Bioelectrical Impedance Analysis and Hydration Awareness Promotion in the Older Adult

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Abstract

Bioelectrical impedance analysis (BIA) provides a simple noninvasive way to monitor total body water (TBW). Older adults are at risk for dehydration and related illnesses due to a variety of age related changes. The purpose of this clinical inquiry project was to determine if BIA coupled with a hydration awareness promotion program increased TBW content over a one week period in older adults. A convenience sample of adults age 65 and older was recruited from a rural community. Three objectives for the educational intervention were: (a) describing issues associated with under-hydration in the older adult, (b) explaining reasons older adults are at particular risk for under-hydration, and (c) discussing methods shown to increase hydration in the older adult. Thirty participants (26 females, 4 males) completed the study. Participants ranged from 65 to 86 ($M = 70$, $SD = 5.46$). A Wilcoxon Signed Rank Test determined there was an overall significant increase in TBW change between participants pre- and post-intervention, $z = -2.20$, $p = .028$. The median percent total body water reading increased from pre-intervention ($Mdn = 43.35$) to post-intervention ($Mdn = 44.35$). Kruskal-Wallis test revealed a significant difference in TBW change between participants consuming the least amount of fluids prior to the study and those reporting consuming more. Significant findings were not found related to age, sex, and self-reported mobility status in relation to changes in total body water content respectively. This study has shown that education on the importance of hydration can lead to significant changes in percentage of total body water. If these results could be extended over the participants’ remaining years, there could be a reduction in dehydration related events as compared to the general aging population.
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Bioelectrical Impedance Analysis and Hydration Awareness Promotion in the Older Adult

United States residents are living longer than ever before; the current life expectancy is 75.2 years for males, and 80.4 years for females (National Center for Health Statistics, 2009). The National Institute of Health on Aging reports there are currently about 35 million Americans aged 65 and over, and this number is expected to double within the next 25 years. Because people are living longer there has been a great deal of interest about maintaining optimal health during the senior years. Two main goals of Healthy People 2010 are to increase quality and years of healthy life and eliminate health disparities (U.S. Department of Health and Human Services, 2000). Organizations such as the National Institute of Aging and the American Association of Retired Persons are supporting and encouraging research projects that would enable seniors to remain healthy and productive (National Institute on Aging, 2010).

The MacArthur Study of Successful Aging examined a large group of elderly citizens during the late 1980’s to early 1990’s to determine the factors that influence the physical and cognitive functioning of older adults (Rowe & Kahn, 1998). Rowe and Kahn compiled the knowledge gained from this study to explain factors related to successful aging. The three components to successful aging they identified were: avoiding disease and disease-related disability, maintaining high cognitive and physical functioning, and engagement with life. The importance of nutrition and optimal water balance was one topic related to the prevention of disease and optimal physical functioning that facilitated successful aging. Rowe and Kahn noted that poor fluid intake, a decreased capacity of the aging kidney to concentrate urine, and a decreased thirst sensation are frequently associated with development of dehydration among elders. This capstone project aimed to improve self-care and promote increased quality of life
and successful aging in community dwelling older adults by increasing their awareness of proper hydration and encouragement of adequate fluid intake.

**Statement of the Problem**

Dehydration is defined as the depletion of total body water (TBW) content due to a pathologic fluid loss or decreased fluid intake (Garcia, 2001). Dehydration has been reported as the most common fluid and electrolyte imbalance among elderly adults. Mortality rates accompanying a diagnosis of dehydration in hospitalized older adults are as high as 45%-46% (Hodgkinson, Evans, & Wood, 2003). The problem addressed by this clinical inquiry project was to determine those factors that increase the risk of dehydration among elderly adults and to devise interventions to prevent dehydration.

**Rationale for the Study**

As a Family Nurse Practitioner working with aging adults in a family practice clinic, the principal investigator of this clinical inquiry project has been concerned with optimizing successful aging. According to Encarta Dictionary (Soukhanov, 2004), the definition of “optimize” is to enhance the effectiveness of something, which means “to make something (someone) function at its (his/her) best or most effective”. Currently U.S. adults aged 65 years can expect to live 17.2 more years (National Center for Health Statistics, 2009). Interventions are needed to ensure these remaining years are as healthy and as comfortable as possible. Adequate hydration was found to be an important variable in ensuring overall health. Dehydration increases the risk of health complications and mortality. Fluids play an important role in the function of every system in the body. Inadequate fluids can cause problems with temperature regulation, falls, syncope, hypotension, increased respiratory infections, constipation, urinary tract infections, electrolyte imbalance, and medication toxicity to name a
few (Mentes & Culp, 2003). This realization of how crucial hydration is to the highest functioning and best performance of the aging body made this topic of prime interest for research.

**Purpose of the Study**

The purpose of this capstone project was to develop and deliver a teaching intervention for older adults to prevent dehydration. This teaching intervention aimed at increasing older adult’s awareness and knowledge about the importance of hydration in those aged 65 and over. The effectiveness of the teaching intervention was analyzed by measuring changes in hydration status of older adult participants, who were recruited from a rural community in north Texas.

There were three objectives for this teaching intervention:

1. Describe issues associated with under-hydration in the older adult.
2. Explain reasons older adults are at particular risk for under-hydration.
3. Discuss methods shown to increase hydration in the older adult.

The review of the literature aided in determining: (a) health-related issues associated or exacerbated by dehydration in older adults, (b) age-related changes associated with dehydration in this population, and (c) recommendations for the promotion of hydration in older adults.

**Objective One**

Many health complications in older adults are associated with or exacerbated by under-hydration, including increased mortality. Possible complications related to dehydration include: constipation, falls, medication toxicity, urinary-tract and respiratory infections, delirium, renal failure, seizure, electrolyte imbalance, hyperthermia, and longer wound healing time (Mentes & Culp, 2003).
Inadequate intake of fluids results physiological difficulties removing solid and liquid wastes. Consequences of dehydration include constipation and kidney excretion of small amounts of concentrated urine. Without adequate amounts of fluid to flush out the urinary tract, there is increased risk for bacterial urinary tract infection. Infection produces fever, which will lead to further dehydration (Kobriger, 1999).

The brain and body need nutrients, such as oxygen and glucose, brought to every cell. If the body is experiencing decreased levels of fluid, these nutrients are not adequately distributed to tissues. The result is confusion and weakness. Consequences of an impaired mental status include falls, decreased abilities to perform activities of daily living (ADLs), fatigue, difficulty swallowing, and other sensory deficits (Kobriger, 1999).

**Objective Two**

Older adults are at risk for under-hydration due to age-related changes (Garcia, 2001). These physiological changes include a diminished sense of thirst, a decline in kidney function, a loss of muscle mass, a decrease in bone mass, and a decrease in total body fluid. There are also several factors that decrease adequate fluid intake by limiting access to drink such as: visual impairment, diminished mobility or immobility, confusion or other cognitive alterations, and decreased communication abilities (Ferry, 2005). Other factors that increase the risk of dehydration in the older adult include: excessive sweating, diarrhea, vomiting, fever, co-morbid diseases, use of certain medications such as laxatives and diuretics, and diseases associated with excessive urination, for instance diabetes (Hodgkinson et al., 2003). In addition to these physiological problems, the elderly often do not have adequate dietary intake or purposely avoid fluids to decrease incontinence (Ferry, 2005).
As adults age they are more likely to have difficulty with self care and are at increased risk of maintaining hydration because of inadequate thirst stimulus and/or the decreased ability to gain access to fluids (Morley, 2000; Sullivan, 2005). Sheehy, Perry, and Cromwell (1999) noted that even though much is known about the importance of fluid homeostasis, dehydration, and contributory factors that relate to the aging process, health care providers need to improve the best practices and development of creative clinical interventions to support adequate fluid intake behaviors in the elderly population. The Doctor of Nursing Practice role is focused upon developing and evaluating interventions that translate research into effective practice with improved outcomes (Chism, 2009).

**Objective Three**

Several interventions promote hydration in older adults. Developing and making available information and in-services to health care professionals and caregivers is a first step. Other interventions include teaching elderly adults to drink even when they are not thirsty and identifying older people who are at risk for dehydration. Health care providers can ensure elderly patients have access to drinks, evaluate medication use related to dehydration, and identify early signs of decreased dietary intake (Ferry, 2005).

Health care professionals do not agree about how much fluid intake older adults need (Morley, 2000). Studies have shown that Chernoff’s standard of 1500 ml/day provides an adequate amount of fluid to prevent dehydration in older adults (Garcia, 2001). An objective of this study was to encourage the consumption of 1500 ml/day of fluid by the participants. Participants were given charts to monitor their fluid intake, tables displaying cups to milliliter conversions, a brochure describing reasons to drink fluids with a recommended daily drinking pattern, and a sports bottle to encourage consumption of fluids.
Significance of this Clinical Inquiry Project

For the older adult there is significant mortality associated with a hospitalized diagnosis of dehydration, 18% die within 30 days, and 31% die within the year. In 1996, approximately 208,000 patients age 65 and older were hospitalized with a primary diagnosis of dehydration at an average cost of $6,539 per person. In 1999, the cost of treating older adults with an avoidable hospitalization having a primary diagnosis of dehydration was estimated to be $1.14 billion. The rate of hospitalizations for older adults with a primary diagnosis of dehydration increased 40% from 1990 to 2000 (Abdallah, Remington, Houde, Zhan, & Melillo, 2009).

The general consensus from the literature review is that efforts to prevent dehydration in the elderly need to be initiated, and these efforts include education about learning to recognize signs and symptoms of dehydration early (Davidhizar, Dunn, & Hart, 2004; Hodgkinson et al., 2003), recognize those elders particularly at risk for dehydration (Faes, Spigt, & Olde Rikkert, 2007; Hodgkinson et al., 2003; Simmons, Alessi, & Schnelle, 2001), and instituting steps to prevent the occurrence of dehydration (Abdallah et al., 2009; Davidhizar et al, 2004; Simmons et al., 2001). No published studies were found that specifically focused on an intervention to increase hydration among community dwelling older adults. Hodgkinson et al. (2003) reports “very little quality research has been performed to determine the risk factors for dehydration, the best assessment tool (s) to identify risk or the presence of dehydration, or ultimately the management of hydration status in this population” (p. 526). One study found that fluid intake of cognitively impaired nursing home residents could be increased with regular prompting to consume fluids (Simmons et al., 2001). Sheehy et al. (1999) reported dehydration and its consequences could be basically prevented, as well as corrected, if detected early.
This study was designed to improve the hydration of community-dwelling older adults. Through education about the importance of hydration and tips on ensuring adequate fluid intake, the goal was to increase hydration in the elderly and reduce the incidence of dehydration-related hospitalization within this community. Reducing dehydration would be expected to reduce health care costs associated with dehydration and its complications. Ultimately, research studies and clinical projects such as this one would improve the quality of life of elderly citizens and facilitate attainment of the goals of Healthy People 2010.

**Conceptual Framework**

Pender’s model of health promotion (HPM) served as a framework for this clinical inquiry project (see Figure 1). The HPM provides direction for the examination of the complex biopsychosocial processes that motivate individuals to adopt behaviors aimed toward health promotion. Pender focused on three areas, described as variables, in the achievement of health: (a) individual characteristics and experiences, (b) behavior-specific cognitions and affect, and (c) behavioral outcome (Pender, Murdaugh, & Parsons, 2006). These variables provided the basis on which the teaching intervention to promote optimal hydration and prevent dehydration was constructed.

According to the HPM, understanding each person’s individual characteristics and experiences would be important in order to recognize how these may affect the proposed behavior change (Pender et al., 2006). For this study, each participant’s personal factors, along with biological, psychological, and sociocultural factors, were considered as part of the implementation of the intervention.
The review of literature aided in identifying behavior-specific cognitions and affect. Recognizing the elements of this variable, as described in the HPM, was a crucial component, which was needed to develop the intervention targeting the promotion of the proposed behavioral outcome. These are the components of the model that are subject to change through the intervention. (Pender et al., 2006). For this study, the elements targeted included: (a) perceived barriers to action, (b) perceived benefits of action, (c) perceived self-efficacy, and (d) recognizing interpersonal influences. The aim of this teaching intervention was to (a) address perceived barriers to change and put them in perspective, (b) provide an explanation of the benefits of hydration on the body and consequences of dehydration, (c) provide hydration monitoring tools and improved awareness to increase self-efficacy in improving hydration, and
(d) understand the importance providers, family members, and friends can have on improving hydration in older adults.

The behavioral outcome intended for this intervention was increasing the fluid intake of older adults. In order to promote commitment to the plan of action several strategies were used. Distribution of brochures and fluid monitoring tools were included during the teaching intervention. The teaching intervention by addressing the behavior-specific cognitions and affect helped to increase awareness of the participants on a very important health behavior topic, which can improve and perhaps prolong a healthy life. The recognition that adopting minor changes to their current lifestyle can have an impact on their personal health aided in the commitment to the plan of action. An understanding of individual characteristics and experiences permitted the encouragement of proposed changes causing the least disruption in a participant’s normal routine in order to promote the behavior outcome.

Assumptions

The following are assumptions associated with this study:

1. Older adults will attend the intervention due to a desire to learn more about the importance of hydration.
2. Older adult participants will take part in the study in order to improve their hydration status and promote healthy outcomes.
3. Improving hydration can reduce dehydration events and related complications.
4. Older adult participants are able to understand and incorporate increased fluid intake behaviors into their current habits.
5. Advertising in a local newspaper will encourage attendance for the intervention.
Hypotheses and Research Questions

The primary research question for the basis of this study was: In community dwelling older adults will promotion of increased fluid intake result in an increase in TBW measurements as measured by bioelectrical impedance analysis? Secondary research questions included: Is there a correlation between age and TBW content change of participants post intervention? Is there a significant difference in TBW content change of self-reported mobility impaired versus self-reported non-mobility impaired participants post intervention? Is there a significant difference in total body water content change of participants who report drinking less fluid per day (in terms of 8 ounce glasses) prior to the intervention as compared to those reporting a higher intake of fluid per day pre-intervention? Is there a significant difference in TBW content change of male versus female participants post intervention?

Hypothesis to correlate with the research questions are as follows:

1. Hypothesis: There will be a significant increase in TBW content of participants between pre- and post-educational intervention.
   Null: There will be no change in TBW content of participants between pre- and post-educational intervention.

2. Hypothesis: There will be a correlation between age and TBW content change post-intervention.
   Null: There will be no correlation between age and TBW content change post-intervention.

3. Hypothesis: There will be a significant difference in TBW content change in participants reporting different amounts of fluid consumed prior to the educational intervention.
Null: There will be no difference in TBW content change in participants reporting different amounts of fluid consumed prior to the educational intervention.

4. Hypothesis: There will be a significant difference in TBW content change in male versus female participants post-intervention.
Null: There will be no difference in TBW content change in male versus female participants post-intervention.

5. Hypothesis: There will be a significant difference in TBW content change in participants self-reporting a mobility impairment and those reporting no impairment.
Null: There will be no difference in TBW content change in participants self-reporting a mobility impairment and those reporting no impairment.

**Definition of Terms**

For the purposes of this study the following terms were operationally defined:

*Older adults*: persons aged 65 years and older.

*Community-dwelling*: living in his/her own home or the home of a relative, rather not in a nursing home or other residential-care setting.

*Education*: the dissemination of information in this study for the purposes of increasing knowledge of the importance of hydration in the aging body. The education will include the presentation of a power point lecture, distribution of a brochure and fluid monitoring tools, along with a question and answer session following the lecture.

*Total body water*: measured using a Tanita BF-522W body fat monitor and scale, the reading obtained represents the percentage of a person’s weight accounted for by water within his body. Physiologically it is defined as a total of intracellular water and extracellular water, these are located in the fat free mass compartment of the body as opposed to the fat mass
compartment (Kyle et al., 2004). Normal range in most adults for total body water is 45-60% of total body weight (Mullins, 2009). As people age the percent total body water decreases to about 50% in males and 45% in females (Davis, 2008).

**Glasses**: for the purposes of this study, the term will refer to 8 ounces, 1 standard cup, or 250 milliliters.

Several concepts for this study are conceptually defined:

- **Education**: defined as an intervention designed to promote the intended behavioral outcome – increasing the fluid intake of older adults. Pender’s model of health promotion (Pender et al., 2006) used in the design of this intervention considers the variables of individual characteristics and experiences, behavior specific cognitions and affect, and perceived self-efficacy in the development of this intervention. Components considered in this intervention included current and past intake patterns and preferences and techniques to improve current practices. Potential reasons for avoiding fluid intake were addressed, which included decreased thirst perception, preventing incontinence, and mobility issues. Anticipated benefits of change in terms of improved health, reduction in disease and disability were explained. Participants were provided with information on adequate intake amounts, how to determine if they were getting enough fluids, and ways to increase their consumption in order to promote improvement in self-efficacy.

- **Impaired mobility**: for the purposes of this study, the term refers to the use of a cane, walker, other assistance device used for walking, or a personal awareness of difficulties ambulating.

- **Fluids**: refers to all liquids that a person could consume, including but not limited to water, milk, soft drinks, coffee, tea, juice, and alcohol.
Limitations

A number of limitations have been identified in this study:

1. The small number of participants in this sample limits the statistical power of the data.
2. A control group was not used.
3. Participants choosing to participate in this study may not be representative of all older community-dwelling adults, the targeted population.

Delimitations

Two delimitations were identified in this study. Participants were recruited with an ad placed in the county Shopper, received by residents in the mail. Data from this study will be generalizeable only to adults who are over the age of 65, who attended the educational intervention, who are able to read and write English, and who meet the inclusion criteria for participation in the educational intervention.

Summary

The number of older Americans is expected to double over the next couple of decades. Encouraging measures to increase quality of life for older adults will not only allow them to live comfortably longer; but these measures should also help reduce the use of health care resources. Research to improve overall health of older adults is necessary to promote increased quality and years of healthy life. Dehydration has been found to be a common factor that contributed too many illnesses and adverse health conditions in older adults. Using the HPM as a framework to promote a behavior change, an Increasing Fluid Intake educational intervention was developed. This intervention addresses perceived barriers to changing fluid intake, perceived benefits of increasing fluid intake, issues of perceived self-efficacy, and recognizing interpersonal influences of the behavior change.
Review of the Literature

As Davidhizar, Dunn, and Hart (2004) noted, “everyone has individual water needs” (p. 160) indicating providers should consider each client’s intake needs. Older adults may have different fluid intake requirements as compared to children or younger adults. As people age, their water requirements can change based on personal activity levels, health conditions, individual physiological aspects of the aging process, and/or medications.

The following discussion provides a review of the literature on the following topics: (a) older adults and dehydration risk factors, (b) conditions exacerbated by dehydration, (c) support for hydration education, (d) hydration promoting strategies, (e) bioelectrical impedance analysis explained, and (f) use of BIA and older adults. The following databases were used to access the literature: EBSCOhost, MEDLINE, OVID, and GoogleScholar. The subject headings of older adult, elderly, community-based, fluids, hydration, dehydration, risk factors, bioelectrical impedance analysis, body composition, and education were used in the search.

Over the past several decades, dehydration has been recognized as a common occurrence among older adults in our nation’s emergency rooms. Recent studies have uncovered several risk factors for dehydration. Dehydration actually has been found to cause or exacerbate numerous conditions (Mentes, 2006). Awareness of these risk factors and conditions is especially important for the health of the older adult population.

There have been attempts to determine effective tools to measure and monitor hydration. A few involve the use of laboratory testing. These methods can prove inconvenient at times. A newer method known as Bioelectrical Impedance Analysis is becoming more popular and is commercially available as a method of measuring body fat and body water content (Jaffrin & Morel, 2008).
In 2004 the Institute of Medicine, recognizing water deficits in the body can lead to poor function and health, announced its first Dietary Reference Intakes for water and other electrolytes that were age and gender specific in measureable amounts. The standards set for males age 19 to 70 was 3.0L (13 cups) and for females the same age 2.2L (9 cups) (Grandjean & Campbell, 2004). Actual average fluid intakes may, however, be less in this age group. Kolasa, Lackey, and Grandjean (2009) reviewed the 1999-2002 National Health and Nutrition Examination Survey data finding the total intakes reported from food and beverages for males greater than 19 years averaged 2.40L and for women 1.76L.

**Older Adults and Dehydration Risk Factors**

As adults age the body’s function undergoes changes related to the aging process. As people age there are several changes that can be attributed to age. A decline has been shown in the need to consume fluids, thirst perception. Total body water has been shown to decrease with age as a result of loss of lean body mass and an increase in body fat (Davis & Minaker, 1994). Aging leads to a decrease in function of the kidneys including glomerular filtration rate, reduction in renin secretion and response to hormones (Sheehy et al., 1999). When decreased fluid intake occurs, dehydration can result in older adults due to this decline in kidney function. This decline results from the inability to concentrate urine (Sheehy et al., 1999; Thomas, 2004). Alvarez Gregori and Nunez (2009) reviewing the effects of aging on the kidney and its function found under normal circumstances the kidney of older adults functions similar to that of younger adults. The differences in function occur, however, when the body of the older adult is experiencing times of overload or dehydration. During these times the kidneys were found to be less able to adapt.
In a systematic review of literature, Hodgkinson et al. (2003) reported several risk factors commonly associated with an increased risk for dehydration. These included age, decreased mobility, reduced functional ability, sex, visual disturbances, speech deficits, incontinence, and number of meals ingested. Specifically among older adults additional risk factors have been identified including: lack of adequate fluid intake, complications associated with medications, physical/cognitive impairment, exposure to excessive heat (Abdallah et al., 2009), and decreased thirst sensation (Zembrzuski, 2004).

Age-related changes in the physiological control of water balance within older adults can place them at risk for water and electrolyte disturbances. These changes together with illnesses can result in a higher incidence of hydration disturbances (Stout, Kenny, & Baylis, 1999). In order to maintain hydration, one needs to be able to recognize the factors associated with dehydration. During an assessment, providers should monitor for acute/chronic illnesses, physical/mental/functional disabilities, fears of incontinence, anorexia, and use of certain medications (Ferry, 2005). Physical changes affect all body systems including the nervous, cardiac, respiratory, gastrointestinal, and genitourinary systems (Sheehy, Perry, & Cromwell, 1999). Changes in these systems, combined with changes in physical, mental, and social functioning, can easily lead a person to experience dehydration and its consequences (Mentes, 2006).

When older adults are faced with hydration challenging events, evidence has shown older adults have reduced fluid intakes and experience a decreased thirst sensation. They eventually do become re-hydrated, however it can take longer when compared to healthy younger adults. In this study, Kenney and Chiu (2001) determined from baseline readings that healthy community-dwelling older adults did not suffer from chronic dehydration. They related episodes of
dehydration as more likely occurring from the presence of various clinical conditions and/or medications.

**Conditions Exacerbated by Dehydration**

There are many potential consequences of dehydration including: constipation, falls, medication toxicity, urinary tract and respiratory tract infections, delirium, renal failure, seizures, electrolyte imbalance, hyperthermia, and longer wound healing time (Mentes, 2006; Pinto, 2008). Dehydration has been shown to increase mortality rates among hospitalized older adults (Mentes, 2006). Palmisano-Mills (2007) also noted increasing frailty and decline in cognitive functioning to be associated with dehydration.

Fluid losses of as little as 2% body weight can lead to decreased endurance and increasing risk of heat exhaustion (Kleiner, 1999). The negative influences on performance and physiological function include: lowered cardiac output, decrease in skin blood flow, alterations in muscle metabolism, and nervous system function. Mental performance is also affected by decreased hydration. Kolasa et al. (2009) reported studies have shown loss of body fluids reduces psychomotor, muscle control, dexterity, and cognitive functioning.

Kolasa et al. (2009) reviewed literature on associations between illnesses and dehydration. The authors found studies that demonstrated strong evidence for the association of dehydration with kidney stones, urinary tract infections, hyperosmolar hyperglycemic diabetic ketoacidosis, and mitral valve prolapsed. Other studies found associations between dehydration and constipation, hypertension, venous thromboembolism, coronary heart disease, stroke, gallstones, and glaucoma.

Inadequate hydration has also been shown to result in delayed and poor wound healing. Wipke-Tevis and Williams (2007) studied the effects of hydration on skin perfusion in young
and old adults. They found subtle differences in perfusion levels between younger and older adults as a result of under-hydration. Tissue oxygenation and perfusion are necessary aspects of wound healing. Dehydration can therefore, decrease perfusion of necessary nutrients to the skin and other organs.

Significant levels of dehydration have been found to be present in older adults on admission for ischemic stroke. This has been mentioned as a possible contributing factor in this type of stroke. Encouraging methods to maintain hydration may benefit older adults by reducing the risk of cerebral ischemia (Rodriguez et al., 2009).

**Support for Hydration Education**

Specific hydration management programs have shown to decrease occurrences of acute confusion, urinary tract and respiratory tract infections by 50% (Mentes & Culp, 2003). In a survey, 89% of health care providers identified dehydration as a problem among community-dwelling older adults (Abdallah et al., 2009). Adults aged 85 and older are three times more likely to be diagnosed with dehydration in the emergency room than are adults age 65 to 74 (Mentes, 2006). While some studies indicate that community-dwelling, healthy, older adults show no differences in water consumption, total water intake, and urine output than younger adults (Bossingham, Carnell, & Campbell, 2005), other reviews have found up to 48% of older adults admitted in emergency rooms had laboratory values consistent with dehydration, and 80% of these older adults lived in the community (Bennet, Thomas, & Riegel, 2004). This finding makes it reasonable to conclude that education is needed to ensure consistent hydration among older community-dwelling adults.

Morley (2000) reported there has been little information found concerning the normal fluid intake of community-dwelling older adults. Most research has focused on older adults
residing in long term care facilities. Many conditions lead to nursing home placement; however, many of these have been found to be related to prior poor hydration related conditions (Sullivan, 2005). A loss of 3% total body water in an older adult is considered significant and without timely correction can result in severe dehydration (Wotton, Crannitch, & Munt, 2008).

Davis and Minaker (1994) also reported on the changing perceptions of thirst with aging. In a random sample of community dwelling elderly, 1/7 subjects aged 65 and older, and 1/4 age 85 and older consumed insufficient amounts of drinking fluid. In the sample, 63% reported they paid attention to ensuring they drank an adequate amount of fluid, 54% stated they drank only when thirsty, and 12% purposefully reduced fluid intake to avoid urinating during the night. Juan and Basiotis (2004) reviewed and analyzed data from the NHANES III and the Continuing Food Survey, and using Chernoff’s measure of 1500 ml as the recommended fluid intake found more than 1/3 of older adults had inadequate water consumption. Of those not meeting the recommendation they reported drinking 2-3 less glasses of plain water and ate 1.5 times less moisture containing foods and beverages. Those meeting the recommendation reported drinking 5-6 glasses of plain water per day.

**Hydration Promoting Strategies**

Most studies done to promote hydration have been done on nursing home patients. This review of literature found two specific studies, although unpublished, that specifically focused on effects of hydration education on community dwelling older adults. Several reviews and studies were located that recommended strategies to promote fluid intake in community and residential-care dwelling older adults. Hodgkinson et al. (2003) reported in their systematic review that few studies have been done in western countries on identifying and managing hydration status in older adults. Work continues to need to be done to determine the best practices and development
Ensuring good hydration means maintaining hydration and encouraging the consumption of fluids. Getting older adults to consume more liquids includes educating them on the need to drink plenty. Recommendations for fluid consumption range from at least 1.5L/day up to 2.0 L/day depending on source (Mentes, 2006). Gradually increasing fluid intake and consuming an amount that a person is comfortable with have been recommended (Lindeman et al., 2000). Hydration education should include explaining how a variety of beverages can be consumed including water, milk, juices, soups, vegetables, fruits, jellos, sherbets, and puddings (Ferry, 2005; Mentes, 2006). In addition, consuming small quantities frequently over a longer period of time, rather than large quantities at one time, promotes both improved hydration and comfort (Ferry, 2005; Kenney & Chiu, 2001). Providing education on how to measure liquids using a graduated cup and encouraging social events that include drinking were additionally recommended by Mentes (2006). Valtin (2002) stated caffeinated and alcoholic beverages may also be counted towards the total fluid intake; however one needs to be aware these also have a diuretic affect and should be limited.

Mentes (2006) offered tips on promoting fluid consumption, including questioning on current intakes, encouraging 1.5-2L/day, education on consumption needs, reviewing medications, and addressing issues leading to personal fluid restrictions. Strategies suggested to promote fluid intake include drinking fluids with each meal, keeping a beverage nearby during the day, and encouraging fluids when brushing teeth, when in the kitchen, and when taking medications (Davidhizar et al., 2004). Bennett (2000) recommended that water provide half the daily fluid intake; however milk, vegetable and fruit juices, and soups could also be included as
fluid intake. Total fluid intake from food varies from 19-25%, with fruits and vegetables having higher water content and foods such as meats, breads and nuts providing much lower amounts (Kolasa et al., 2009).

Simmons, Alessi, and Schnelle (2001) studied a behavioral intervention designed to increase fluid intake in nursing home residents. In this randomized control study they found verbal prompting alone was effective in the more cognitively impaired residents, however with the less impaired residents compliance with beverage preference was necessary to increase fluid intake. This finding with less impaired residents may be useful in designing interventions centered on community-dwelling older adults.

Abdallah et al. (2009) specifically noted that nurses can play a significant role in promoting hydration in this population by hosting educational programs in the community. This is an area that more nursing research is needed in order to evaluate the effects of interventions and strategies on hydration promotion in the community-dwelling older adult population. A focus group they held of health care providers discussed ways to promote hydration in older adults, coming up with several recommendations including: Provide easy access to fluids by placing containers such as sports bottles within easy reach; have visitors or family/care providers encourage and remind older adults to drink; and educate older adults about consuming hydrating foods like popsicles, sherbet, gelatin, and pudding.

Muck (2003) in an unpublished study recognized the lack of studies evaluating the effectiveness of education programs on preventing dehydration. Their approach involved 3 weekly 45-minute sessions on preventing dehydration. They measured change in knowledge and fluid consumption. At 6 weeks, results showed no significant increase in report of fluid
consumption; however the intervention did improve knowledge. One recommendation for future studies included using a quantitative assessment of hydration.

In another unpublished study, Paskvan (2001) compared the effectiveness of informative brochures versus an educational lesson on fluid intake and knowledge of hydration issues among older adults. Paskvan found that the brochure group had a significant increase in the knowledge quiz scores compared to the lesson group. Their participants were found to be consuming the recommended minimum amount of 48 ounces of fluids prior to the interventions, and no significant change in fluid intake was noted. The author did, however, conclude the recommended use of brochures as an effective method to consider by future professionals in the education of hydration in older adults.

**Bioelectrical Impedance Analysis Explained**

Bioelectrical impedance analysis (BIA) is a technique used to measure body composition. BIA provides a quick, safe, and noninvasive method to measure total body water (TBW), extracellular water (ECW), intracellular water (ICW), and determines percentage of body fat. A bioelectrical impedance analyzer measures the impedance or resistance to a signal (current) as it travels through the body from one electrode to another electrode (National Institute of Health, 2006).

A typical current of 800 µA at a frequency of 50 kHz is introduced by the device. Impedance is measured by the device, and using additional parameters such as age, sex, and height the device estimates total body water. From this estimate it can further estimate percent body fat. Newer analyzers have been developed using multiple frequencies that allow for the estimation of both ECW and ICW (National Institute of Health, 2006).
In addition to single and multi-frequency devices, various analyzers also use different types of electrodes and electrode placements. This study used a foot-to-foot analyzer similar to a bathroom scale with fixed electrodes. Traditional methods used foot to hand placement using electrocardiograph type electrodes. There is also a hand to hand system available.

Use of BIA and Older Adults

Davidhizar et al. (2004) mentioned the promising value that BIA may have for the assessment of hydration in older adults. Traditional hand to foot models were shown to be valid in older adults in several research studies. In 2005, Ritchie, Miller, and Smiciklas-Wright demonstrated a Tanita foot to foot system correlated with a hand to foot model in a group of community dwelling older adults.

BIA methods have been used successfully in older adults with various disorders. Powers, Choi, Bitting, Gupta, and Buchowski (2009) using a hand to foot method showed TBW readings were not significantly different then isotopic dilution methods (considered the gold standard). Their sample consisted of 32 acutely ill hospitalized adults aged 65-87 years. Other studies have used BIA successfully in elderly samples with a variety of hydration disorders (Ritz, 2001), congestive heart failure (Sergi et al., 2006) and pancreatic cancer (Bauer, Capra, Davies, Ash, & Davidson, 2002).

Research Methodology

The teaching intervention included a PowerPoint® presentation, a brochure, and educational handouts. The handouts were obtained from the Water for Wellbeing Toolkit, a hydration promotion program developed by the Victoria Continence Foundation of Australia (see Appendix A). Permission was obtained from the Victoria Continence Foundation of Australia to use the toolkit in this study (see Appendix B). The presentation was developed on a 9th to 10th
grade reading level using information from the toolkit and additional evidence-based information from recent publications (see Appendix C). A forum was included at the end of the presentation to answer questions and provide further explanations of presentation content.

**Research Design**

This study followed a prospective correlational design. The implementation of the project involved three phases: recruitment of participants, educational presentation, and obtaining TBW measurements of participants. The participants attending the educational presentation and qualifying for the study were solicited to participate and sign the consent (see Appendix D). Attendees were allowed to take part in the presentation even if they did not wish or were ineligible to participate. Information on demographics, fluid intake, and mobility status were gathered on each participant (see Appendix E). Individuals having a urinary catheter, feeding tube, pacemaker and/ or any implanted mechanical/electrical device were excluded from this study. Individuals were also excluded from this study if they had a diagnosis of congestive heart failure, end stage renal disease, or had a fluid restriction.

The teaching intervention was held in a conference room at a rural north Texas hospital. The goal was to ideally reach a minimum of thirty participants. The power point session was about 20 minutes. A discussion session of 10 minutes or more was held after the presentation to answer questions and discuss useful hydration promotion methods.

The effectiveness of the educational intervention was determined by measuring the TBW content of participants. The TBW of the participants was evaluated after the presentation and again one week after the initial intervention. The age, sex, and height of each participant were also obtained for the TBW calculations.
Setting

The setting for this educational intervention was a conference room at a rural north Texas hospital. The hospital is a well known location in the surrounding community; it offers several opportunities to older adults in this community including a Wellness Center with exercise equipment and classes on aerobics and yoga. The conference room provided accommodations for comfortable seating with nearby access to restrooms. Drinks, muffins, and cookies were provided for the participants’ enjoyment.

Population and Sample

The county that is the site of the study is primarily rural with a total population of 19,548 with 19.8% of the population being over age 65 years and 3.1% being over age 85 years. The county seat has a population of 5,496. The study city has a population of 3,206 (Texas Association of Counties, 2010). Since it is unknown if the older adults choosing to participate in the intervention are representative of all older adults in the population, results from the analysis of this clinical inquiry project can only be generalizable to the older adult participants in this group. This study is crucial, however, in finding and recommending improvements for future studies in choosing a sample and intervention techniques in order to conduct further research designed to reach a larger generalizable population.

Sample Recruitment

A flyer was published in the county Shopper one week prior to the intervention (Appendix F). The Shopper is delivered free of charge to all residents receiving their mail in the study county. This method was chosen due to the wide spread distribution of information.
Sample

This study sample included 33 participants aged 65 years and older; 30 participants returned for the second set of total body water readings. The majority of participants were white, female, consumed 4-6 glasses of fluid per day, and did not report a mobility impairment.

Protection of Human Participants

Approval for this study was obtained through Texas Woman’s University Institutional Review Board (see Appendix G). Approval for use of a conference room at the study hospital was obtained from the Chief Executive Officer (see Appendix H). Participants were solicited from the surrounding community.

Informed Consent

Participants present for the presentation were instructed on the goals for the presentation and possible voluntary participation in a research study related to the presentation. The criteria for inclusion and exclusion for the study was explained. Participants were invited to stay following the presentation if they wished to participate in the study. Those staying were advised they could withdraw from the study at any time without consequence. The participants were given an explanation of the consent, time commitment of study, risks and benefits of the study, confidentiality and participant rights. Consents were signed with the participants and they received a copy of the consent. The principal investigator’s and Texas Woman’s University contact information was pointed out for each participant. Participants were informed if they wished to receive results of the study to provide their contact information on the consent form.

Risks of Participation

Several risks of participation were identified for this study including: loss of confidentiality, loss of privacy, physical discomfort, risk of injury, and fear of harm. Steps were
taken to minimize the identified risks for the participants. For loss of confidentiality, participants were assured documented personal information was only known and available to the principal investigator. Participants were given a unique identification number that was then used to identify all study materials. No individual participant test results were shared with other study participants. Each participant received only his or her own information. To ensure personal privacy, the participants were weighed in a room in such a way as to make certain that only the participant and principal investigator could see the readings.

Measures were taken to limit physical discomfort during sessions related to time confined to conference room. To decrease the chance of physical discomfort, the first and second measurement sessions were limited to no longer than 5 minutes of actual standing. During the initial session the participants were allowed to assume or change position as needed throughout the data collection and intervention. At the beginning of each measurement session, all participants were reminded that they could choose to discontinue participation in the study at any time. Refreshments were provided including coffee, tea, and various juices along with a variety of muffins and cookies.

In order to reduce chance of injury, participants were screened for eligibility to participate, excluding individuals who met exclusion criteria and/or did not meet inclusion criteria. Decreasing fear of harm was done through careful explanation of the bioelectrical impedance device. Participants were made aware that the Tanita BF-522W Body fat monitor/scale would send an imperceptible electric current from one foot to the other. It was reinforced that there would be no pain involved; sensation would be the same as standing on a regular bathroom scale.
Benefits of Participation

Each participant benefited from this study by receiving information on the importance of hydration for personal optimal health. Participants were also informed of their individual hydration status and received tips on improving their hydration. The generalizable benefits of this study include contribution to knowledge on the effectiveness of hydration promotion measures in the community-dwelling older adult population and refinement of a teaching tool based on the Water for Well-Being toolkit. Each participant received brochures, fluid monitoring tools, and a 16oz sports bottle.

Instruments

Bioelectrical impedance analyzers provide a quick, safe, noninvasive way to measure total body water. The gold standard of body composition analysis is spectroscopy analysis to measure the concentration of deuterium in saliva after ingesting an oral dose of deuterium oxide. A sample is collected before the oral dose and four hours afterward. This method is not convenient for typical field use and some research studies (Jebb, Cole, Doman, Murgatroyd, & Prentice, 2000; Powers et al., 2009). BIAs are available from several manufactures for personal as well as professional use. These analyzers became widely available in the early 1990’s (Kyle et al., 2004). Single frequency analyzers as used in this study (see Appendix I) operate at an undetectable frequency of 50 kHz. At this frequency, the current will pass through both intracellular and extracellular fluid, which allows for prediction of total body water. The analyzer measures resistance and reactance. As the current moves through the fat-free mass the resistance is measured and used to predict the percent of total body water. Total body water is made up of intracellular water and extracellular water. Fluids found within in the cells of
muscles and organs make up intracellular water. Extracellular fluid consists of that found in the plasma, interstitial fluid, and in the fluids of connective tissue (Powers et al., 2009).

BIA has been widely used in research and found to be a reliable and valid way to measure TBW in the elderly. BIA has been validated in the elderly for measuring the water content of the different body compartments: intracellular, extracellular, and total body water (Ferry, 2005). Olde Rikkert, Van’t Hof, Baddenhuysen, and Hoefnagels (1998) confirmed BIA as a useful method for monitoring change of TBW over time. Powers et al. (2009) found that in hospitalized elderly patients, BIA reliably predicted TBW and extracellular water, and could be used as a useful tool to quickly assess hydration status.

There are various BIA single-frequency and multiple-frequency systems available. This study will use a single frequency, foot-to-foot system. There are also hand-to-hand and hand-to-foot models. The Tanita foot-to-foot analysis system has been validated in older adults. Ritchie et al. (2005) used a Tanita scale and found it could be practical and beneficial in clinical and community settings for the assessment of body composition in older adults.

A survey was developed by the principal investigator in order to obtain information on demographics, current fluid consumption, and mobility status (Appendix E). Participants were asked to write in their personal age in years, check whether they were male or female, and self-identify race-ethnicity as white, black, Hispanic, Asian, or other. The participants were given three choices regarding their history of fluid consumption: less than or equal to three 8 ounce glasses per day, four to six ounce glasses per day, or seven or more ounce glasses per day. Additionally, participants were asked to check “Yes” or “No” to determine the presence of personal perception of mobility problems. They were asked to check “Yes” if they used a cane or walker or in general had difficulty walking.
**Data Collection Procedure**

This study took place over a 1-week period. The first session involved the presentation on hydration awareness and promotion, as well as recording the first total body water readings. The second session involved the participants returning for the second total body water readings. The first and second sessions were held in the conference room at the study hospital. Individuals received the brochure, fluid monitoring tools, invitation to participate, sports bottle, and survey when entering room. Pens were provided and any questions about forms were addressed. A general review of the project and study was given after arrival of attendees. After the presentation, those wishing to participate received a consent form, which was reviewed with them. Those participating had their height, weight, and total body water reading measured in a private area. The participants were asked to return in one week at the same time for their second reading. All surveys and data collection tools were secured in a locked brief case after being returned by each participant.

**Treatment of Data**

All data collection materials were kept in the primary investigator’s personal possession at the data collection site and during transport to primary investigator’s residence. At this residence, data was immediately entered into SPSS version 17 after each session. When not being used for data entry or analysis, all data was kept in a locked file cabinet. A code book was developed for all variables prior to entry into SPSS. Each survey was matched with corresponding weight and total body water readings and data was entered for each identification number in the SPSS version 17.0 program. Descriptive statistics including frequencies and central tendency measures were performed to depict the sample. Tests for normality were determined on the primary variable, change in TBW between pre- and post-intervention. The
assumption of normality was not met; therefore, nonparametric statistics were chosen to analyze the data for this study.

Summary

A presentation on hydration promotion was developed and used to inform older adults on the importance of hydration. This educational intervention had three objectives: (a) to describe issues associated with under-hydration, (b) to explain reasons older adults are particularly at risk for under-hydration, and (c) to discuss methods for increasing hydration. Following a prospective correlational design, older adults in a rural north Texas community were recruited and asked to participate in the week long study. Thirty participants ultimately completed the survey and had their TBW recorded twice using a bioelectrical impedance analyzer, the Tanita BF-522W. Determination of the significance of TBW changes pre and post teaching intervention were part of statistical analyses. Correlations were calculated regarding changes in TBW and age, sex, previous daily fluid intake, and mobility status. Previous research analysis had determined that age, particularly greater than 85, female gender, and immobility were associated with increased risk for dehydration in older populations (Hodgkinson et al., 2003).

Analysis of Data

The following section covers an analysis of the hydration education intervention directed at adults 65 years of age and older. The study followed a prospective correlational design. Each participant choosing to participate following the educational intervention had their height, weight, and total body water readings obtained; additional readings were obtained the following week. Pallant’s (2007) SPSS Survival Manual techniques were used in the analysis of the data collected. The results of the analyses are discussed in relation to the proposed hypotheses and research questions.
Statistical Assumptions and Treatment of Data

SPSS version 17 was used in the statistical analysis of the data for this study. Only the participants attending both sessions were entered into SPSS. To ensure accuracy of data, the data was reviewed with the data collection instruments on a separate occasion for precision of input. Prior to analysis, a determination of assumptions was evaluated. The major dependent variable, change in total body water, was assessed for normality. A histogram was computed with the subsequent distribution appearing to be abnormal. Kolmogorov-Smirnov (KS) and Shapiro-Wilk (SW) tests of normality were computed. The results KS of 2.66 and SW of -1.06 suggested that scores were peaked and clustered at the high-end, right side of graph. Nonparametric statistics were chosen for analysis of the data due to not meeting the assumption of normality required for parametric statistical analyses (Pallant, 2007). Although one outlier was detected through a scatterplot analysis, because of the small convenience sample and excluding it did not change the previous conclusion on normality, this score was included within subsequent analysis.

Descriptions of the Sample

Thirty-three adults who were 65 years of age and older attended and participated in the educational intervention and first data collection session. The following week 30 of the participants returned for their second data collection measurements. Participants ranged in age from 65 to 86, with a mean age of 70 (SD = 5.46). There were 4 (13.3%) males and 26 (86.7%) females. The majority of participants were white 28 (93.3%); 1 (3.3%) was black and 1 participant (3.3%) recorded race-ethnicity as “Other”. Most participants 17 (56.7%) reported drinking 4-6 glasses of fluid per day; 6 (20.0%) reported drinking <=3 glasses per day, and 7 (23.3%) reported consuming 7 or more glasses. Only 7 (23.3%) reported having a mobility impairment, while 23 (76.7%) reported no problems with mobility.
Research Question and Hypothesis 1

The aim of the first research question was to determine if hydration promotion education would result in a change in total body water after a one week period. The corresponding hypothesis was: There will be a significant increase in total body water readings between pre- and post-educational intervention. The null hypothesis was: There will be no change in total body water readings between pre- and post-educational intervention.

A Wilcoxon Signed Rank Test revealed a statistically significant increase in percent total body water following participation in the hydration education intervention, $z = -2.20, p = .028$, with a medium effect size using Cohen (1988) criteria ($r = .28$). The median percent total body water reading increased from pre-intervention ($Mdn = 43.35$) to post-intervention ($Mdn = 44.35$). The null hypothesis was rejected since significant difference was found between pre and post-intervention total body water change. This study provided evidence to support the proposition that a hydration promotion education intervention can result in a change in total body water readings after one week.

Research Question and Hypothesis 2

The aim of the second research question was to determine the relationship between age and change in total body water content post educational intervention. The corresponding hypothesis was: There will be a correlation between age and total body water content change post intervention. The null hypothesis was: There will be no correlation between age and total body water content change post intervention.

Spearman’s rho was performed to determine if a relationship existed between age and change in total body water post-intervention. No statistically significant correlation was found between the two variables, $rho = .21, n = 30, p = .266$, suggesting that age has no relationship in
the analysis of this sample to change in total body water readings post intervention. This study was not able to provide evidence supporting the proposition that age is associated with an increase in total body water change after a hydration education intervention, thus the null hypothesis was not rejected.

Research Question and Hypothesis 3

The aim of the third research question was to determine the difference between amount of fluids consumed prior to educational intervention and change in total body water post intervention. The corresponding hypothesis was: There will be a significant difference in total body water change in participants reporting different amounts of fluid consumed prior to intervention. The null hypothesis was: There will be no significant difference in total body water changes in participants reporting varying amounts of fluids consumed prior to the intervention.

A Kruskal-Wallis Test revealed a statistically significant difference in change in percent total body water across the three groups of number of glasses of fluids consumed prior to intervention (Gp1, n = 6: <=3 glasses, Gp2, n = 17: 4-6 glasses, Gp3, n = 7: 7+ glasses), χ²(2, n = 30) = 7.49, p = .02. The group reporting to drink <=3 glasses of fluid per day prior to the intervention recorded a higher median change (1.05) in percent total body water than the other two groups; 4-6 glasses recorded no change in TBW, and 7+ group recorded a median increase of 0.4% in TBW. The null hypothesis was rejected since a significant difference was found between the groups pre and post intervention TBW change. This study provided evidence to support the proposition that prior amounts of fluid consumed can affect the change in total body water content after a hydration promotion education intervention.
Research Question and Hypothesis 4

The aim of the fourth research question was to determine if there was a difference in total body water change between males and females. The corresponding hypothesis is: There will be a significant difference in total body water change in male versus female participants post intervention. The null hypothesis: There will be no significant change in total body water in male versus female participants post intervention.

A Mann-Whitney U test revealed no significant difference in the changes in percent total body water of males \((Mdn = -.5, n=4)\) and females \((Mdn = 0.4, n=26)\), \(U = 22, z = -1.83, p = .07\), with a small effect size using Cohen (1988) criteria \((r = .23)\). The null hypothesis was not rejected, no significant change in total body water was found between males and females in this study. This study provided support for the proposition that total body water content change did not differ between males and females.

Research Question and Hypothesis 5

The aim of the fifth research question was to determine if self-reported mobility status would affect total body water change post intervention. The corresponding hypothesis is: There will be a significant difference in total body water change in participants self-reporting a mobility impairment and those reporting no impairment. The null hypothesis is: There will be no significant difference in total body water change and report of mobility status.

A Mann-Whitney U test revealed no significant difference in the change in percent total body water change of self-reported mobility impaired \((Mdn = .7, n = 7)\) and no mobility impairment \((Mdn = .2, n = 23)\), \(U = 52, z = -1.4, p = .16\), with a small effect size using Cohen (1988) criteria \((r = .18)\). The null hypothesis was not rejected, no significant change in total body water was found between those with a self-reported mobility impairment and those
reporting no impairment. This study provided support for the proposition that total body water content change did not differ between those reporting a mobility impairment and those not reporting an impairment.

**Summary**

In summary, 30 adults aged 65 and older ($M = 70, SD = 5.46$), 26 females and 4 males, participated in this hydration promotion education intervention. The purpose of this study was to educate adults aged 65 and over on the importance of hydration, risk factors associated with dehydration, and tips on increasing their hydration, in an effort to improve the total body water content of the participants. The participants were a convenience sample of older adults responding to advertisement of the intervention in a local newspaper flyer.

The study revealed that hydration education can lead to significant changes in total body water content in participants over a one week period. The study found significant findings with respect to number of glasses of fluid consumed prior to the intervention and increases in total body water. Significant findings were not found related to age, sex, and self-reported mobility status in relation to changes in total body water content respectively.

**Summary of the Study**

The following provides a discussion of the findings of a hydration promotion educational intervention directed at older adults aged 65 and older. This goal of the study was to increase total body water content in the participants by educating them on the importance of hydration, risks of dehydration, and providing tips on improving hydration. This research study was conducted over a one week period, with advertisement of the intervention taking place one week prior to the study. The principle investigator was interested in promoting an improved quality of life for older adults living in the community. Some issues shown to decrease quality of life have
associations with dehydration. The principle investigator aimed to increase awareness of the importance of hydration and risks of dehydration among community dwelling older adults in order to promote an increased duration of comfortable living in their community. The intervention was designed using Pender’s Health Promotion model as a framework to increase the awareness of the importance of hydration among adults ages 65 and older.

**Sample Characteristics**

Thirty-three adults aged 65 and older attended and participated in the educational intervention and initial total body water readings. Thirty participants (26 females, 4 males) returned for the second total body water readings. Participants ranged from 65 to 86 ($M = 70$, $SD = 5.46$). These participants responded to a flyer placed in a local newspaper flyer one week prior to the educational intervention. The majority of the sample was white ($n=28$, 93.3%), reported drinking 4-6 glasses of fluid per day ($n=17$, 56.7%), and had no self-reported mobility problem ($n=23$, 76.7%).

**Findings**

Because of analyses indicating that this data did not meet the assumption of normality, the limited number of participants, and the unequal group sizes of this convenience sample, nonparametric tests were appropriate for further data analysis (Pallant, 2007). A Wilcoxon Signed Rank Test determined there was an overall significant increase in TBW change between participants pre- and post-intervention. Spearman’s rho test determined there was no correlation between age and TBW change. Kruskal-Wallis test revealed a significant difference in TBW change between participants consuming the least amount of fluids prior to the study and those reporting consuming more. The Mann-Whitney U test revealed no significant difference in
TBW change between males and females, and between mobility impaired and non-impaired participants.

**External Validity**

These research findings can only be generalized to this sample. The small number of participants responding and taking part in the study may not be representative of all adults age 65 and older living in this rural community. The Hawthorne effect may have influenced this study. Participants may have, realizing they were in a study, intentionally consumed more liquids for the week and not necessarily for the health benefits.

**Internal Validity**

Due to the small sample size, attrition had an effect in this study. Three of the thirty-three initial participants did not return for the second set of total body water readings. One of these was a male, which was the gender that was already limited by representativeness in this study.

Confounding variables not controlled for in this study include medication used and types of chronic disease present. The unequal numbers of different groups, sex, mobility status, and number of glasses of fluids consumed, limits the comparisons among groups.

**Reliability**

The instrument used to measure total body water in this study was a Tanita BF-522W. Tanita Corporation includes information with their products on reliability. This includes explanations on what total body water is, what is considered normal, and how BIA correlates with the gold standard the Deuterium Dilution Method. The normal value of percent total body water for a healthy adult is 45-65%, or females 45-60%, and males 50-65% of their total weight.
Tanita Corporation reports on multiple regression analysis, a mutuality of 0.8 between the BF-522W and Deuterium dilution method (see Appendix I).

**Study Limitations and Strengths**

The small sample size was a major limitation of this study. An inability to control how much fluid the participants consumed prior to each measurement was another limitation, the participants were encouraged to repeat the first day’s activities prior to measurement on the second visit. The education level or comprehension of material was not assessed with this group.

The major strength of this study was the quality of information provided to the participants. Participants were made aware of how much fluids they should be consuming and how more or less fluid can impact their personal health and perceived quality of life. The participants were introduced on how the use of a new tool, the scale, would show them how to monitor their total body water and body fat.

**Conclusions and Implications**

The successful implementation of this program could result in the reduction in health care expenditures related to decreased admissions and treatment of dehydration and inadequate hydration related illnesses. Over a one week period, most participants did have an increase in total body water content. Further research is needed to determine the length of time the increase in total body water content is sustained and what circumstances promote sustained optimal hydration. Previous studies demonstrated that knowledge was increased with educational interventions (Muck, 2003; Paskvan, 2001); knowledge gained was not tested in this study. Previous studies did not use a tool to quantitatively assess total body water content, rather these researchers used a system of symptoms and recall as a sign of fluid intake. Increased hydration could result in improved quality of life of older adults by decreasing dehydration-related events.
This study design and teaching intervention will provide a tool for future researchers who want to increase the awareness of hydration and related issues among older adults living in the community.

The development, implementation, and results of this study have met several of the Essentials of Doctoral Education for Advanced Nursing Practice set forth by the American Association of Colleges of Nursing (2006). *Essential I: Scientific Underpinnings for Practice*, was addressed through the use of scientific knowledge and resources to develop a health promoting intervention directed at a specific population and to evaluate the outcomes of the intervention. *Essential III: Clinical scholarship and Analytical Methods for Evidence-Based Practice*, was met by reviewing the existing literature and current practice in order to develop appropriate strategies to ensure quality outcomes in the intervention. *Essential VII: Clinical Prevention and Population Health for Improving the Nation’s Health*, was met by recognizing a need and constructing an intervention with intentions to promote health, prevent disease, and acknowledge current gaps in the health of older populations.

**Recommendations for Future Study**

There are several recommendations for future studies. These include population selection and setting. Choosing a setting where there would be easier access to a large group of older adults, such as an assisted living center, may be beneficial for recruitment. This type of recruitment could be done in person with more specific instructions given on preparation for participation in the study in order to ensure similar pre-measurement activities. Future studies would benefit from testing of knowledge gained and understanding of the material presented. Measurements carried out over several weeks, months, or years would provide information on
long term effects of the intervention. This endeavor would be strengthened with devising an intervention to promote hydration and using random assignment to designate two groups

**Summary**

With the increasing number of aging Americans, steps need to be taken to optimize successful aging. Simple tasks such as improving hydration status could in theory promote improved health and quality of life. This study has shown that education on the importance of hydration can lead to significant changes in percentage of total body water. The most significant change was seen in those consuming the least amount of fluids prior to the educational intervention. If these results could be extended over the participants’ remaining years, there could be a reduction in dehydration related events as compared to the general aging population.

New questions can now be proposed, such as:

1. Which ages or populations would most benefit from an intervention of this type?
2. How often would information and practices need to be reinforced to maintain adequate hydration?
3. Would placing BIA scales in the homes of the elderly promote continued improvement in hydration status?
4. Would it be effective if results from these scales were stored in digital format and communicated to a computer that contains software embedded alerts to notify the health care provider if certain parameters are not maintained?

This study provides awareness of the important issue of hydration in older adults and the use of technology in the evaluation of hydration in the older adult population. It enhances a path to the future use of technologically enhanced instruments in the assessment and management of hydration.
References


