of 96 survivors completing trial • Convenience sampling External Validity • Limited generalizability</td>
</tr>
<tr>
<td>Reference</td>
<td>Study Design (Level)</td>
<td>Sample/Setting</td>
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<td>Results/Conclusion(s)</td>
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<tr>
<td>Cakar et al. (2010)</td>
<td>Cross-over intervention, within-subjects (II)</td>
<td>Chronic hemiparetic stroke survivors, mild to moderate lower limb spasticity, able to walk independently without assistive device</td>
<td>Measures: BBS, PST, and Biodex Balance System FRT measurement with/without prefabricated thermoplastic PLS-AFO with footwear</td>
<td>Results: Prefabricated thermoplastic PLS-AFOs improve balance and reduce fall risk (3.4±2.0 without vs. 2.7±1.7 with, p&lt;0.01). Conclusion: Use of PLS-AFOs in chronic hemiparetic stroke survivors with mild to moderate lower limb spasticity encouraged.</td>
<td>Internal Validity: Nonrandomized cross-over without counterbalancing, Sampling bias (32% women) External Validity: Small sample with limited generalizability</td>
</tr>
<tr>
<td>Hung et al. (2011)</td>
<td>Cross-sectional cohort comparison (II)</td>
<td>Stroke survivors wearing anterior AFO ≥ 5 months possessing independent walking ability with/without assistive device.</td>
<td>Measures: mEFAP and 6MWT with/without anterior AFO; subjective perceptions assessment with Falls Efficacy Scale-International and self-designed questionnaire</td>
<td>Results: With anterior AFO mEFAP scores significantly decreased (p&lt;0.01). Falls Efficacy Scale-International scores significantly lower with than without (32±13 vs. 40±13). 90% of survivors perceived walking improvement and would recommend. Conclusion: Anterior AFOs significantly improve functional walking ability and fall efficacy of stroke survivors. Anterior AFOs are more suitable for younger survivors or those with low walking ability.</td>
<td>Internal Validity: Performance bias with no blinding feasible, Clinical measures only, Sampling bias (33% women) External Validity: Limited generalizability</td>
</tr>
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<td>Reference</td>
<td>Study Design (Level)</td>
<td>Sample/Setting</td>
<td>Methods/Measures</td>
<td>Results/Conclusion(s)</td>
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<tr>
<td>Sato et al.</td>
<td>Open-label trial RCT (II)</td>
<td>Hemiparetic convalescent stage stroke survivors</td>
<td>IG ($n=41$): alendronate 35 mg</td>
<td>Falls $n=77$ (alphacalcidol $n=10$, alendronate $n=67$); fallers $n=19$ (alphacalcidol $n=14$, alendronate $n=5$); hip fracture $n=1$ (CG). Alendronate therapy accounted for 65% fall reduction (95%CI=25-72%, $p=0.0021$).</td>
<td>- Gender demographics not reported</td>
</tr>
<tr>
<td>(2011)</td>
<td></td>
<td>• $n=82$</td>
<td>CG ($n=41$): alphacalcidol 1 mcg</td>
<td></td>
<td>- Open-label design, though blinding of nurses recording falls and physicians performing follow-up assessment did occur</td>
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<tr>
<td></td>
<td></td>
<td>• Women=% unspecified</td>
<td>Frequency/Duration: IG weekly, CG daily/8-week pretreatment period and 1 year treatment period</td>
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<td>- External Validity</td>
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<td></td>
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<td>• $M$ age=73 years</td>
<td>Measures: Falls per survivor, hip fracture incidence</td>
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<td>- Limited generalizability</td>
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<td></td>
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<td>• $M$ time post-stroke=3 years</td>
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<td></td>
<td></td>
<td>• Ischemic=73%</td>
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<td></td>
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<td>Setting: Long-term care hospital</td>
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<td></td>
<td></td>
<td>Country: Japan</td>
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<tr>
<td>Tilson et al.</td>
<td>Prospective longitudinal prevalence study and cross-sectional analysis of RCT (II)</td>
<td>Ambulatory stroke survivors enrolled in Locomotor Experience Applied Post-Stroke (LEAPS) RCT</td>
<td>Measures: Falls; faller classification as M/I, single and noninjurious, or nonfaller; incidence and time to M/I compared across LEAP interventions</td>
<td>36% of survivors were M/I, 21.6% single and noninjurious, 42.4% nonfallers. Most falls occurred at home within 3 months of assessment. BBS score $\leq 42/56$ single best predictor of M/I falls.</td>
<td>- Potential recall bias of self- or caregiver-reported falls</td>
</tr>
<tr>
<td>(2012)</td>
<td></td>
<td>• $n=408$</td>
<td>Results: Falls $n=77$</td>
<td></td>
<td>- External Validity</td>
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<td></td>
<td></td>
<td>• $M$ age=62</td>
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<td>- Limited generalizability</td>
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<td></td>
<td></td>
<td>• Women=45%</td>
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<td>• $M$ time post-stroke=2 months</td>
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<td></td>
<td></td>
<td>• Ischemic=71%</td>
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<td></td>
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<td>Setting: Community</td>
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<td></td>
<td></td>
<td>Country: United States</td>
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<td>Reference</td>
<td>Study Design (Level)</td>
<td>Sample/Setting</td>
<td>Methods/Measures</td>
<td>Results/Conclusion(s)</td>
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</table>
| Lau, Yip, and Pang (2012)  | Single-blinded RCT (II) | Hemispheric stroke survivors participating in stroke self-help group able to stand independently with/without assistive devices >1.5 minutes | IG \( (n=41) \): WBV with dynamic leg exercises  
CG \( (n=41) \): Dynamic leg exercises  
Frequency/Duration: 3 times weekly/8 week training program  
Measures: Fall rate, number of fallers, number of fallers sustaining fracture, number of fallers with related hospital admissions, and adverse events | Results: Significant \((p<0.001)\) improvement in balance, mobility, muscle strength, and fall-related self-efficacy in both groups. No significant \((p>0.05)\) difference in fall incidence.  
Conclusion: WBV no more effective that a dynamic leg exercises in reducing fall incidence. | Internal Validity  
- Potential recall bias of self-reported falls  
- Sampling bias  
- Limited generalizability |
| Batchelor et al. (2012)    | Prospective, single blind, multicenter, RCT (II) | Home-dwelling stroke survivors post rehabilitation discharge  
- \( n=156 \)  
- \( M \) age=71  
- Women=40%  
- \( M \) time post stroke=not specified  
- Ischemic=78%  
Setting: Community  
Country: Australia | IG \( (n=71) \): Tailored multi-interventional fall prevention with home exercise, fall risk reduction strategies, injury reduction strategies  
CG \( (n=85) \): Physical and occupational therapy  
Frequency/Duration:  
Measures: Primary measures of fall rate, proportion of fallers; secondary measures of injurious falls, falls risk, participation, activity, leg strength, gait speed, and falls efficacy | Results: Total falls IG=119, versus CG=140, not significant; fall rate IG=1.9 falls per survivors versus CG=1.8 falls per survivor; proportion of fallers RR=0.83 \( (CI=0.60-1.14) \); intervention adherent survivors (25%) had fewer falls \( (X^2=8.3, p=0.02) \); attrition=15%  
Conclusion: No significant differences between groups. | Internal Validity  
- Low intervention adherence  
- Potential recall bias of self reported falls  
External Validity  
- Limited generalizability |
<table>
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<tr>
<th>Reference</th>
<th>Study Design (Level)</th>
<th>Sample/Setting</th>
<th>Methods/Measures</th>
<th>Results/Conclusion(s)</th>
<th>Challenges to Scientific Rigor</th>
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<tbody>
<tr>
<td>*Taylor-Piliae et al. (2014)</td>
<td>Single-blind RCT (II)</td>
<td>Stroke survivors</td>
<td>IG 1 (n=53): Tai Chi (TC)</td>
<td>TC had 2/3 fewer falls (n=5) than SS (n=14) or UC (n=15); Significant group-by-time interaction for StepTest (F2,142=4.69, p&lt;0.01); TC (t53=2.45, p=0.02) and SS (t44=4.63, p&lt;0.01) had significantly better aerobic endurance compared to UC (t48=1.58, p=0.12). Conclusion: TC and SS improved aerobic endurance and are suitable for community-based stroke rehabilitation. TC was most effective in fall reduction. Internal Validity</td>
<td><strong>Potential recall bias of self reported falls</strong> Potential type II error Potential learning bias Limited generalizability</td>
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<td>IG 2 (n=44): SilverSneakers® (SS)</td>
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<td><strong>External Validity</strong></td>
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<td>CG (n=48): Usual care (UC), weekly phone calls</td>
<td></td>
<td><em>Limited generalizability</em></td>
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<td><strong>Frequency/Duration:</strong> 3 times weekly/12 weeks for IGs</td>
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<td><strong>Measures:</strong> SPPB, fall rates, 2-Minute StepTest, Medical Outcomes Study SF-36, CES-D scale, PSQI.</td>
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<td>Dean et al. (2012)</td>
<td>Prospective, multicenter, parallel RCT (II)</td>
<td>Stroke survivors participating in local stroke club able to walk 10m independently with/without assistive device</td>
<td>IG (n=76): Exercise classes; advice; program focused on walking improvement, physical activity enhancement, and fall prevention</td>
<td>Results: IG walked 34 meters further in 6 min (95% CI-19-20, p&lt;0.001) and 0.07 m/s faster over 10 m (95% CI=0.01-0.14, p=0.03) than CG. IG fall n=129 versus CG fall n=133 without proportional or rate difference between groups (incidence rate ratio=0.96, CI=0.59-1.51, p=0.88) Conclusion: IG intervention enhanced mobility without effect on falls.</td>
<td><strong>Internal Validity</strong> Potential recall bias of self reported falls</td>
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<td>CG (n=75): Exercise classes, advice, program focused on upper limb and cognitive function</td>
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<td><strong>External Validity</strong> Limited generalizability</td>
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<td></td>
<td><strong>Frequency/Duration:</strong> 3 times weekly/40 weeks over 12 months</td>
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<td></td>
<td><strong>Measures:</strong> Walking capacity, speed, fall rate</td>
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*Note: Intervention Group=IG; Control Group=CG; Berg Balance Scale=BBS; Postural Stability Test=PST; Fall Risk Test=FRT; Posterior Leaf Spring=PLS; Ankle Foot Orthoses=AFO; Modified Emory Functional Ambulation Profile= mEFAP; 6 Minute Walking Test=6MWT; Multiple or injurious=M/I; Whole Body Vibration=WBV), Short Physical Performance Battery=SPPB, Center for Epidemiological Studies-Depression (CES-D), Pittsburgh Sleep Quality Index (PSQI). *Manuscript in press, co-authored by student, not retrieved through aforementioned search strategy.
Summary of Systematic Review Results and Conclusions

Two level I systematic reviews were extracted from the Cochrane Database of Systematic Reviews, a systematic review and meta-analysis and a Cochrane review of RCTs (Batchelor et al., 2010; Verheyden et al., 2013; see Table 2).

Batchelor, Hill, Mackintosh, and Said (2010) conducted their systematic review and meta-analysis to determine what fall prevention interventions have been effective for stroke survivors and found the issue relatively unexplored throughout literature. Batchelor et al. (2010) reviewed a total of 13 studies meeting inclusion criteria and noted pooling possible for only 3 comparisons in 2 types of intervention, variable methodological quality due to lack of blinding, and variability in falls data reporting (see Table 2).

Though meta-analysis was limited due to the aforementioned pooling limitations, Batchelor et al. (2010) found no significant effect of exercise upon fall rate (RR 1.22; 95% CI 0.76-1.98) or faller proportion (RR 0.77, 95% CI 0.24-2.43). Batchelor et al. (2010) also found no significant effect of bisphosphonate upon faller proportion (RR 0.95, 95% CI 0.73-1.22).

Batchelor et al. (2010) concluded that there is little high-quality evidence and no published multi-intervention RCTs supporting stroke survivor fall prevention. Though Sato et al. (2005) found that low-dose vitamin D may reduce falls in institutionalized female stroke survivors, most stroke survivors are community dwelling, and no evidence supports generalization of findings to transitional care survivors (Batchelor et al., 2010; Go et al., 2013). Hence, the study results of Sato et al. (2005) cannot be reliably
generalized to the acute stroke survivors preparing for TOC into the community setting (see Table 2).

Authors noted that future studies should: fulfill the need for additional RCTs; standardize fall definition, measurement, report, and analysis; strive for outcome consistency with other studies; and evaluate a range of single and multifactorial fall prevention interventions among stroke survivors (see Table 2).

Verheyden et al. (2013) conducted their Cochrane review of RCTs to evaluate the effectiveness of fall prevention interventions aimed at stroke survivors. Verheyden et al. (2013) reviewed 10 intervention studies meeting inclusion criteria and noted: no significant effect of acute versus sub-acute exercises in rate of falls (RR 0.92, 95% CI 0.45-1.90) or number of fallers (RR 1.19, 95% CI 0.83-1.71), no significant effect of exercises on rate (RR 0.75, 95% CI 0.41-1.38) or number of fallers (RR 1.01, 95% CI 0.83-1.24), rate and number of fallers significantly reduced with vitamin D in institutionalized female stroke survivors and alendronate in hospitalized stroke survivors, and no significant effect of single lens distance glasses versus regular multifocal glasses on fall rate or number of fallers (see Table 2).

Verheyden et al. (2013) concluded there is a dearth of studies focusing on stroke survivors, little evidence fall prevention interventions are effective for the population, and further medication trials should be conducted before recommendations are made. Specifically, Verheyden et al. (2013) noted that future studies should: assess exercise as a single or multi-interventional fall prevention program component, focus on early fall risk reduction while survivors are still hospitalized, be adequately powered, provide a
standardized fall definition, use appropriate fall ascertainment methods, and adhere to current standards of data analysis and reporting (see Table 2).

Table 2

*Fall Prevention for Stroke Survivors Review Synthesis Table*

<table>
<thead>
<tr>
<th>Reference and Review Design (Level)</th>
<th>Data Collection and Analysis</th>
<th>Results</th>
<th>Conclusions</th>
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</thead>
</table>
| Batchelor et al. (2010) Systematic Review and Meta-Analysis (I) | **Inclusion Criteria:** RCT, stroke survivors ≥18 years, primary or secondary fall-related outcome measures | • 13 level II RCTs, 
• (n)=1473 | There is little high-quality evidence and no multi-interventional published RCTs supporting fall prevention interventions for stroke survivors. Though low-dose vitamin D may reduce falls in institutionalized female stroke survivors, no evidence supports generalization of findings to transitional care survivors. |
| | **Exclusion Criteria:** Non-English studies and laboratory-induced falls | • Variable methodological quality due to lack of blinding. 
• Variability in falls data reporting. 
• Pooling possible for 3 comparisons in two types of intervention: No significant effect of exercise upon fall rate (RR 1.22; 95% CI 0.76-1.98) or faller proportion (RR 0.77, 95% CI 0.24-2.43). 
• No significant effect of bisphosphonate upon faller proportion (RR 0.95, 95% CI 0.73-1.22). 
• Vitamin D for institutionalized female stroke survivors was the only effective fall prevention intervention. | |
| | **Collection:** Independent assessment of included studies, quality assessment with Physiotherapy Evidence Database score | **Analysis:** Pooling of results for similar interventions with comparable outcomes through inverse variance method | Future studies should: 
• Fulfill the need for additional RCTs. 
• Standardize fall definition, measurement, report, and analysis. 
• Strive for outcome consistency with prior studies. 
• Evaluate range of single and multi-interventional fall prevention techniques among stroke survivors. |
Verheyden et al. (2013) Cochrane Review of RCTs (I)

**Inclusion Criteria:**
RCTS with primary/secondary aim of fall prevention

**Collection:** Independent selection, inclusion, quality assessment, and data extraction of studies

**Analysis:** ARR and 95% CI to compare fall rate and risk between IG and CG, results pooled when appropriate

**Results**
- 10 level II RCTs (n)=1004
- No significant effect of acute versus sub-acute exercises in rate of falls (RR 0.92, 95% CI 0.45-1.90) or number of fallers (RR 1.19, 95% CI 0.83-1.71) among chronic stroke survivors.
- No significant effect of exercises on rate (RR 0.75, 95% CI 0.41-1.38) or number of fallers (RR 1.01, 95% CI 0.83-1.24) among chronic stroke survivors.
- Rate and number of fallers significantly reduced with vitamin D in institutionalized female stroke survivors and alendronate in hospitalized stroke survivors.
- No significant effect of single lens distance glasses versus regular multifocal glasses on fall rate or number of fallers.

**Conclusions**
Due to a limited number of studies focusing on stroke survivors, there is little evidence that fall prevention interventions are effective for the population. Further medication trials should be conducted before recommendations are made.

Future studies should:
- Assess exercise as a single or multi-interventional fall prevention program component.
- Focus on early fall risk reduction while survivors are still hospitalized.
- Be adequately powered.
- Provide a standardized fall definition.
- Use appropriate fall ascertainment methods.
- Adhere to current standards of data analysis and reporting.

*Note:* Transition of care=TOC.
Summary

Insufficient evidence currently exists to generate practice recommendations or evidence-based guidelines for fall prevention of stroke survivors. Though level II evidence exists, findings are often challenged by recall bias and limited generalizability. To date, no fall prevention interventions have been tested or programs developed targeting vulnerable stroke survivors preparing for TOC from the acute to the home setting. Despite such, current evidence is promising and worthy of further testing within this transitional care stroke survivor population. Specifically, single or multi-interventional fall prevention programs involving the following interventions should be applied and tested within the transitional care stroke survivor population: exercise programs, vitamin D supplementation, alendronate therapy, appropriate AFO use, and/or fall risk reduction education.

Though obvious gaps in research exist, recent study findings hold promise for the amelioration of fall trends among stroke survivors. Moreover, the lack of translational research in the field of fall prevention among stroke survivors is an opportunity for advancement of practice. Stroke care providers must empower transitional care stroke survivors through education and advocacy of evidence-based fall prevention interventions, while continuing to inspire future research efforts aimed at fall prevention intervention cultivation.
CHAPTER 3: METHODOLOGY

As noted in Chapter 1, the purpose of this practice inquiry is to develop an evidence-based fall prevention program aimed at empowering acute stroke survivors preparing for TOC into the home setting. The aforementioned theoretical nursing frameworks and theories of aging will synergistically inform development of a modified conceptual framework to foundationally guide program development. Subsequently, the modified conceptual framework, previous problem exploration, and literature review synthesis will collectively inform construction of a mixed theory-outcome-activities approach logic model to systematically guide program development, implementation, and evaluation plans. Accordingly, this chapter will present the methodology for planned program-related conceptual framework modification and logic model development.

Aim 1: Conceptual Framework Modification

Rogers’ (1992) Science of Unitary Beings informs Shearer’s (2009) Health Empowerment Intervention Framework (see Figure 2). Shearer’s (2009) Health Empowerment Intervention Framework can be adapted to further reveal major tenets of Rogers’ (1992) Science of Unitary Beings that are applicable to transitional care stroke survivors and related care coordination. Moreover, Stern’s (2002, 2009) theory of cognitive reserve is a related aging theory that can further inform modification of Shearer’s (2009) Health Empowerment Intervention Framework to facilitate empowerment of the stroke survivor to successfully adapt to post-stroke challenges.

Permission has been attained from Elsevier to reuse Shearer’s (2009) Health Empowerment Intervention Framework (see Figure 2; see Appendix A2). Additionally,
permission to reuse and adapt Shearer’s (2009) Health Empowerment Intervention Framework was attained from the author (N.B.C. Shearer, personal communication, December 21, 2013).

Shearer’s (2009) Health Empowerment Intervention Framework (see Figure 2) will be modified through Microsoft PowerPoint. Major tenets of Shearer’s (2009) framework will remain unchanged; while major tenets of Rogers’ (1992) and Stern’s (2002, 2009) theories will be interwoven into the modified conceptual framework to inform subsequent program development.

**Aim 2: Logic Model Development**

Successive program development will be led by creation of a logic model facilitated by W.K. Kellogg Foundation’s (2004) and CDC, DHDSP (n.d.) logic model development and use guides. Logic models communicate a program’s purpose, actions, expected results, and are a reference for program stakeholders (CDC, DHDSP, n.d.). Logic models can facilitate program planning, implementation, and evaluation (CDC, DHDSP, n.d.). Additionally, logic models incorporate stakeholders into the program planning, implementation, and evaluation process, which can enhance buy-in or commitment (CDC, DHDSP, n.d.). Furthermore, logic models are designed to incorporate findings from prior research and are thus suitable for facilitation of translational research and research utilization (CDC, DHDSP, n.d.). Finally, logic models assist program developers in early identification and amelioration of potential operational obstacles that could impede program success and outcome optimization (CDC, DHDSP, n.d.).
As noted in Chapter 1, there are various templates and logic model designs, which enhance the breadth of their applicability and utility. However, basic rules for logic model development exist:

- Logic models are to be displayed on one page to facilitate objective program conceptualization (CDC, DHDSP, n.d.).
- Models should be visually engaging yet easy for a specific audience to relate to (CDC, DHDSP, n.d.).
- Models should be appropriately detailed to clarify program activities and expected outcomes (CDC, DHDSP, n.d.).
- Logic models should reflect the program’s operational context (CDC, DHDSP, n.d.).

The basic logic model introduced in Chapter 1 (see Figure 1) illustrates the following primary model components, which are further defined in following subsections:

- inputs,
- activities,
- outputs,
- outcomes, and

**Planned Work**

The planned work of the program is illustrated throughout the first two logic model components, resources or inputs and activities (W.K. Kellogg Foundation, 2004).
These components describe what the program development intends to implement and do (W.K. Kellogg Foundation, 2004).

**Inputs.** Inputs refer to the resources that are invested into a program from any source, including, but not limited to human, organizational, community, time, and financial resources required for performance of program activities (CDC, DHDSP, n.d.; W.K. Kellogg Foundation, 2004).

**Activities.** Activities are the processes, tools, and actions that are intentionally used to produce desired program outcomes (CDC, DHDSP, n.d.; W.K. Kellogg Foundation, 2004). Some logic models separate activities into “early” and “later” activities (CDC, DHDSP, n.d.; W.K. Kellogg Foundation, 2004). Activities can include partnership creations, training sessions, advertisements, referrals, and other pursuits (CDC, DHDSP, n.d.; W.K. Kellogg Foundation, 2004).

**Intended Results**

Intended results of the program are illustrated throughout the last three logic model components: outputs, outcomes, and impact (CDC, DHDSP, n.d.; W.K. Kellogg Foundation, 2004). Intended results encompass all of the program’s desired consequences (CDC, DHDSP, n.d.; W.K. Kellogg Foundation, 2004).

**Outputs.** Outputs refer to the direct and tangible results of program activities (CDC, DHDSP, n.d.; W.K. Kellogg Foundation, 2004). Output examples include created partnerships, professionals trained, and campaigns developed (CDC, DHDSP, n.d.).
Outcomes. Outcomes refer to the specific changes achieved through program application (CDC, DHDSP, n.d.; W.K. Kellogg Foundation, 2004). Some logic models separate outcomes into short-term, intermediate, and long-term outcomes depending upon program objectives, length, and expectations (CDC, DHDSP, n.d.). Generally, short-term outcomes should be immediately achievable within 1 to 3 years, intermediate within 4 to 6 years, and long-term within 7 to 10 years (W.K. Kellogg Foundation, 2004). However, these time lengths are not static and are highly relative to the specific program in reference. The CDC’s DHDSP (n.d.) offers a more broad definition of these relative outcomes: short-term outcomes refer to a program’s immediate effects; intermediate to behavior, normative, or policy changes; and long-term to desired program results, which could take years to achieve.

Impact. Impact is the underlying fundamental change that occurs in organizations, communities, or systems as a result of program operation (CDC, DHDSP, n.d.; W.K. Kellogg Foundation, 2004). Though impact is closely related to long-term outcomes, the true program impact is often more broad and far-reaching that the long-term outcomes (CDC, DHDSP, n.d.; W.K. Kellogg Foundation, 2004).

Expanded General Logic Model

As previously noted, various versions of a logic model exist and expand upon the components of the basic logic model. The CDC DHDS (n.d.; see Figure 4) modestly expands W.K. Kellogg Foundation’s basic logic model (see Figure 1) to illustrate process components, outcome components, and underlying assumptions or contextual factors. These components are further described in the following sub-sections.
Process. The process section refers to the program’s inputs, activities, and outputs (CDC, DHDSP, n.d.). It signifies the program course necessary to yield outcomes (CDC, DHDSP, n.d.).

Outcomes. The outcomes section refers to the short-term, intermediate, and long-term intended effects of the program (CDC, DHDSP, n.d.).

Assumptions or Contextual Factors. The assumptions under which a program operates and related contextual factors can be incorporated into the logic model to provide even greater objective conceptualization of the program for involved stakeholders (CDC, DHDSP, n.d.). These components are often featured in theory approach logic models and serve to visually link theoretical concepts to program processes and outcomes (W.K. Kellogg Foundation, 2004).

Logic Model Approaches

Real-world logic models are often complex, falling into one or a blend of three approach categories: theory approach, outcomes approach, or activities approach models (W.K. Kellogg Foundation, 2004). A program may use all three types of these logic model approaches to serve different purposes (W.K. Kellogg Foundation, 2004). The
types of logic models, their emphasis, strengths, and synergistic program specific applications are illustrated in Figure 5 and are further described in the following subsections.

**Theory Approach Models.** Theory approach models emphasize theoretical concepts that inspire program development to illustrate how and why developers believe their program will work (W.K. Kellogg Foundation, 2004). These models conceptualize the “big picture” and are often used to substantiate grant proposals (see Figure 6, W.K. Kellogg Foundation, 2004).

**Outcomes Approach Models.** Outcomes approach models concentrate on early program planning by linearly connecting processes with outcomes through causal linkage emphasis (W.K. Kellogg Foundation, 2004). These models sometimes specify outcomes over time by delineating short-term, intermediate, long-term outcomes and overall impact (W.K. Kellogg Foundation, 2004). Though such models have theoretical basis, related underpinnings are not always explicitly illustrated (see Figure 7; W.K. Kellogg Foundation, 2004).

**Activities Approach Models.** Activities approach models focus on program implementation specifics and maps planned activities to reflect the implementation process (W.K. Kellogg Foundation, 2004). These models are particularly useful for program monitoring as they specify detailed steps necessary for program implementation once funding is secure (see Figure 8; W.K. Kellogg Foundation, 2004).
Planned Logic Model Approach

A mixed theory-outcome-activities approach logic model will be used to develop the *Patient Empowerment at Transitions of Care Fall Prevention Program for Stroke Survivors*. First, theory approach model components will be developed through the following steps, as guided by the *W.K. Kellogg Foundation (2004) Logic Model Development Guide*:

- problem statement synthesis,
- population needs identification,
- desired results specification,
- influential factor identification,
- literature review supported ameliorative and promising intervention identification, and
- theoretical assumption specification (*W.K. Kellogg Foundation, 2004*).

Next, the outcome approach model components will guide desired result description through the following steps.

- For each specific program activity, the expected short-term, intermediate, and long-term outcome will be described (*W.K. Kellogg Foundation, 2004*).
- For each specific program activity, anticipated outputs will be detailed (*W.K. Kellogg Foundation, 2004*).
- For each specific program activity, the related population or community impact will be described (*W.K. Kellogg Foundation, 2004*).
Finally, the activities approach model components will guide resource and activities description as noted.

- Specific activities necessary for desired result attainment, as informed by literature review findings, will be specified (W.K. Kellogg Foundation, 2004).
- Specific resources necessary to support these activities will be identified (W.K. Kellogg Foundation, 2004).

**Protection of Human Subjects**

This practice inquiry focuses upon program, implementation, and evaluation plan development through attainment of conceptual framework modification and logic model development aims. Thus, protection of human subjects was facilitated through evidence-based program planning and deferred implementation. Considering such, no human subject recruitment was necessary for completion of this practice inquiry. However, approval to proceed with practice inquiry development, as noted through Chapters 1 through 3 of this proposal, was attained from the University of Arizona Intuitional Review Board (IRB, see Appendix B).

**Summary**

Collectively, these methods will facilitate development of an evidence-based fall prevention program aimed at empowering acute stroke survivors preparing for TOC into the home setting. Complementary theoretical nursing frameworks and theories of aging will be used to guide conceptual framework modification to foundationally underpin program development through design of theory approach logic model components.
Subsequently, previous problem exploration and literature review findings will dynamically inform specification of mixed outcome and activities approach logic model components to systematically guide program development, implementation, and evaluation plans. The *Patient Empowerment at Transitions of Care Fall Prevention Program for Stroke Survivors* will be a novel evidence-based multi-interventional approach synergistically steered by nursing and aging theory.
CHAPTER 4: RESULTS

Through specific practice inquiry aims (see Chapter 1), a novel evidence-based empowerment-focused fall prevention program was developed for acute stroke survivors preparing for TOC into the home setting. Specifically, a modified conceptual framework (see Figure 9) was created based upon the Science of Unitary Human Beings, theories of health empowerment, cognitive plasticity, and cognitive reserve was synthesized to conceptually guide the multi-interventional *Patient Empowerment at Transitions of Care Fall Prevention Program for Stroke Survivors* (Rogers’, 1992; Shearer, 2009; Stern 2002, 2009). Additionally, a program implementation and evaluation plan was conceptualized through construction of a supporting mixed theory-outcome-activities approach logic model informed by the W.K. Kellogg Foundation (2004) and CDC, DHDSP (n.d.) logic model development and use guides (see Figure 11). These results will henceforth be presented.

**Modified Conceptual Framework**

As outlined by Chapter 2, Shearer’s (2009) Health Empowerment Intervention Framework was modified (see Figure 9) for application within the stroke survivor population. The modified conceptual framework (see Figure 9) has been further infused with themes from Rogers’ (1992) Science of Unitary Beings and the theories of cognitive plasticity and reserve (Steffener & Stern, 2012; Stern 2002; Stern 2009). Again, while key tenets of Shearer’s (2009) framework remain unchanged, key tenets of Rogers’ (1992) and Stern’s (2002, 2009) theories have been interwoven into the modified
conceptual framework (see Figure 9) to inform subsequent fall prevention program development.

**Key Theoretical Tenets**

Key theoretical tenets underpinning the modified conceptual framework (see Figure 9) were presented in chapter 1 and are further summarized by theorist below. Collectively, these synthesized tenets foundationally inform the *Patient Empowerment at Transitions of Care Fall Prevention Program for Stroke Survivors.*

**Rogers.**

- Aging post-stroke is a continuously creative process in which survivors can mindfully participate rather than a decompensation they forcibly endure (Rogers, 1992).
- Stroke survivors are greater than the sum of their post-stroke parts (Rogers, 1992).
- According to the homeodynamic principle of integrality, stroke survivors are continuous, mutually integral, and fundamentally connected to their environment (Rogers, 1992). Consequently, survivors can recognize this strength and utilize external or environmental resources to successfully adapt to post-stroke changes.
- Health and well-being promotion must enhance the humanity of stroke survivors by meeting the survivor where he or she is at within their creative process of aging (Rogers, 1992).
- Post-stroke changes, albeit unwanted, are opportunities to further successfully adapt to the creative process of aging (Rogers, 1992).
Shearer.

- Stroke survivors are empowered through recognition of personal and socio-contextual resources and participation in goal attainment (Shearer, 2009).
- The potential for empowerment is continuously inherent within all stroke survivors (Shearer, 2009).
- Stroke survivor empowerment will be both a process and outcome of the Patient Empowerment at Transitions of Care Fall Prevention Program for Stroke Survivors (Shearer, 2009).
- Stroke care providers do not seek to empower, rather they facilitate the outcome of empowerment within the stroke survivor (Shearer, 2009).
- Empowerment of the stroke survivor emphasizes emancipation, liberation, and energy sharing while shifting perspectives from perceived survivor victimization to perceived survivor potential (Shearer, 2009).

Stern.

- Stroke survivors possess latent cognitive reserve, or potential, that can be exercised to successfully adapt to post-stroke challenges (Stern, 2002, 2009; Willis, Schaie, & Martin, 2009).
- Rather than being fixed or destroyed by neural compromise, cognitive reserve can evolve in the face of stroke-related changes and is enhanced by leisure activities, social network utilization, and related reserve recruitment interventions (Steffener & Stern, 2012; Stern 2002, 2009).
Stroke recovery requires methodical enhancements in brain networks underlying specific behaviors or actions (Stern 2002, 2009). Consequently, individual post-stroke changes are opportunities to discover and employ these novel neural networks, thus cultivating even greater cognitive reserve (Stern, 2002, 2009).


Mixed Approach Logic Model

After development of the *Patient Empowerment at Transitions of Care Fall Prevention Program for Stroke Survivors* modified conceptual framework (see Figure 9),
a mixed theory-outcome-activities approach logic model (see Figure 11) was constructed to guide future program development, implementation, and evaluation. Collectively, the modified conceptual framework and mixed approach logic model will facilitate development of a novel evidence-based multi-intervention fall prevention program for acute care stroke survivors preparing for TOC into the home setting.

**Theory Approach Logic Model Components**

Beyond the key theoretical tenets informing the modified conceptual framework (see Figure 9), various considerations inform theory approach logic model components, including a statement of the problem, population needs, desired results, evidence-supported interventions, and/or influential factors (W.K. Kellogg Foundation, 2004; see Figure 10). These considerations and key theoretical tenets synergistically inform development of the *Patient Empowerment at Transitions of Care Fall Prevention Program for Stroke Survivors*’ objective statement (see Figure 10).

Stroke survivors preparing for discharge from the acute to the home setting are at greatest fall risk, yet no multi-interventional fall prevention programs have been tested in this patient population (Batchelor et al., 2010; Go, et al., 2013; Verheyden et al., 2013). Transitional care stroke survivors are in need of a successful multi-interventional fall prevention intervention program (Batchelor et al., 2010; Go, et al., 2013; Verheyden et al., 2013). Desired program results include decreased fall incidence and facilitation of empowerment among transitional care stroke survivors. Evidence supported interventions and/or influential factors warranting further multi-interventional investigation in this population include: Tai Chi exercise, Vitamin D Supplementation,
Alendronate Therapy, Appropriate AFO use, and fall risk reduction education (Batchelor et al., 2010; Taylor-Piliae et al., 2014; Verheyden et al., 2013). When compared to a usual care control group (CG), the Patient Empowerment at Transitions of Care Fall Prevention Program for Stroke Survivors intervention group (IG) will have significantly ($p < 0.05$) fewer falls over the first 6 months post-discharge home from the acute setting. These theory approach components and the program objective statement they inform are summarized in Figure 10.

Problem: Stroke survivors preparing for discharge from the acute to the home setting are at greatest fall risk, yet no multi-interventional fall prevention programs have been tested in this patient population (Batchelor et al., 2010; Go, et al., 2013; Verheyden et al., 2013).

Population Needs: Successful Fall Prevention (Batchelor et al., 2010; Go, et al., 2013; Verheyden et al., 2013)

Desired Results: Decreased Fall Incidence among Transitional Care Stroke Survivors

Evidence-Supported Interventions and/or Influential Factors: Tai Chi Exercise, Vitamin D Supplementation, Alendronate Therapy, Appropriate AFO Use, and Fall Risk Reduction Education (Batchelor et al., 2010; Taylor-Piliae et al., 2014; Verheyden et al., 2013)

Program Objective Statement: When compared to a usual care control group (CG), the Patient Empowerment at Transitions of Care Fall Prevention Program for Stroke Survivors intervention group (IG) will have significantly ($p < 0.05$) fewer falls over the first 6 months post-discharge home from the acute setting.

FIGURE 10: Theory Approach Components.

Outcome Approach Logic Model Components

Outcome approach logic model components clearly link desired program results with specific program activities, anticipated outputs, and related population impact (W.K. Kellogg Foundation, 2004). In other words, each program activity is associated with detailed outputs that collectively yield anticipated population outcomes and a greater system impact (W.K. Kellogg Foundation, 2004). The synergistic relationship of these
outcome approach components can be clearly visualized throughout the activities, outputs, outcomes, and impact sections of the program’s mixed approach logic model (see Figure 11).

Activities Approach Logic Model Components

Activities approach logic model components are informed by literature review findings and specify activities necessary to attain desired program results (W.K. Kellogg Foundation, 2004). Additionally, activities approach components identify inputs necessary to support logic model activities (W.K. Kellogg Foundation, 2004). This relationship can be noted throughout the process section of the program’s mixed approach logic model (see Figure 11).
FIGURE 11. Mixed Approach Logic Model. Note. SS = stroke survivors; APRN = Advance Practice Registered Nurse; CM = Case Management; PT = physical therapy; OT = occupational therapy; ST = speech therapy; AFO = ankle foot orthoses; CG = control group; IG = intervention group; * = Minimal sample size required for power > 0.80 per apriori power analysis if p < 0.05, ES > 0.5, CI 95% (Soper, 2014); λ = if indicated; FE = Falls Efficacy. * = see program objective statement in Figure 10.
Program Implementation Plan

To achieve practice inquiry aims, construction of the Mixed Approach Logic Model (see Figure 11) informed the *Patient Empowerment at Transitions of Care Fall Prevention Program for Stroke Survivors* implementation plan. Specifically, development of the assumptions, inputs, and activities sections of the Mixed Approach Logic Model (see Figure 11) yielded the following program implementation implications.

Assumptions Implications

The theoretical assumptions foundational to the program, as noted in Figure 11, are pivotal to program success, as well as stroke survivor and care provider program-related training. The theoretical assumptions must be communicated to all program participants, both survivors and providers, to energetically and therapeutically inform survivor – provider interactions.

Inputs Implications

1. **128 (n) Stroke Survivors:** A total of 128 (n) stroke survivors, 64 (n) for the IG and 64 for the CG, are required to achieve a power > 0.80 per apriori power analysis if \( p < 0.05, ES > 0.5, CI 95\% \) (Soper, 2014). However, consultation with a nurse researcher (see No. 3) may reveal need for a larger sample size to accommodate attrition without power compromise.

2. **APRN (Program Champion/CO-PI):** The APRN with serve as the on-site program champion and co-principal investigator. The APRN will possess a doctorate of nursing practice (DNP) degree. The APRN will coordinate education of and delegation to all other on-site departments to ensure knowledgeable, smooth, and
program-protocol-adherent operations. Furthermore, the APRN will facilitate resolution of program operational challenges, while ensuring research integrity exists throughout practice. Additionally, the APRN will ensure that program results are translated back into practice continued activation of the translational research cycle.

3. Nurse Researcher (CO-PI): The nurse researcher will collaborate with the APRN to: ensure rigor of program design, optimization of potential funding optimization, accuracy of statistical analyses and associated result interpretation, and through-put of program result dissemination. The nurse researcher will possess a doctorate of nursing philosophy (PhD) degree. Considering such, the collaboration of nursing leaders with both practice and research doctorates will synergistically ensure program optimization, dynamic innovation, and continued activation of the translational research cycle (see No. 2).

4. Graduate Assistant: The graduate assistant will assist in after-hours (uncovered by APRN) study recruitment and protocol adherence.

5. Nursing: Participation of nursing services will be required for the following program operations: venipuncture for pre-discharge vitamin D and calcium assessment, fall risk reduction training, and staff training.

6. Attending and Primary Medical Providers: Attending and primary medical providers, such as attending physicians and primary care nurse practitioners, will be pivotal for program success. They will be responsible for consulting with the APRN Program Champion to ensure the program activities, such as vitamin D
assessment, calcium level, and Tai Chi exercise referral, occur per protocol. Specifically, primary care providers will be responsible for managing vitamin D and calcium level optimization post-discharge.

7. **Laboratory:** Laboratory services are needed for processing of pre-discharge vitamin D and calcium levels.

8. **Pharmacy:** Pharmacy services are needed for inpatient monitoring and dosing of vitamin D supplementation and/or alendronate therapy when indicated. Additionally, pharmacy services will be responsible for related stroke survivor education.

9. **Social Services and Case Management:** Social services and case management will collaborate to ensure community primary and specialty care providers are aware of survivor program participation. Additionally, social services and case management will ensure that physical, occupational, and speech therapy evaluations have occurred pre-discharge.

10. **PT, OT, ST:** Physical therapy services are needed for AFO needs assessment, fitting, supply, and related patient education. Occupational therapy services will be required for home safety training through activities of daily living mindfulness. Both a physical therapist and occupational therapist will be present at all Tai Chi classes to assist the Tai Chi instructor in safe therapeutic exercise modification suitable for stroke survivors. Speech therapy services will be necessary to assist the stroke survivor in communication restoration and or modification so that
optimal utilization of social and environmental resources can occur (see Assumption No. 2).

11. **TC Instructor:** A Tai Chi instructor will lead Tai Chi classes for IG stroke survivors for 1 hour, 3 times weekly, over 6 months.

12. **Time:** Staff training for program operations will occur over 1 to 2 months, and the program will implemented over 6 months post-discharge from the acute care setting. This will occur over a suggested study period of 2 to 5 years.

13. **Funds:** Anticipated cost sources include, but are not limited to: associated staff wages, laboratory analysis, medication, facility utilities, Tai Chi props (tapping stick and therapy ball), educational booklets, and audiovisual presentation media.

**Activities Implications**

As briefly noted throughout the prior inputs, the following activities are foundational to the program and must occur at program initiation. Specifics related to activity performance are further discussed.

1. **Recruitment:** Admission diagnosis will generate an automated electronic alert to the APRN, who will then address program enrollment in accordance with study protocol pre-approved by the facility’s institutional review board (IRB).

2. **Staff Training:** Staff training will occur over the 1 to 2 months prior to program implementation and periodically throughout program operation.

3. **Vitamin D Assessment:** Each IG survivor will undergo vitamin D assessment prior to discharge from the acute care facility.
4. **Calcium Assessment:** Each IG survivor will undergo calcium assessment prior to discharge from the acute care facility.

5. **AFO Need Assessment:** Each IG survivor will undergo AFO need assessment by PT prior to discharge from the acute care facility.

6. **Fall Risk Reduction Training:** Each IG survivor will receive fall risk reduction training.

7. **Data Collection and Analysis:** Throughout operation and at completion of the 6-month program, the APRN, Nurse Researcher, and Graduate Assistant will perform data collection for subsequent analysis. While the IG is participating in the aforementioned activities, the program’s CG is receiving usual care, or traditional discharge, referral, and outpatient services. However, falls data and qualitative questionnaires will be gathered from both the IG and CG.

   **Program Evaluation Plan**

   Similarly, construction of the Mixed Approach Logic model also informed the *Patient Empowerment at Transitions of Care Fall Prevention Program for Stroke Survivors* evaluation plan. Specifically, the outputs, outcomes, and activities sections of the Mixed Approach Logic Model (see Figure 11) yielded the following program evaluation implications.

   **Outputs Implications**

   The following outputs are noted in Figure 11: IG \((n = 64)\), CG \((n = 64)\), theoretically informed and trained staff, Tai Chi training customized for SS, vitamin D deficiency recognition, hypercalcemia recognition, AFO need recognition, fall risk
reduction recognition, and program results. In order for the program to be successful, these outputs must be produced. Considering such, their production will be evaluated throughout the program implementation period through quality monitoring of the electronic chart and questionnaire administration.

**Outcomes Implications**

1. Though retention of participating stroke survivors is a short-term-to-intermediate outcome, program completion by such survivors is the long-term outcome (see Figure 11). Thus, the overall program attrition rate will be considered in evaluation of program efficacy.

2. Mindful stroke care founded upon the program’s noted theoretical assumptions (see Figure 11) will be provided throughout the program. This will result in program operation and evaluation optimization and will be measured through qualitative questionnaires.

3. The desired outcome of Tai Chi exercise performance (1 hour, 3 times weekly, over 6 months) is reflex, balance, and mobility optimization so that long-term fall reduction will result (see Figure 11; Taylor-Piliae et al., 2014). The following outcome measures will be evaluated: Short Physical Performance Battery, fall rate, and 2-minute step test (Taylor-Piliae et al., 2014).

4. Vitamin D deficiency results in muscle weakness and walking difficulty, while deficiency amelioration improves muscle strength and walking among mobile stroke survivors (Sato et al, 2005; Sato et al., 2011). The synergistic fall reducing
effect of this therapy will be evaluated among mobile vitamin D deficient stroke survivors preparing for discharge into the home setting.

5. It is postulated that post-stroke immobility-induced hypercalcemia is a fall and fracture risk for survivors (Sato et al., 2011). Alendronate has been shown to improve immobilization-induced hypercalcemia, increase serum 1, 25-[OH]2D concentration, reduce falls per patient by 55%, and prevent hip fractures in elderly stroke survivors affected by increased bone resorption (Sato et al., 2011). Thus, Sato et al., 2011 propose that hypercalcemic elderly stroke survivors be treated with alendronate to reduce fall and hip fracture incidence (Sato et al., 2011). This therapy will be evaluated among hypercalcemic acute stroke survivors preparing for discharge into the home setting.

6. Cakar et al. (2010) encouraged PLS-AFOs use for hemiparetic stroke survivors with mild to moderate lower limb spasticity. Hung et al. (2011) found that anterior AFOs significantly improve functional walking ability and fall efficacy of younger or low-walking-ability stroke survivors. Consequently, PT will evaluate IG stroke survivors for anterior or PLS-AFO candidacy to fit and instruct qualifying survivors accordingly.

7. Fall risk reduction knowledge acquisition is expected to yield fall risk reducing behaviors and overall fall reduction. This outcome will be measured through monitoring of fall incidence and rate of IG and CG stroke survivors.

8. Result dissemination will occur after result synthesis so that associated practice indications may be evaluated and implemented through continued activation of
the translational research cycle. The APRN and Nurse Researcher will champion this process through presence and advocacy in international professional organizations, future practice, and research.

**Impact Implications**

Collectively attainment of program outcomes is expected to yield stroke survivor and stroke care provider empowerment (see Figure 11). Moreover, a dynamic multi-interventional stroke survivor fall prevention program will be available to survivors transitioning from the acute to the home setting (See Figure 11). Additionally, stroke survivors have an opportunity to persistently optimize aging, wellbeing, integrality, cognitive reserve, and neural networks through program participation. If such impacts occur, *Patient Empowerment at Transitions of Care Fall Prevention Program for Stroke Survivors* has the potential to create a paradigm shift in conceptualization of stroke recovery from perceived survivor victimization to perceived survivor potential. Measurement of this impact will be, undoubtedly, qualitative in nature, and continue long after program completion (W.K. Kellogg Foundation, 2004).

**Summary**

In this chapter, a modified conceptual framework (see Figure 9) and mixed theory-outcome-activities approach logic model (see Figure 11) was proposed for the multi-interventional *Patient Empowerment at Transitions of Care Fall Prevention Program for Stroke Survivors*. Though transitional care stroke survivors are at greatest fall risk, multi-interventional fall prevention programs have yet to be tested among this patient population (Batchelor et al., 2010; Go, et al., 2013; Verheyden et al., 2013).
However, literature review (see Chapter 2) suggests that the collective fall preventative utility of Tai Chi therapy, vitamin D supplementation, alendronate therapy, appropriate AFO use, and fall risk reduction education warrants further investigation among the stroke survivor population (Batchelor et al., 2010; Taylor-Piliae, 2014; Verheyden et al., 2013).

When compared to a control group, the *Patient Empowerment at Transitions of Care Fall Prevention Program for Stroke Survivors* intervention group will have significantly ($p < 0.05$) fewer falls over the first 6 months post-discharge home from the acute setting. This novel multi-interventional empowerment-focused stroke survivor fall prevention program has the potential to facilitate a paradigm shift in stroke recovery, from perceived survivor victimization to perceived survivor potential.
CHAPTER 5: DISCUSSION

Throughout this practice inquiry, the problem of falling among stroke survivors has been explored, reviewed, and presented; while an ameliorative empowerment-focused fall prevention program has been proposed. The practice inquiry purpose and aims specified in Chapter 1 were achieved through creation of a modified conceptual framework (see Figure 9) and mixed approach-logic model (see Figure 11), which, in turn, informed a proposed implementation and evaluation plan (see Chapter 4). In the following chapter, the strengths, limitations, and potential barriers to implementation of the Patient Empowerment at Transitions of Care Fall Prevention Program for Stroke Survivors will be discussed.

Program Strengths

Practice inquiry strengths include: a solid theoretical foundation, substantial evidentiary support consisting of a multi-interventional design, an informative mixed approach logic model, and dynamic funding opportunities. These specific practice inquiry strengths are specifically discussed in the subsequent sections.

Theoretical Foundation

This practice inquiry has been informed by a solid theoretical foundation comprising of two nursing theories and one aging theory. Specifically, Rogers’ (1992) Science of Unitary Human Beings, Shearer’s (2009) theory of health empowerment, and Stern’s theory of cognitive plasticity and reserve theoretically inform the proposed Patient Empowerment at Transitions of Care Fall Prevention Program for Stroke Survivors.
A foundation rooted in these theories infuses the proposed program with a spirit of undeniable optimism and hope for stroke recovery. Stroke care professionals must recognize the drastic changes occurring in the lives of acute care stroke survivors. Consequently, stroke care professionals must recognize the impact their care can have upon recognition of recovery potential and subsequent pursuits thereof.

Theoretical tenets informing the Patient Empowerment at Transitions of Care Fall Prevention Program for Stroke Survivors (see Figures 9 and 11) prompt providers to communicate mindfully in all interactions with stroke survivors. For example, when a stroke survivor has presently impaired swallowing function, stroke care providers often innocently and well meaningfully inform survivors, “You have failed your swallow study.” Stroke providers must recognize the disempowering effect the message “you failed” can send to an acute stroke survivor.

Providers must communicate a message of empowerment, and all words count. This is not to say that stroke care providers avoid acknowledgement of the devastating effects of stroke, as this would be invalidating to survivor’s current grief process. Moreover, however, stroke care providers seek to acknowledge the stroke survivor’s present potential for recovery success.

Evidentiary Support

This practice inquiry and related program proposal have been informed by rigorous literature review and high-level evidentiary support. The current status of fall prevention interventions was synthesized from evidence ranking level I or level II using
Polit and Beck’s (2012) Quick Guide to an Evidence Hierarchy of Designs for Cause-Probing Questions (see Figure 3).

**Multi-interventional Design.** One deliberate evidence-based practice inquiry design was the multi-interventional nature of the program fall prevention program. This proposal was a direct response to prompting from the latest high-level Cochrane Review on fall prevention for stroke survivors, which recommended multi-interventional fall prevention programs be developed and assessed among transitional care stroke survivors (Verheyden et al., 2013).

**Mixed Approach Logic Model**

Another practice inquiry strength is the mixed theory-outcome-activities approach logic model design. As noted in Chapter 3, this logic model design was constructed to foundationally inform the *Patient Empowerment at Transitions of Care Fall Prevention Program for Stroke Survivors*. This mixed approach links foundational theoretical tenets to specific evidence-based activities and desired outcomes so program purpose, potential, and operation and can objectively conceptualized by key stakeholders (W.K. Kellogg Foundation, 2004).

**Dynamic Funding Opportunities**

Dynamic funding opportunities exist further inspiring subsequent program application and evaluation facilitated by grant pursuit. One specific potential funding source is the Patient-Centered Outcome Research Institute (PCORI, 2014), an independent, non-profit, non-governmental organization authorized by Congress to
conduct research and provide the best available evidence upon which to base informed medical decisions.

**PCORI.** PCORI (2014) has specified five research agenda priorities: Assessment of Prevention, Diagnosis, and Treatment Options; Improving Healthcare Systems; Communication and Dissemination; Addressing Disparities; and Accelerating Patient-Centered and Methodological Research. Each of these priorities are motivated by recognition of unmet patient, caregiver, clinicians, and other healthcare stakeholder needs (PCOR, 2014). Uniquely, the *Patient Empowerment at Transitions of Care Fall Prevention Program for Stroke Survivors* addresses each of these research priorities.

PCORI has identified specific funding opportunity areas, entitled PCOR Funding Announcements (PFAs), likely to have a substantial impact on practice and patient outcomes. One of the five PFAs focuses upon the prevention of injurious falls in the elderly. Research addressing this PFA is eligible for an accelerated funding process (PCORI, 2014). Collectively, these PCORI (2014) funding opportunities hold great potential for the related *Patient Empowerment at Transitions of Care Fall Prevention Program for Stroke Survivors*, with up to $32 million in funds available.

**Program Limitations**

Practice inquiry limitations include expected limitations of a multi-interventional design and the necessity of future implementation and evaluation for benefits to be translated to the stroke survivor patient population. These specific practice inquiry limitations are specifically discussed in the subsequent sections. Moreover, their associated opportunities are presented.
Multi-interventional Design

Though the multi-interventional program design is a practice inquiry strength, it also poses a challenge to program evaluation and result interpretation. Indeed, the design was based upon related need revealed through extensive literature review (see Chapter 2). However, the synergistic effect of program activities could yield significant effects not isolated with one activity alone. As such, certain activities could be incorrectly perceived as contributive to a significant effect, resulting in an activity-specific type I error (Heavey, 2011). Additionally, certain activities could negate optimizations directly attributable to other program activities, resulting in an incorrect rejection of the null hypothesis or type II error (Heavey, 2011).

Future Implementation and Evaluation Necessity

Another practice inquiry limitation is the necessity of future program implementation and evaluation occurrence before practice inquiry results can inform practice, potentially improve stroke survivor outcomes, and yield intended program impact. Despite program theoretical and design strengths, program implementation and evaluation can pose unexpected challenges.

Associated Opportunities

Despite potential challenges of these identified limitations, associated opportunities do exist. Practice inquiry strengths overcome potential limitations in that the multi-interventional design is intentional and motivated by high-level research. Pending implementation and evaluation provides further opportunity to seek program funding, attain stakeholder buy-in, and refine planned program operations.
Potential Barriers to Program Implementation

Lastly, potential barriers to program implementation must be identified so that respective anticipation and early amelioration can be facilitated (CDC DHDSP, n.d.; W.K. Kellogg Foundation, 2004). Though evidence-based development of the program’s mixed approach logic (see Figure 11) model enables program success through barrier-minimization and program optimization, identification of persistent potential barriers can further prepare program developers or champions to efficiently, resiliently, and successfully respond to such challenges as they arise.

Three potential barriers to implementation of the *Patient Empowerment at Transitions of Care Fall Prevention Program for Stroke Survivors* include the: geographic diversity of participating stroke survivors and related program activity accessibility, availability of qualified Tai Chi instructors, and challenges of funding procurement for a multi-interventional program inclusive of medication-related interventions. These potential barriers and recommendations for their amelioration are further discussed.

Geographic Diversity and Program Activity Accessibility

While varied transportation resources may exist for local metropolitan stroke survivors, such services are often more limited for rural survivors. Additionally, lengthy transits can be a deterrent to optimized program participation. Considering this, it is recommended that initial recruitment target stroke survivors residing within city limits. Once an initial feasibility study is conducted, further program optimization and funding procurement can ensue to facilitate program expansion to rural stroke survivors.
Tai Chi Instructor Availability

Suitable Tai Chi instructors will have undergone traditional Tai Chi training and have experience teaching older adults including those with chronic illness. Availability of such qualified instructors may be limited in some areas. However, the recommendation to restrict initial enrollment to stroke survivors residing within city limits will help contain this potential barrier until feasibility is assessed and additional funding procured. As the geographic service area of the program expands, recruitment of additional qualified Tai Chi instructors may be necessary.

Funding Procurement Challenges

Though dynamic funding opportunities exist, the inclusion of medications as multi-interventional program components could challenge initial attempts at funding procurement. However, because the inclusions of the specified medications are evidence-based, as is the multi-interventional program design, it is recommended that initial grant pursuit include all specified interventions (Batchelor et al., 2010; Sato et al., 2005; Sato et al., 2011; Verheyden et al., 2013). If inclusion of all interventions become a barrier to funding attainment, a smaller feasibility study inclusive of the non-medications-related interventions could be conducted until further drug trials supporting the use of vitamin D supplementation and alendronate therapy are conducted.

Conclusion

It is evident that potential for stroke recovery is far less limited than initially conceptualized (Stern 2002, 2009). However, facilitation of such recovery and resultant
empowerment is dependent upon a paradigm shift in the way stroke professionals and survivors view recovery and inherent survivor potential. Every stroke survivor has potential to successfully participate in the continuously creative process of aging (Rogers, 1992; Shearer, 2009).

In closing, readers of this inquiry are left the following words from American Stroke Association’s feature text, *A Guide for families Living with Stroke* (Senelick & Dougherty, 2001, p. 243 – 244):

But is that change an impossible one to deal with?
No.
A debilitating change that prevents you from moving forward?
No.
Life is not always fair.
But as long as there is breath, as long as there is even the memory of the person you love in the face that sleeps in the hospital bed, as long as there is the occasional smile, the gesture that you remember from holidays long past, from Sunday afternoons, from times well shared – as long as there are these, there is hope. There is life.
You and your loved one should not give up as long as there is that hope. Yes, you might need help. But life has not ended. It does not have to become impossible. It has just changed.
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