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Objective and perceptual measures of physical health, nutrition and hydration relative to swallowing function in self-reported healthy older adults in a continuing care community

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OBJECTIVE AND PERCEPTUAL MEASURES OF PHYSICAL HEALTH,
NUTRITION AND HYDRATION RELATIVE TO SWALLOWING FUNCTION IN
SELF-REPORTED HEALTHY OLDER ADULTS IN A CONTINUING CARE
COMMUNITY

A Thesis by

Ashley Fisher

Bachelor of Arts, Wichita State University, 2010

Submitted to the Department of Communication Sciences and Disorders
and the faculty of the Graduate School of
Wichita State University
in partial fulfillment of
the requirements for the degree of
Master of Arts

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OBJECTIVE AND PERCEPTUAL MEASURES OF PHYSICAL HEALTH,
NUTRITION AND HYDRATION RELATIVE TO SWALLOWING FUNCTION IN
SELF-REPORTED HEALTHY OLDER ADULTS IN A CONTINUING CARE
COMMUNITY

The following faculty members have examined the final copy of this thesis for form and content and recommend that it be accepted in partial fulfillment of the requirement for the degree of Master of Arts with a major in Communication Sciences and Disorders.

Lynette R. Goldberg, Committee Chair

Douglas F. Parham, Committee Member

Victoria Mosack, Outside Committee Member

Susan Parsons, Committee Member

Julie Scherz, Committee Member

ABSTRACT

The onset of dysphagia (swallowing difficulty) is associated with increasing age and the diseases that frequently occur with increasing age. Dysphagia increases the risk of dehydration and malnutrition with subsequent declines in body composition, physical health, and quality of life. The purpose of the present study was to administer a set of valid objective and perceptual measures to document (a) physical health, and (b) nutrition and hydration, relative to (c) swallowing function in 15 self-reported healthy older women in a Continuing Care Retirement Community. Statistically significant ($p < 0.05$) correlations were identified between perceived physical health, emotional well-being, and reflux symptoms and objective measures of breathing capacity, blood oxygen level, and tongue strength and endurance. The consumption of a regular, unrestricted diet was significantly associated with *Eating Duration* and *Eating Desire* on the *Swallowing Quality of Life (SWAL-QOL)* survey. Objective measures and participants' responses on the *SWAL-QOL* identified a subgroup of older adults who were experiencing swallowing difficulties. Results confirm the importance of including both objective and perceptual measures of physical health, nutrition, hydration, and swallowing function in a screening protocol for older adults in residential care to identify those at-risk for developing dysphagia.

KEYWORDS: Continuing Care Retirement Community; dysphagia screening protocol; objective and perceptual measures; older adults; quality of life.

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CHAPTER 1

REVIEW OF THE LITERATURE

The population of older adults, defined as those 65⁺ years of age, is increasing exponentially (U.S. Census, 2011). Estimates suggest that by 2020, one of every four adults will be in this age group. Of equal importance, one-third of these older adults may move into Continuing Care Retirement Communities (CCRCs; Organisation for Economic Cooperation and Development [OECD], 2005; Eslick & Talley, 2008; Rofes et al., 2011). The increasing number of older adults demands a focus on the assessment of issues associated with typical aging as well as the medical conditions that are associated with aging (Chen, Golub, Hapner, & Johns, 2009).

Although aging is no longer considered a disease or a disability, it is important to understand that getting older affects all physiological processes (Boss & Seegmiller, 1981; World Health Organization [WHO], 2002). These processes include decreases in heart function, bone mass, skin elasticity, breathing capacity, gastrointestinal and neuromuscular functions, hearing, vision, memory and cognitive capacity. The attrition of function that is associated with increasing age in older adults (i.e., healthy aging) can be compounded by the loss of function that results from disease-related conditions (e.g., stroke, Parkinson's Disease, dementia) that are experienced by many older adults, particularly those in residential care (Boss & Seegmiller, 1981; Howe, Morano, & Atanous, 2008).

One particular area of difficulty that can be associated with both healthy and disease-related aging is that of swallowing (Boss & Seegmiller, 1981; Chen et al., 2009; Leonard & Kendall, 2008; Leslie, Drinnan, Ford, & Wilson, 2005; Robbins, Langmore, Hind, & Erlichman, 2002; Roy, Stemple, Merrill, & Thomas, 2007). Being able to swallow safely is vital for the

nourishment and hydration of the body and brain that is needed to maintain physical and cognitive functions. As eating and drinking are inherently social aspects of life, being able to swallow safely is an equally important factor in an older adult's identification of self, psychological well-being, desire and willingness to participate in social activities, and quality of life (QOL) (Ashford, Logemann, & McCullough, 2011; Barr & Schumacher, 2003; McHorney, Martin-Harris, Robbins, & Rosenbek, 2006).

Disordered swallowing (dysphagia) can have a profound and adverse effect on both the physical and nutritional health of older adults and on their QOL (Amarantos, Martinez, & Dwyer, 2001; McHorney et al., 2006; Rofes et al., 2010; Singh & Hamdy, 2006). Older adults who reside in CCRCs, especially those who are dependent on others for care, are particularly at-risk for dysphagia. Estimates indicate that one of every two older adults in assisted living or dependent residential care in the United States may be dealing with dysphagia and its subsequent health and QOL issues (Chen et al., 2009; Eslick & Talley, 2008). Further, many older adults living independently in the general community experience symptoms of dysphagia, such as taking more time to eat, coughing or choking related to eating, difficulty taking pills, a sensation of food stuck in the throat, and increased fatigue, that they do not associate with swallowing difficulty (Chen et al., 2009; McHorney et al., 2006; Roy et al., 2007).

When older adults move into CCRCs, they move into one of three areas: (a) independent living, (b) assisted living, or (c) dependent care (Silva-Smith et al., 2011). Those who move into dependent care may come with documented diagnoses, many of which may be associated with dysphagia, e.g., stroke, progressive neuromuscular disease, or dementia. Those who move into assisted living are evaluated, frequently by a nurse, occupational therapist, or physician, for any physical frailties but not necessarily for the risk of any swallowing difficulties (Silva-Smith et

al., 2011). Those who move into independent living may disclose any difficulties they perceive but they cannot be asked to undergo facility-related testing due to the Fair Housing Act. This federal act prohibits housing discrimination on the basis of race, color, religion, gender, familial status, national origin, and disability (<http://www.hud.gov/offices/fheo/disabilities/index.cfm>, accessed April 2, 2012). Thus, a different mechanism needs to be in place to assist older adults in independent living to identify any risk for dysphagia or actual swallowing difficulties they may be experiencing.

Establishing a Screening Protocol for Swallowing Difficulties.

The identification of swallowing difficulties can be achieved through screening services offered by external organizations, such as Wichita State University, once older adults have moved into residential care. As dysphagia is associated with declines in body composition, physical health, respiratory support, increased risk for malnutrition and dehydration, and decreased QOL (Bauer, 2011; Dunne & Dahl, 2007; Ekberg, Hamdy, Woisard, Wuttge-Hannig, & Ortega, 2002; Leow, Huckabee, Anderson, & Beckert, 2010; Leslie et al., 2005; Ney, Weiss, Kind, & Robbins, 2009), a dysphagia screening protocol needs to address these issues as well as focus on swallowing function.

In addition to the objective measurement of physical health (including respiratory support), nutrition, hydration, and swallowing function, a dysphagia screening protocol must include older adults' perceptions of their abilities and vulnerabilities (Peterson & Pedersen, 2007). The importance of obtaining the perspective of the older adult is emphasized by the WHO in its revised biopsychosocial model advocating health, person-centered care, independent function, the prevention of disability, and the facilitation of active participation in society, rather than a singular focus on the effective treatment of a disease or handicapping condition (WHO,

2001, 2002). Thus, older adults at-risk for dysphagia must be given the opportunity to provide their perspective on the factors that can be affected by impaired swallowing, particularly their (a) physical health, (b) nutrition and hydration status, and (c) psychosocial functions (Knappe & Pinquart, 2009; McHorney et al., 2006).

The current study was the third of three initiatives to establish a theoretical framework for the development of a screening protocol to optimize quality of life for older adults at-risk for dysphagia. The first initiative involved the identification of a set of valid and reliable measures that could document older adults' physical and nutritional health, level of hydration, and swallowing ability (termed "objective measures") in a natural, compared to experimental, context. The second initiative involved the identification of valid and reliable self-report questionnaires (termed "perceptual measures") that could be paired with the objective measures. The selected objective and perceptual measures are listed below, along with references supporting their relevance in the evaluation of older adults with, or at-risk for, dysphagia. These measures are categorized in Table 1; further details are presented in a subsequent section.

Objective Measures

Physical Health. Six measures were selected for this category: (a) energy expenditure during a meal, using the portable computerized SenseWear® system (Goldberg et al., 2012), (b) breathing capacity, using spirometry (Barreiro & Perillo, 2004; Capderou, Berkani, Becquemin, & Zelter, 2009), (c) blood pressure (Wright, Hughes, Ostchega, Yoon, & Nwankwo, 2011), (d) blood oxygenation, using pulse oximetry (Valdez-Lowe, Ghareeb, & Artinian, 2009) and (e) tongue strength and endurance, using the *Iowa Oral Pressure Instrument (IOPI)* (Kays, Hind, Gangnon, & Robbins, 2010; Luschei, 2011; Stierwalt & Youmans, 2007; Youmans, Youmans, & Stierwalt, 2009).

Nutrition and Hydration. Three measures were selected for this category: (a) *Body Mass Index (BMI)*, a surrogate measure of body fatness (Dehghan & Merchant, 2008; Martin-Harris et al., 2008), (b) *MidArm Muscle Circumference (MAMC)* to document body fat and muscle mass (Landi et al., 2010; Sungurtekin, Sungurtekin, Oner, & Okke, 2008), and (c) *Bioelectrical Impedance Analysis (BIA)* to document body composition, specifically hydration (total body water [TBW]) and fat free mass (FFM) in individuals with a $BMI \leq 34$ (Dehghan & Merchant, 2008; Kyle et al., 2004; Shanholtzer & Patterson, 2003; Tengvall et al., 2009).

Swallowing Function. The *Functional Communication Measure – Swallowing (FCM-S)* developed by the American Speech-Language-Hearing Association (ASHA, 1998) was used to document swallowing function and the type of food and liquid being consumed. This scale is similar, both in content and scoring, to the *Functional Oral Intake Scale (FOIS)*; Crary, Carnaby Mann, & Groher, 2005) that now is used more frequently in dysphagia literature.

Perceptual Measures

Physical Health. Two questionnaires were selected for this category: (a) *Short Form-36* (Ware & Sherbourne, 1992), which measures eight dimensions of health and has been applied to older adults with dysphagia (O'Mahony, Rodgers, Thomson, Dobson, & James, 1998; Martin-Harris et al., 2008), and (b) *Reflux Symptom Index (RSI)*; Belafsky, Postma, & Koufman, 2002), a self-report measure that identifies symptoms of reflux and their severity. Reflux symptoms frequently are associated with dysphagia (Belafsky et al., 2002; McHorney et al., 2006).

Nutrition and Hydration. One measure, the *Nutrition Quality of Life (NQOL)* questionnaire (Barr & Schumacher, 2003) was selected for this category. It complements information obtained on the *SF-36*, a more general QOL measure, through questions that encourage respondents to reflect on the role nutrition plays in their daily life experiences.

Swallowing Function. One measure, the *Swallowing Quality of Life (SWAL-QOL)* survey (McHorney et al., 2002, 2006) was selected for this category. This tool has 10 categories. Higher scores in each category are associated with higher QOL (Martin-Harris et al., 2008; McHorney et al., 2002).

Table 1. Objective and perceptual measures of physical health, nutrition, and hydration relative to swallowing in older adults.

Objective Measures of Body Composition and Function as Indicators of Physical Health, Nutrition and Hydration Status Relative to Swallowing	Perceptual (Self-Report) Measures
Energy expenditure during a meal (SenseWear®) Breathing capacity (spirometry) Blood pressure and pulse oxygenation Tongue strength and endurance (<i>IOP</i>)	<i>Short Form-36 (SF-36;</i> Ware & Sherbourne, 1992) <i>Reflux Symptom Index (RSI;</i> Belafsky et al., 2002)
<i>Body Mass Index (BMI;</i> including height and weight) <i>Mid Arm Muscle Circumference (MAMC)</i> <i>Bioelectrical Impedance Analysis (BIA)</i>	<i>Nutritional Quality of Life (NQOL;</i> Barr & Schumacher, 2003)
<i>Functional Communication Measure: Swallowing (FCM-S;</i> ASHA, 1998)	<i>Swallowing Quality of Life (SWAL-QOL;</i> McHorney et al., 2002)

Purpose of the Study

This was a feasibility study to determine objective and perceptual measures to include in a screening protocol to evaluate swallowing function in older adult residents living independently in a Continuing Care Retirement Community. The specific purpose of the study was to investigate the correlations between selected valid and reliable objective and perceptual measures in the categories of (a) physical health, (b) nutrition and hydration, and (c) swallowing function. The following research questions were posed:

Question 1. Are there significant correlations between objective and perceptual measures of physical health?

Question 2. Are there significant correlations between objective and perceptual measures of nutrition and level of hydration?

Question 3. Are there significant correlations between objective and perceptual measures of swallowing ability?

One could expect that the measures selected within each of the three categories (physical health, nutrition and hydration, and swallowing function) would be positively correlated, i.e., high objective measures of physical health would be strongly associated with high perceptual measures of physical health. More specifically, objective measures of energy expenditure, breathing ability, blood pressure, pulse oxygenation, and tongue strength and endurance would be within functional limits for these self-reported healthy older adults. These healthy levels then would be reflected in the older adults' perceptions of their physical abilities.

With regard to nutrition and hydration status, one could expect that the self-reported healthy older adults would have *BMI*, *MAMC*, and *BIA* measures within normative limits for their age. These objective measures then would be matched by the adults' positive perceptions of their nutrition and hydration status. Similarly, high scores of swallowing function would equate to the adults' perceptions of their intact swallowing ability.

However, while pilot testing has shown the value of using objective and perceptual measures (Goldberg, Soyez, & Heiss, 2009), it also has shown that that not all of the expected correlations may be warranted. Hess, Goldberg, & Parham (2011) administered selected objective and perceptual measures to a group of 10 self-reported healthy older adults who were residents of independent living in a CCRC. Four of these adults were rated as physically healthy

using objective measures. However, their perceptions of their physical health were notably lower. Conversely, in the same group, several adults scored low on objective measures of nutrition and hydration but perceived their nutritional health as high. Such preliminary data support the importance of using both objective and perceptual measures to identify physical health, nutrition, and hydration relative to swallowing function in older adults.

CHAPTER II

METHODOLOGY

Participants

Participants were 20 self-reported healthy older (65⁺ years) adults who resided at the Kansas Masonic Home (KMH) in Wichita, KS. All responded “no” when asked if they were experiencing any difficulties with swallowing (Chen et al., 2009) and none reported any acute health concerns. Prescribed medications were documented but were not considered criteria for exclusion. All participants signed an Informed Consent form and achieved a passing score (mean = 26.80 ± 2.24) on the *Mini-Mental State Examination (MMSE)*; Folstein, Folstein, & Fanjiang, 2001). This passing score indicated that each participant had the cognitive ability to understand the purpose of the testing and provide his/her agreement to participate (Brandão, Nascimento, & Vianna, 2010; Milman et al., 2008). As a lack of hearing can affect an older person’s desire to participate in social activities, thus lowering QOL (Yueh, Shapiro, MacLean, & Shekelle, 2003), all participants also passed a hearing screening test documenting their ability to hear, aided or unaided. All participants received \$20 as compensation for their time.

Objective Measures

The following measures were used to document function in the targeted domains of physical health, nutrition and hydration relative to swallowing function:

Physical Health

- (i) *SenseWear*® to document energy expenditure during a meal. This computerized armband collects physiologic data through multiple sensors that touch the skin. These sensors track

movement/body position, body heat loss, skin temperature, and electrical resistance of the skin (Adriaens, Schoffelen, & Westerterp, 2003; Andre et al., 2006; Fruin & Walberg Rankin, 2004). The obtained data are used, along with gender, age, height, and weight, to estimate energy expenditure (in total kilo calories [kcal]) with a regression equation developed by the manufacturer.

Older adults have been shown to experience loss of tongue strength, increased fatigue and potentially increased effort during a highly textured-meal (Kays et al., 2010). In a pilot study with college-age students, Goldberg et al. (2012) documented concurrent validity between the SenseWear® system and indirect calorimetry and suggested that SenseWear® may be a valuable tool to document the energy expended by older adults during eating and swallowing. The SenseWear® device was calibrated during a period of rest and then worn as participants ate a regular lunch.

- (ii) *Spirometry to document breathing capacity.* Breathing capacity is associated with physical health (Barreiro & Perillo, 2004) and spirometry is an accepted method of documenting lung function (Stanojevic et al., 2008). The MicroDirect MicroPlus Spirometer with a nose clip (Medical Device Dept, Inc., Ellicott City, MD) was used to measure participants' ability to take a deep breath and exhale forcefully. Three trials were conducted. Participants were seated for the test to minimize any temporary effects of light-headedness. Forced Expired Volume in one second (FEV₁; measured in Liters [L]) and Forced Vital Capacity (FVC; in L) were documented. While total lung capacity does not change greatly with age, both FEV₁ and FVC decrease, indicating age-related restriction (Sharma & Goodwin, 2006). With an obstructive lung disorder, FEV₁ decreases but FVC does not. Thus, the FEV₁/FVC ratio was calculated as this ratio is an

important factor in determining airway restriction or obstruction (Capderou et al., 2009; Hankinson, Odencrantz, & Fedan, 1999).

- (iii) *A high quality stethoscope and sphygmomanometer (with customizable blood pressure cuff) to document blood pressure.* Blood pressure is a reflection of physical health (National Institutes of Health [NIH] summary report, 2002). Participants were seated in an upright position and asked to rest for a 5-minute period. The blood pressure measurement then was taken on the left arm following established guidelines.
- (iv) *Pulse oximetry to document level of oxygen in the blood.* Changes in blood oxygenation level (the amount of oxygenated hemoglobin in the blood) $\geq 3\%$ relative to eating can be considered as an indication of dysphagia (Leslie, Drinnan, Finn, Ford, & Wilson, 2004). Pulse oximetry measures were taken using the SPECTRO₂ / 10 SPECTRO₂ Pulse Oximeter (Smiths Medical PM, Inc., Waukesha, WI). This non-invasive pulse oximeter includes a small comfortable hood that is placed over the tip of the index finger for one minute.
- (v) *The Iowa Oral Performance Instrument (IOPI) to document tongue strength and endurance* (Medical LLC, Carnation, WA). Participants placed a pressure sensitive bulb in their mouth and forcefully pushed this bulb against the hard palate for 1-2 seconds. The IOPI provides a digital readout of the pressure exerted (tongue strength) in kiloPascals (kPa). Three trials were conducted and the highest pressure generated (P_{\max}) was counted. Participants then were asked to maintain 50% of P_{\max} by pushing against the bulb, guided by a visual light display, for as long as they could. This measure of tongue endurance was documented in seconds.

Nutrition and Hydration

- (i) *Body Mass Index (BMI)*. *BMI* is an accepted measure of the nutritional status of an individual. It can be used as an estimate of general health (Akner & Flöistrup, 2003) and to determine the effect of a swallowing impairment on nutritional status (Martin-Harris et al., 2008). *BMI* was calculated by dividing weight in kg by height in squared meters, i.e., kg/m^2 .

Weight

Participants' body weight was measured in kilograms (kg) using a Seca® calibrated electronic scale (H & C Weighing Systems, Columbia, MD). All participants were able to stand on the scale. Participants were bare-foot and wore typical everyday clothing. They removed all accessories prior to being weighed. This weight measurement also was included in the calculations for *BIA*.

Height

Participants' height was measured in centimeters (cm) using a portable stadiometer (Pearson Surgical Supplies, Sylmar, CA). Participants stood bare-foot on the stadiometer platform. Their height measurement also was included in the calculations for *BIA*.

- (ii) *MidArm Muscle Circumference (MAMC)*. *MAMC* is used to estimate body fat by measuring muscle girth (Sungurtekin et al., 2008), an important measure in adults considered at-risk for malnutrition. Participants' arm muscle on the right side was measured with a taut, but not tight, plastic measuring tape placed mid-point between the shoulder and elbow. Measurement of triceps skinfold thickness was made using a Harpenden skinfold caliper. *MAMC* was calculated using the standard formula:

$MAMC = \text{mid-arm circumference} - (3.14 \times \text{triceps skinfold thickness})$ (Landi et al., 2010).

- (iii) *Bioelectrical Impedance Analysis (BIA)*. *BIA* is a commonly-used, non-invasive measure of body composition to document tissue hydration (total body water [TBW] calculated from extracellular water [ECW; approximately 45% of body water] and intracellular water [ICW; approximately 55% of body water]) and fat free mass (FFM). FFM can be predicted from the ECW and ICW that constitute TBW. Body fat (BF) then can be calculated as the difference between body weight and FFM (Dehghan & Merchant, 2008; Kyle, Genton, Slosman, & Pichard, 2001; Powers, Choi, Bitting, Gupta, & Buchowski, 2009; Shanholtzer & Patterson, 2003; Tengvall et al., 2009).

In the procedure, two paired surface electrodes are placed on the back of each individual's right hand and on the top of the right foot, according to the manufacturer's instructions. A small, not felt, single-frequency (50 kHz) alternating electrical current is introduced into the body via the surface electrodes for a five-minute period. Two components of the alternating current signal, *resistance* and *reactance* (measured in ohms), are obtained from equations in the proprietary software. *Resistance*, measured by the two inner pairs of electrodes, reflects extracellular space; *reactance*, measured by the two outer pairs of electrodes, measures cellular activity (Powers et al., 2009). The underlying principle of *BIA* is that BF impedes electrical current more than FFM and this impedance can be measured by the decrease in voltage between the two pairs of electrodes. The calculation of *BIA* is premised on an individual's height, weight, gender, race, and medical condition. Dehydration increases resistance (Dehghan & Merchant, 2008).

The Quantum X Bioelectrical Body Composition Analyzer (RJL Systems, Clinton Township, MI: www.rjlsystems.com) was used. Participants were asked not to exercise, take a sauna or consume alcohol for 12 hours prior to the test. Participants also were asked to empty their bladders before testing began. Fasting was not required. Participants then were asked to lie supine on a comfortable, non-metal surface for 15 minutes to stabilize natural electrical energy currents. When needed, a small pillow was used to support the head.

Swallowing Function

- (i) *Functional Communication Measure: Swallowing (FCM-S; ASHA, 1998; Appendix A).*
An experienced clinician used this 7-point scale to document the independence-dependence level of participants' swallowing function as they consumed a regular mid-day meal.

Perceptual Measures

The following self-report questionnaires were administered to document participants' perceptions of their ability in the targeted domains of physical health, and nutrition and hydration relative to swallowing function.

Physical Health

- (i) *Short Form-36 (SF-36; Ware & Sherbourne, 1992; Appendix B).* This 36-item questionnaire uses 6-point scales, 3-point scales, and yes/no responses to score perceptions of physical health and any limitations on function, emotional well-being, physical function affected by emotional problems, level of energy (or fatigue), social function, level of pain, and general health. The *SF-36* is applicable to older adults with dysphagia (Brandão et al., 2010; Brazier et al., 1992; Martin-Harris et al., 2008; Ware et

al., 1995). Scores for each dimension are transformed into percentages; the higher the percentage, the better the function.

- (ii) *Reflux Symptom Index (RSI)*; Belafsky et al., 2002; Appendix C). This 9-item questionnaire measures perceptions of sensations related to laryngopharyngeal reflux (LPR). LPR can be associated with dysphagia (Belafsky et al., 2002). The *RSI* uses a 6-point rating scale, 0 = *No Problem* to 5 = *Severe Problem*. The scores for each question are summed. A maximum total score of 45 is possible; the lowest score indicates best function; the higher score indicates the presence and severity of reflux.

Nutrition and Hydration

- (i) *Nutrition Quality of Life (NQOL)*; Barr & Schumacher, 2003; Appendix D). This 50-item survey is organized into six categories: (a) impact of food, (b) self image, (c) psychological factors, (d) social/interpersonal factors, (e) physical state, and (f) self-efficacy. Each item is scored on a 5-point rating scale. A total score is calculated out of 250 possible points. The lowest score equates to the best function.

Swallowing Function

- (i) *Swallowing Quality of Life (SWAL-QOL)*; McHorney et al., 2006; Appendix E). The 44-item *SWAL-QOL* measures the relationship between swallowing difficulty and 10 factors: burden of care, duration of eating, eating desire, food selection, ability to communicate, fear of eating, mental health, social function, fatigue, and sleep. A 5-point rating scale is used throughout. Each set of items is scored separately. A total score is not calculated.

Procedures

Institutional Review Board (IRB) approval from Wichita State University and the Kansas Masonic Home (KMH) was obtained prior to data collection (Appendix F). A colorful

recruitment flyer was developed and placed in the mailbox of each resident in independent living at KMH. With the permission of the KMH administrators, all potential participants were invited to an informal meeting at KMH at which the study was explained.

Individual meetings with potential participants then were arranged for each to review and sign the informed consent form (Appendix G). Following this, each potential participant completed the *MMSE* (Appendix H). The order in which objective and perceptual measures were administered to participants is outlined in the *Procedure Protocol* (Appendix I) and *Participant Measurement Recording Sheet* (Appendix J). The presentation of the self-report questionnaires was randomized for each participant. If any participant was unable to complete the questionnaires independently, the investigator assisted by reading the items aloud and/or marking the participant's dictated responses. The administration of spirometry and *IOPI* measures was counter-balanced to control for effects of participant fatigue. An ASHA-certified speech-language pathologist completed the *FCM-S* during a mealtime to identify the presence and severity of any swallowing difficulty. All data were obtained in a comfortable, private room selected by each participant.

Data Analysis

Data from the objective and perceptual measures were entered into an SPSS spreadsheet for analysis (SPSS Inc., Chicago, IL). Following the calculation of descriptive measures, Pearson product-moment correlation coefficients were run to document the relationship between objective and perceptual measures within the categories of physical health, nutrition and hydration, and swallowing function.

CHAPTER III

RESULTS

The mean age of the 20 participants was 85.66 (± 5.17) years. There were 15 women (mean age 85.73 ± 5.30 years) and 5 men (mean age 85.80 ± 6.04 years). All participants were Caucasian. In addition to over-the-counter calcium, vitamins, and drops for dry eyes, participants were taking medications prescribed for blood pressure ($n = 17$), depression ($n = 8$), cholesterol ($n = 5$), osteoporosis ($n = 5$), gastroesophageal reflux disorder (GERD) ($n = 4$), “restless leg syndrome” ($n = 4$), diabetes ($n = 3$), hypothyroidism ($n = 3$), seizures ($n = 2$), blood clots ($n = 2$), dementia ($n = 2$), duodenal ulcer ($n = 1$), constipation ($n = 1$), chronic obstructive pulmonary disorder (COPD) ($n = 1$), and insomnia ($n = 1$). Two participants had prescriptions for pain to be taken as needed. The prescribed medications and their potential side effects are listed in Table 2.

Means and standard deviations for *objective* measures of participants’ physical health, nutrition, hydration, and swallowing ability are presented in Table 3. *Body Mass Index (BMI)* rankings are presented in Table 4. As the body composition measures vary according to gender, data for the female and male participants were separated. The group of five male participants was not large enough to permit data analysis. The data obtained from the 15 female participants thus became the focus of the analysis.

The female participants’ blood oxygenation levels and swallowing ability (Table 3) were at, or close to, expected values for healthy 85 year-olds (ASHA, 1998; Valdez-Lowe et al., 2009). However, their breathing capacity, as measured by the amount of air they could forcefully exhale in 1 second compared to their vital capacity, was less than expected. In addition, their FEV₁/FVC ratio was lower than ratios reported for healthy 65-85 year old women (Capderou et

al., 2009). As a group, these women were heavier than expected (NIH, 2012; Speakman & Westerterp, 2010), with a larger *MAMC* (Landi et al., 2010), increased percent body fat (Tengvall et al., 2009), and lower blood pressure (Wright et al., 2011). They expended more energy during a meal (McArdle, Katch, & Katch, 1991) and showed decreased tongue strength and endurance (Stierwalt & Youmans, 2007) (Tables 3 & 4).

Mean measures (and standard deviations) for participants' *perceived* physical health, nutrition, hydration, and swallowing ability are presented in Table 5. Their responses documented a high level of social functioning and emotional well-being, and an acceptable level of general health that was relatively pain-free. Participants reported more difficulties in physical, compared to emotional, functioning and the adverse effect of physical difficulties was reflected in their decreased daily activities and level of energy. They reported few symptoms of reflux and generally positive scores on nutritional intake and swallowing. Although all participants stated that they did not have any difficulties with swallowing, some symptoms of swallowing difficulty were apparent.

In summary, participants viewed themselves as healthy, which was positive. However, objective measures indicated they were not as healthy as age-matched older women living independently in the general community.

Question 1. *Are there significant correlations between objective and perceptual measures of physical health for the female participants?*

Statistically significant correlations were identified between objective and perceptual measures of physical health and these correlations are detailed in Table 6. Breathing capacity, specifically Forced Expiratory Volume (FEV₁) and Forced Vital Capacity (FVC) correlated

Table 2. Prescribed medications for participants and their potential swallowing-related side-effects .

Medication	Potential Side-Effects	N
<u>Blood pressure</u> Amlodipine, Hydrochlorothiazide, Lisinopril, Nifedipine, Propranolol, Spironolactone, Torsemide, Valsartan, Bisoprolol, Furosemide, Metoprolol	Drowsiness; excessive tiredness; coughing; restlessness; dry mouth	17
<u>Anti-depressants</u> Mirtazapine, Citalopram, Escitalopram, Amitriptyline, Venlafaxine, Sertraline, Lamotrigine	Drowsiness; dry mouth; difficulty swallowing; difficulty sleeping;	8
<u>Blood cholesterol</u> Pravastatin Sodium, Simvastatin Atorvastatin, Cymacatin, Rosuvastatin	Decreased appetite; heartburn; tiredness; coughing; difficulty sleeping	5
<u>Osteoporosis</u> Raloxifene, Calcitonin salmon nasal spray Alendronate	Difficulty sleeping; nasal dryness or swelling; changes in taste	5
<u>Gastroesophageal reflux disorder (GERD)</u> Omeprazole	Nausea	4
<u>Restless legs syndrome</u> Gabapentin, Ropinirole, Diphenhydramine, Pramipexole	Drowsiness; tiredness; nausea; dry mouth, nose and throat	4
<u>Diabetes</u> Glimepiride, Glyburide/metformin	Nausea	3
<u>Hypothyroidism</u> Levothyroxine	Difficulty sleeping; nausea	3
<u>Anti-coagulant</u> Clopidogrel, Warfarin	Changes in taste; nausea; tiredness	2
<u>Anti-seizure</u> Clonazepam, Gabapentin	Drowsiness; tiredness; nausea; runny nose; increased saliva production; dry mouth; coughing; sore throat	2
<u>Dementia</u> Memantine, Rivastigmine transdermal patch	Difficulty sleeping; tiredness; weakness; nausea; coughing	2
<u>Chronic obstructive pulmonary disorder (COPD)</u> Symbicort	Choking; throat irritation; nausea	1
<u>Insomnia</u> Zolpidem	Drowsiness; tiredness; dry mouth and throat	1
<u>Duodenal ulcer</u> Sucralfate	Drowsiness; constipation; dry mouth; indigestion; nausea	1
<u>Constipation</u> Docusate	Nausea	1

Table 3. Mean objective measures (\pm standard deviations) of participants' physical health, nutrition, hydration, and swallowing ability.

Objective Measures	Self-Reported Healthy Older Adults ($n = 20$)	Women ($n = 15$)	Expected Values for Age and Weight-Matched Older Adults
Physical Health			
Energy expenditure at lunch (kcal)	61.90 \pm 6.90	62.67 \pm 7.16	48 kcal (McArdle et al., 1991)
Spirometry			
• Forced Expiratory Volume (1 sec; L)	0.99 \pm 0.41	0.94 \pm 0.44	1.03 \pm 0.20
• Forced Vital Capacity (L)	1.65 \pm 0.71	1.40 \pm 0.60	1.11 \pm 0.19
• FEV ₁ /FVC	60%	67%	93% (Capderou et al., 2009)
Blood pressure (mmHg)			
• Systolic	125.95 \pm 11.45	125.40 \pm 12.05	136 \pm 0.50 SEM*
• Diastolic	65.40 \pm 15.40	66.27 \pm 17.70	68 \pm 0.3 SEM (Wright et al., 2011)
Pulse Oximetry (SpO ₂ %)	94.75 \pm 1.92	95.27 \pm 1.75	\geq 95% (Valdez-Lowe et al., 2009)
Tongue Function			
• Strength (kPa)	40.40 \pm 9.45	39.87 \pm 8.67	55.01 \pm 14.32
• Endurance (sec)	34.60 \pm 16.00	33.13 \pm 13.55	40.49 \pm 35.23 (Stierwalt & Youmans, 2007)
Nutrition and Hydration			
<i>Body Mass Index (BMI)</i>	26.47 \pm 3.69	26.50 \pm 4.26	18.5 - 24.9 = Normal (National Heart Lung and Blood Institute, 2012)
Mean height (cm)	159.50 \pm 10.10	155.69 \pm 8.14	22.1 \pm 3.2 for 80-89 yr olds (Speakman & Westerterp, 2010)
Mean weight (kg)	67.46 \pm 11.72	64.35 \pm 11.68	
<i>MidArm Muscle Circumference (MAMC; cm)</i>	29.11 \pm 8.70	29.50 \pm 8.20	23.2 \pm 1.5 for 85-yr women (Landi et al., 2010)

Table 3 (continued)

<i>Bioelectrical Impedance Analysis (BIA)</i>			
<ul style="list-style-type: none"> • Resistance (ohms) • Reactance (ohms) 	<p>580.20 ± 136.79</p> <p>51.02 ± 12.09</p>	<p>629.60 ± 133.23</p> <p>48.41 ± 11.26</p>	<p>679 ± 73.00**</p> <p>40.7 ± 6.8</p> <p>(Tengvall et al., 2009)</p>
Swallowing Ability			
<i>Functional Communication Measure – Swallowing (FCM-S; scaled score)</i>	6.80 ± 0.41	6.87 ± 0.35	7 = best function on a 7-point scale (ASHA, 1998)

*SEM = Standard Error of the Mean

** 555.9 ± 70.0 (Resistance) and 50.3 ± 12.40 (Reactance) for older women according to Roubenoff, Dallal, and Wilson (1995)

Table 4. Categories of *Body Mass Index (BMI)*.

<i>BMI</i> Category (kg/m ²)	Self-Reported Healthy Older Adults (n = 20)	Women (n = 15)
Underweight • Below 18.5	0	0
Normal • 18.5-24.9	7 (35%)	7 (46.7%)
Overweight • 25.0-29.9	9 (45%)	4 (26.7%)
Obese • 30.0 and above	4 (20%)	4 (26.7%)

significantly with perceived Physical Functioning (on the *SF-36*), $r = 0.51, p = 0.05$ and $r = 0.52, p = 0.05$, respectively, suggesting that participants who perceived their level of physical function as high had better breathing capacity.

The significant negative correlation between participants’ higher-than-expected energy expenditure during a meal, measured through SenseWear®, and the low number of reported reflux symptoms ($r = -0.64, p = 0.01$) may indicate that when participants were not concerned with reflux, they moved more during the meal. The significant negative correlation between

Table 5. Mean measures (\pm standard deviations) of participants' perceived physical health, nutrition, hydration and swallowing ability.

Self-Report Questionnaires (Perceptual Measures)	Self-Reported Healthy Older Adults (n = 20)	Women (n = 15)	Explanation of Scoring	
Physical Health				
<i>SF-36</i>			Scaled scores are transformed into percentages; the higher the percentage, the better the function.	
• Physical functioning	51.75 \pm 31.00	49.00 \pm 31.29		
• Role limitations due to physical health	55.00 \pm 41.04	55.00 \pm 42.47		
• Role limitations due to emotional problems	59.17 \pm 41.35	61.11 \pm 41.63		
• Energy/fatigue	58.00 \pm 21.97	59.00 \pm 18.82		
• Emotional well-being	75.41 \pm 15.01	74.95 \pm 14.34		
• Social functioning	80.00 \pm 25.78	80.83 \pm 24.03		
• Pain (free)	67.75 \pm 19.23	66.83 \pm 19.99		
• General health	66.96 \pm 19.09	69.22 \pm 13.91		
<i>Reflux Symptom Index (RSI)</i>	10.80 \pm 8.00	8.53 \pm 6.67	Maximum possible score = 45; lowest score indicates least difficulty; higher score indicates the presence and severity of reflux.	
Nutrition and Hydration				
<i>NQOL</i> Total	161.10 \pm 15.97	162.33 \pm 13.00	50 items scored on 5-point scale = 250 possible points; a lower total score = better function.	
Swallowing Ability				
<i>SWAL-QOL</i>			Each set of items is scored separately; higher score = better function	
• Burden	9.60 \pm 0.82	9.60 \pm 0.91		10 possible points
• Eating duration	8.50 \pm 2.50	8.80 \pm 2.24		10 possible points
• Eating desire	13.40 \pm 2.33	14.00 \pm 1.96		15 possible points
• Symptoms	60.80 \pm 7.58	61.87 \pm 7.47		70 possible points
• Food selection	8.85 \pm 1.72	9.20 \pm 1.52		10 possible points

Table 5 (continued)

• Communication	9.25 ± 1.41	9.27 ± 1.33	10 possible points
• Fear	18.45 ± 2.66	18.80 ± 1.93	20 possible points
• Mental health	24.30 ± 1.72	24.60 ± 1.55	25 possible points
• Social function	24.15 ± 2.11	24.53 ± 1.81	25 possible points
• Fatigue	11.85 ± 2.89	12.47 ± 2.42	15 possible points
• Sleep	8.00 ± 2.62	8.20 ± 2.83	10 possible points

tongue strength, as measured on the *IOPI*, and Energy/Fatigue on the *SF-36* ($r = -0.55$, $p = 0.03$), implied that as tongue strength decreased, level of fatigue increased. The significant positive correlation between tongue endurance (or fatigue) on the *IOPI* and degree of pain on the *SF-36* ($r = 0.57$, $p = 0.03$), suggested that a shorter period of sustained pressure on the *IOPI* was associated with less pain. The significant positive correlation between blood oxygen level, as measured through pulse oximetry, and Physical Functioning on the *SF-36*, ($r = 0.61$, $p = 0.01$) confirmed the expectation that the better oxygenated their blood, the better participants perceived their level of physical ability. The significant negative correlation of reflux symptoms with the *SF-36* domains of Role Limitations due to Physical Health ($r = -0.51$, $p = 0.05$), and Emotional Well-Being ($r = -0.63$, $p = 0.01$) indicated that the less likely participants were to have reflux, the better they perceived their ability to be physically and emotionally engaged in daily activities.

Of interest, there were statistically significant correlations identified within the *SF-36* questionnaire and these between-domain correlations are shown in Table 7. The less participants believed their role was limited due to their physical health (Role Limitations due to Physical Health), the less they perceived emotional problems (Role Limitations due to Emotional Problems. $r = 0.52$, $p = 0.05$); experienced fatigue (Energy/Fatigue, $r = 0.51$, $p = 0.05$); any negative effect on social activities (Social Functioning, $r = 0.65$, $p < 0.01$), pain (Pain, $r = 0.62$, $p = 0.01$), and negative effects on general health (General Health, $r = 0.69$, $p < 0.01$). Similarly, the more the participants perceived their daily activities were not affected by emotional problems

(Role Limitations due to Emotional Problems), the better they felt emotionally (Emotional Well-Being, $r = 0.56, p = 0.03$); and socially (Social Functioning, $r = 0.57, p = 0.03$). The better participants felt socially, the more energy they had (Energy/Fatigue: Social Functioning, $r = 0.54, p = 0.04$). The more energy they had, the more pain-free they felt (Energy/Fatigue: Pain ($r = 0.62, p = 0.01$), and the higher they perceived their general health (Energy/Fatigue: General Health, $r = 0.59, p = 0.02$). The importance of a high level of social functioning was reflected in participants' perceived high level of emotional well-being (Emotional Well-being: Social Functioning, $r = 0.73, p < 0.01$), pain-free status (Social Functioning: Pain, $r = 0.55, p = 0.03$), and positive general health (Social Functioning: General Health, $r = 0.57, p = 0.03$).

Question 2. *Are there significant correlations between objective and perceptual measures of nutrition and level of hydration for the female participants?*

Only one statistically significant correlation was identified between objective and perceptual measures of nutrition and level of hydration. *Body Mass Index (BMI)* was negatively correlated with resistance measures on *Bioelectrical Impedance Analysis* ($r = -0.85, p < 0.01$). While *BMI* was calculated for all 15 female participants, *BIA* was performed on only 11. Three of the four women who did not undergo *BIA* had documented cardiac problems and/or an implanted cardiac pacemaker. The fourth participant had been fitted with a temporary foot orthosis that she could not remove. Thus *BMI* was re-calculated for the 11 women who had undergone *BIA*. *Body Mass Index* measures for these 11 women ranged from 18.9 to 32.9 (mean = 26.50 ± 3.84). None of these 11 women were underweight; 4 were in the normal range; 4 were overweight; and 3 were obese. Their *BIA* resistance measures ranged from 467.0 to 888.90 (mean = 629.60 ± 133.23); *BIA* reactance measures ranged from 33 to 64 (mean = 48.41 ± 11.26). These measures were close to the values for all 15 women reported in Table 2. Pearson r

Table 6. Significant correlations between objective and perceptual measures of physical health
($n = 15$)

	<i>SF-36</i> Physical Functioning	<i>SF-36</i> Role Limitations due to Physical Health	<i>SF-36</i> Energy/ Fatigue	<i>SF-36</i> Emotional Well- Being	<i>SF-36</i> Pain	<i>Reflux Symptom Index (RSI)</i>
Breathing Capacity • FEV ₁	$r = 0.51$ $p = 0.05^*$					
• FVC	$r = 0.52$ $p = 0.05^*$					
Energy Expenditure						$r = -0.64$ $p = 0.01^{**}$
Tongue Strength			$r = -0.55$ $p = 0.03^*$			
Tongue Endurance					$r = 0.57$ $p = 0.03^*$	
Blood Oxygen Level	$r = 0.61$ $p = 0.01^{**}$					
<i>Reflux Symptom Index (RSI)</i>		$r = -0.51$ $p = 0.05^*$		$r = -0.63$ $p = 0.01^{**}$		

* $p < 0.05$; ** $p < 0.01$

correlation coefficients were re-calculated for *BMI*, *MAMC*, *BIA*, and *NQOL* measures for the 11 women. Again, only the correlation between *BMI* and *BIA*: resistance was statistically significant ($r = -0.85$, $p < 0.01$). As fatty tissue impedes, or resists, the current in *BIA*, results suggest that the higher the women's *BMI*, and implied fat mass, the slower the passage of the electrical current.

Question 3. *Are there significant correlations between objective and perceptual measures of swallowing ability for the female participants?*

Three statistically significant correlations were identified between objective and perceptual measures of swallowing ability. The high level of swallowing ability (6.80 on the 7- point

Table 7. Significant correlations between domains on the *SF-36* questionnaire ($n = 15$).

	Role Limitations due to Emotional Problems	Energy/Fatigue	Emotional Well-Being	Social Functioning	Pain (Free)	General Health
Physical Functioning					$r = 0.70$ $p < 0.01^{**}$	
Role Limitations due to Physical Health	$r = 0.52$ $p = 0.05^*$	$r = 0.52$ $p = 0.05^*$		$r = 0.65$ $p < 0.01^{**}$	$r = 0.62$ $p = 0.01^{**}$	$r = 0.69$ $p < 0.01^{**}$
Role Limitations due to Emotional Problems			$r = 0.56$ $p = 0.03^*$	$r = 0.57$ $p = 0.03^*$		
Energy/Fatigue				$r = 0.54$ $p = 0.04^*$	$r = 0.62$ $p = 0.01^{**}$	$r = 0.59$ $p = 0.02^*$
Emotional Well-Being				$r = 0.73$ $p < 0.01^{**}$		
Social Functioning					$r = 0.55$ $p = 0.03^*$	$r = 0.57$ $p = 0.03^*$

* $p < 0.05$; ** $p < 0.01$

FCM-S scale) was reflected in the longer time participants took to eat (*FCM-S*: Eating Duration, $r = 0.51$, $p = 0.05$) and their desire to eat (*FCM-S*: Eating Desire, $r = 0.62$, $p = 0.01$). Swallowing ability correlated negatively with Sleep ($r = -0.54$, $p = 0.04$) on the *SWAL-QOL* questionnaire. Participants' responses showed that, while they had no difficulty getting to sleep, they did have difficulty staying asleep. Of interest, there were statistically significant correlations identified within the *SWAL-QOL* questionnaire and these between-category correlations are shown in Table 8.

Within the group of 15 women, a number identified swallowing symptoms on the *SWAL-QOL* and these symptoms were associated with apprehension about eating (Symptoms: Fear, $r =$

0.74, $p < 0.01$), which foods to eat (Symptoms: Food Selection, $r = 0.58$, $p = 0.02$), and fatigue (Symptoms: Fatigue, $r = 0.55$, $p = 0.03$). A lower score (a negative attribute) for Burden was associated with a decreased desire to eat (Burden: Eating Desire, $r = 0.60$, $p = 0.02$), difficulties with communication (Burden: Communication, $r = 0.68$, $p < 0.01$), decreased mental health (Burden: Mental Health, $r = 0.79$, $p < 0.01$), and decreased social function (Burden: Social Function, $r = 0.79$, $p < 0.01$). A decreased desire to eat was associated with less time taken to eat (Eating Duration: Eating Desire, $r = 0.83$, $p < 0.01$), and limiting food choices (Eating Duration: Food Selection, $r = 0.77$, $p < 0.01$).

The more time needed to eat, the greater these participants' fear (Eating Desire: Fear, $r = 0.50$, $p = 0.05$). Decreased desire to eat also was reflected in decreased food choices (Eating Desire: Food Selection, $r = 0.88$, $p < 0.01$) and concern about eating (Eating Desire: Fear, $r = 0.66$, $p < 0.01$). Greater difficulty with food selection was associated with increased fear (Food Selection: Fear, $r = 0.84$, $p < 0.01$) and fatigue (Food Selection: Fatigue, $r = 0.69$, $p < 0.01$).

Difficulties with communication were related to difficulties with mental health (Communication: Mental Health, $r = 0.68$, $p < 0.01$) and social function (Communication: Social Function, $r = 0.68$, $p < 0.01$). Similarly, as concerns about eating increased, difficulties were reported with mental health (Fear: Mental Health, $r = 0.54$, $p = 0.04$), social function (Fear: Social Function, $r = 0.54$, $p = 0.04$) and fatigue (Fear: Fatigue, $r = 0.80$, $p < 0.01$). Difficulties with mental health and social function were closely related (Mental Health: Social Function, $r = 1.00$, $p < 0.01$).

Table 8. Significant correlations between categories on the *SWAL-QOL* questionnaire ($n=15$).

	Eating Desire	Food Selection	Communication	Fear	Mental Health	Social Function	Fatigue
Symptoms		$r = 0.58$ $p = 0.02^*$		$r = 0.74$ $p < 0.01^{**}$			$r = 0.55$ $p = 0.03^*$
Burden	$r = 0.60$ $p = 0.02^*$		$r = 0.68$ $p < 0.01^{**}$		$r = 0.79$ $p < 0.01^{**}$	$r = 0.79$ $p < 0.01^{**}$	
Eating Duration	$r = 0.83$ $p < 0.01^{**}$	$r = 0.77$ $p < 0.01^{**}$		$r = 0.50$ $p = 0.05^*$			
Eating Desire		$r = 0.88$ $p < 0.01^{**}$		$r = 0.66$ $p < 0.01^{**}$			
Food Selection				$r = 0.84$ $p < 0.01^{**}$			$r = 0.69$ $p < 0.01^{**}$
Communication					$r = 0.68$ $p < 0.01^{**}$	$r = 0.68$ $p < 0.01^{**}$	
Fear					$r = 0.54$ $p = 0.04^*$	$r = 0.54$ $p = 0.04^*$	$r = 0.80$ $p < 0.01^{**}$
Mental Health						$r = 1.00$ $p < 0.01^{**}$	

* $p < 0.05$; ** $p < 0.01$

CHAPTER IV

DISCUSSION

In the current study, the association between objective and perceptual measures of physical function, nutrition, and hydration relative to swallowing was explored in a group of self-reported healthy older adult residents in the independent living section of a Continuing Care Retirement Community (CCRC). Independent older adults, whether living in a CCRC or in the general community, are susceptible to swallowing-related difficulties (Ashford et al., 2011; Chen et al., 2009; Roy et al., 2009). The onset of a swallowing problem can have a severe effect on an individual's physical and nutritional health, desire to socialize, and quality of life (Ashford et al., 2011; McHorney et al., 2006). A comprehensive screening protocol that is based upon the biopsychosocial model advocated by the WHO (2002) needs to be developed, particularly for self-reported healthy older adults in CCRCs (Brandão et al., 2010).

Older adults move into independent living in CCRCs for a variety of reasons. For the 15 women in the current study, these reasons centered on the importance of maintaining an independent lifestyle without the responsibility of taking care of a house and to be close to family, whether or not they had relocated from a rural or an urban area. Their mean age was 85 years and they had a mean score on the *MMSE* of 26/30. All were ambulatory and some were still driving. Prescribed medications showed that some were being treated for disease-related conditions. Potential side effects of the prescribed medications included adverse effects on eating, drinking, and swallowing, e.g., dry mouth, nausea, coughing/choking, decreased appetite, changes in taste, and difficulties with saliva management. However, all participants viewed themselves as healthy and none reported any difficulties with swallowing. In response to the

question posed by Chen et al. (2008), “*Do you think that swallowing difficulties are a natural part of aging?*” five participants responded “No,” five responded “Yes,” and five responded “I don’t know.” It is interesting to consider these responses in light of the objective and perceptual data obtained on their physical health, nutrition and hydration status, and swallowing ability.

Physical Health and Function

Age-related sarcopenia (the decline of lean muscle mass and strength) and dynopenia (the decline in muscle power) affect mobility and may influence the muscular effort required for eating (Morley et al., 2010; Speakman & Westerterp, 2010). Thus, it is important to be able to measure energy expenditure during eating in older adults, particularly those with documented dysphagia, in a way that can be used accurately in natural, rather than experimental, contexts. The application of the SenseWear® system documented higher-than-expected energy expenditure in the 15 female participants during their consumption of a regular mid-day meal.

The interpretation of energy expenditure during an activity, particularly eating, is complex (Speakman & Westerterp, 2010). As Goldberg et al. (2012) suggest, the effective use of SenseWear® to measure energy expenditure during eating in natural contexts may require a recalculation of the equations currently in the system. Alternatively, the higher-than-expected energy expenditure, as measured by SenseWear®, may reflect participants’ social engagement during eating, in contrast to the measurement of energy expended during an isolated experimental task. One could speculate that older adults with swallowing difficulties may show either (a) decreased energy expenditure reflecting their social withdrawal, or (b) increased energy expenditure reflecting their increased effort during a meal. This remains an important area to pursue.

Measurements of breathing capacity, blood pressure, and blood oxygenation level are considered valid indications of the state of an individual's physical health (Barreiro & Perillo, 2004; NIH summary report, 2002). With the exception of blood oxygenation level, these measures were lower than the functional values expected for the female participants in this study. Regardless, these measures correlated positively with participants' perceived physical function on the *SF-36* questionnaire (Ware & Sherbourne, 1992).

Participants reported few symptoms of reflux (*RSI*; Belafsky et al., 2002). The administration of both objective and perceptual measures of physical function identified the positive effect of few reflux symptoms on increased physical ability, and the relationship between few reflux symptoms and increased energy expenditure while eating. As a group, participants showed lower than expected tongue strength prior to eating (*IOPI*; Luschei, 2011) and this was associated with increased fatigue on the *SF-36*¹. The use of both objective and perceptual measures of physical health identified important information in ascertaining risk for swallowing dysfunction. Further, participants' responses on the *SF-36* domains showed the relationship of physical health and activity to emotional well-being, energy, and social function, and provided insight into participants' emotional resilience, a strength that otherwise may have been overlooked.

Nutrition and Hydration

With regard to nutrition and hydration, the objective, anthropometric measures of *BMI*, *MAMC* and *BIA* are accepted non-invasive tools to document an individual's well-nourished and hydrated status as an estimate of general health (Akner & Flöistrup, 2003; Shanholtzer & Patterson, 2003; Sungurtekin et al., 2008; Tengvall et al., 2009). These measures are becoming

¹ Kays et al. (2010) documented decreased tongue strength in older adults after consuming a textured meal. The tongue strength of the participants in the current study increased after consuming a regular, but less-textured, meal. These findings will be presented in a separate paper.

increasingly important in the evaluation of older adults (Landi et al., 2010) and, as *BMI* may not be an accurate reflection of body fat in older adults, the inclusion of *BIA* is important (Roubenhoff et al., (1997).

Findings of the current study support the inclusion of the three measures in a dysphagia screening protocol. Participants' *BMI*, *MAMC*, and *BIA* measures were not within normative limits for age-matched older women. As a group, participants in the current study were overweight with a higher than expected *BMI*, *MAMC* and estimated body fat percentage. Age-related accumulation of fat mass in older adults is well-documented, with related loss of fat free and skeletal muscle mass, and decreases in level of activity (Kyle et al., 2001; Morley et al., 2010; Speakman & Westerterp, 2010). An additional waist measurement could be useful as the accumulation of fat around the middle of the body is considered a detriment to heart function and can suggest poorer physical and nutritional health (NIH summary report, 2002; Dehghan & Merchant, 2008; Shin, Panton, Dutton, & Ilich, 2011). Resistance training and consistent increased movement in daily activities has been shown to decrease fat mass in older adults (Adamo & Farrar, 2006; Puggaard, Larsen, Ebbesen, & Jeune, 1999) and such increased movement may be a valuable recommendation for the participants in the current study.

In a study of 357 older adults, Landi et al. (2010) reported an important association between scores on the *Short Physical Performance Battery (SPPB)* and muscle mass, as measured through *MAMC*. The *SPPB* has three timed tests: walking a short distance, balancing, and getting up from a chair. The *SPPB* score has been shown to be a strong predictor of mortality and the inclusion of this battery in a comprehensive dysphagia screening protocol also may be warranted.

As judged from their responses to the *NQOL* questionnaire, participants perceived their nutritional quality of life as positive. However, it was difficult to determine a more specific contribution of the *NQOL*. A total score for this questionnaire was calculated, following published instructions (Barr & Schumacher, 2003), and participants averaged 162/250 possible points. In the future, more helpful information may be gained by calculating individual scores from the six categories: impact of food; self-image; psychological factors; social/interpersonal factors; physical state; and self-efficacy. Alternatively, there may be a different tool, such as the *Mini Nutritional Assessment (MNA)*; (De La Montana & Miguez, 2011; Vellas et al., 1999) that could be used. The *MNA* is an 18-item scale, with reported validity and reliability, that includes anthropometric measures as well as a self-report of dietary assessment to gain insight into older adults' perceptions of their nutritional health.

Swallowing

All participants scored a 6 or 7 on the 7-point *FCM-S* indicating independent swallowing ability, and this correlated with the group's *SWAL-QOL* perceptions of enjoying eating and lingering over a meal. However, a score of 6 on the *FCM-S* suggested that some participants were making changes to their diet by reducing the texture of their foods or no longer eating foods such as steak. Although participants had stated that they did not have any difficulties with swallowing, additional symptoms of swallowing difficulty were apparent for some. It is interesting to question whether these participants were the 10 who responded "no" or "I don't know" when asked if swallowing difficulties were a natural part of aging.

Chen et al. (2009) and Roy et al. (2007) noted that older adults in residential care, and those living independently, frequently did not associate issues such as (a) coughing, choking, or throat clearing related to eating, (b) taking longer to eat, and (c) a sensation of having something

stuck in the throat, as indicative of a swallowing problem. This appeared true for some of the participants in the current study. In addition to the difficulties noted above, this sub-group of participants commented on discomfort with swallowing pills, increased fatigue, waking from sleep, difficulty with excess or thick saliva, and drooling during sleep. Difficulties managing saliva clearly could affect sleep. Only one participant was taking medication to counteract insomnia. Another was being treated for COPD, a medical condition that has been associated with dysphagia (Roy et al., 2007).

Participants' completion of the *SWAL-QOL* was essential in identifying difficulties they were experiencing that they did not associate with swallowing. These difficulties had a negative impact on their desire to eat, the time they spent eating, the type of foods they looked forward to eating, and their level of energy. The burden of these swallowing difficulties increased their apprehension about eating, affected their mental health, communication, social function and quality of life.

Eating, drinking, and swallowing typically occur in a social context and difficulties can have a profound effect on an individual's desire to interact with others. Consequent withdrawal from social situations can adversely affect an individual's quality of life (Leslie et al., 2005; Leow et al., 2010; McHorney et al., 2006). It is vital to be able to identify any risk for swallowing difficulties in older adults who elect to move into residential care, and it is important to do more than just evaluate swallowing function.

Rofes et al. (2011) stipulated that a clinical screening needs to be low risk, efficient, inexpensive, and able to identify older adults who are vulnerable to the onset of dysphagia. It also needs to address quality of life issues (Leow et al., 2010; Martin-Harris et al., 2008). The objective and perceptual measures used in the current study to document physical health,

nutrition, hydration, and swallowing function appear effective components of a screening protocol to identify swallowing difficulties in older adults in residential care. These objective measures are not lengthy and can be administered easily by speech-language pathologists to obtain a more comprehensive and accurate view of the effects of a swallowing difficulty. Such objective measures also can be administered by other professionals on a dysphagia evaluation team, increasing their insight into the effects of swallowing difficulties. The self-report questionnaires (perceptual measures) were completed without difficulty by the participants. Many commented on what they had learned from the process, including how they might make better food choices, and how they now understood issues related to swallowing that they had not considered previously.

Healthy older adults moving into a CCRC cannot be asked by the facility to undergo a comprehensive screening for swallowing difficulties due to the guidelines of the Fair Housing Act. However, organizations, such as Wichita State University, can demonstrate their commitment to community engagement and support and provide such screenings at no, or minimal, cost. Speech-language pathology students can be instrumental in this service, acquiring valuable competence in the administration of objective measures and insight into the perspectives of older adults in residential care.

Conclusions

1. Significant correlations were found between valid and reliable objective and perceptual measures in the categories of (a) physical health, (b) nutrition and hydration, and (c) swallowing function, in a group of 15 self-reported healthy older adult women in residential care.

2. Objective measures documented lower than expected function in all three areas for these women, and thus increased risk for swallowing difficulties.
3. The inclusion of self-report questionnaires (perceptual measures), particularly the *SWAL-QOL*, was essential obtaining the older adults' insights into their abilities and their risk of swallowing problems.
4. Both objective and perceptual measures need to be used in a comprehensive, biopsychosocial screening protocol to identify swallowing difficulties in older adults in residential care.

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APPENDICES

APPENDIX A. Functional Communication Measure: Swallowing

Functional Communication Measure: Swallowing (ASHA, 1998)

Use the following scale to rate the patient's swallowing status.

Note: In Levels 3-5, some individuals may meet only one of the "and/or" criteria listed. If you have difficulty deciding on the most appropriate level for an individual, use dietary level as the most important criterion if the dietary level is the result of swallow function rather than dentition only. Dietary levels/restrictions are defined on the next page. Your facility's levels may not exactly match these, but please use these levels as a guide in scoring this FCM. Dietary levels at FCM levels 6 and 7 should be judged only on swallow functions, and any influence of poor dentition should be disregarded.

- LEVEL 1: Individual is not able to swallow anything safely by mouth. All nutrition and hydration is received through non-oral means. (e.g., nasogastric tube, PEG)
- LEVEL 2: Individual is not able to swallow safely by mouth for nutrition and hydration, but may take some consistency with consistent maximal cues in therapy only. Alternative method of feeding required.
- LEVEL 3: Alternative method of feeding required as individual takes less than 50% of nutrition and hydration by mouth, and/or swallowing is safe with consistent use of moderate cues to use compensatory strategies and/or requires maximum diet restriction.
- LEVEL 4: Swallowing is safe but usually requires moderate cues to use compensatory strategies, and or individual has moderate diet restrictions and/or still requires tube feeding and/or oral supplements.
- LEVEL 5: Swallowing is safe with minimal diet restriction and/or occasionally requires minimal cuing to use compensatory strategies. May occasionally self-cue. All nutrition and hydration needs are met by mouth at mealtime.
- LEVEL 6: Swallowing is safe and individual eats and drinks independently and may rarely require minimal cuing. Usually self-cues when difficulty occurs. May need to avoid specific food items (e.g. popcorn and nuts), or require additional time (due to dysphagia).
- LEVEL 7: Individual's ability to eat independently is not limited by swallow function. Swallowing would be safe and efficient for all consistencies. Compensatory strategies are effectively used when needed.

The patient is currently at Level _____.

Date:

Swallowing FCM Continued

Swallowing: Dietary Levels/Restrictions

Maximum restrictions:	Diet is two or more levels below a regular diet status in solid and liquid consistency.
Moderate restrictions:	Diet is two or more levels below a regular diet status in either solid or liquid consistency (but not both), OR diet is one level below in both solid <i>and</i> liquid consistency.
Minimum restrictions:	Diet is one level below a regular diet status in solid <i>or</i> liquid consistency.

Solids

Regular:	No restrictions.
Reduced one level:	Meats are cooked until soft, with no tough or stringy foods. Might include meats like meat loaf, baked fish, soft chicken. Vegetables are cooked soft.
Reduced two levels:	Meats are chopped or ground. Vegetables are of one consistency (e.g., soufflé, baked potato) or are mashed with a fork.
Reduced three levels:	Meats and vegetables are pureed.

Liquids

Regular:	Thin liquids; no restrictions.
Reduced one level:	Nectar, syrup; mildly thick.
Reduced two levels:	Honey; moderately thick.
Reduced three levels:	Pudding; extra thick.

APPENDIX B. Short Form-36 Health Survey

Short Form-36 Health Survey (SF-36; Ware & Sherbourne, 1992)

Name _____ Date _____ Case # _____

1. In general, would you say your health is:

- Excellent..... 1
- Very good..... 2
- Good..... 3
- Fair..... 4
- Poor..... 5

2. **Compared to 1 year ago**, how would you rate your health in general **now**?

- Much better now than one year ago..... 1
- Somewhat better now than 1 year ago..... 2
- About the same..... 3
- Somewhat worse now than 1 year ago..... 4
- Much worse now than 1 year ago..... 5

The following items are about activities you might do during a typical day. **Does your health now limit you** in these activities? If so, how much?

CIRCLE ONE NUMBER ON EACH LINE

Yes Limited A Lot	Yes Limited A little	Not Limited At all
-------------------------	----------------------------	--------------------------

- 3. **Vigorous activities**, such as running, lifting heavy objects, participating in strenuous sports 1 2 3
- 4. **Moderate activities**, such as moving a table, pushing a vacuum cleaner, bowling or playing golf 1 2 3
- 5. Lifting or carrying groceries 1 2 3
- 6. Climbing **several** flights of stairs 1 2 3
- 7. Climbing **one** flight of stairs 1 2 3

	Yes Limited A Lot	Yes Limited A little	Not Limited At all
--	----------------------------------	-------------------------------------	-----------------------------------

8. Bending, kneeling, or stooping	1	2	3
9. Walking more than a mile	1	2	3
10. Walking several blocks	1	2	3
11. Walking one block	1	2	3
12. Bathing or dressing yourself	1	2	3

During the **past 4 weeks**, have you had any of the following problems with your work or other regular daily activities **as a result of your physical health?**

CIRCLE ONE NUMBER ON EACH LINE

	Yes	No
13. Cut down the amount of time you spend on work or other activities	1	2
14. Accomplished less than you would like	1	2
15. Were limited in the kind of work or other activities	1	2
16. Had difficulty performing the work or other activities (for example, it took extra effort)	1	2

During the **past 4 weeks**, have you had any of the following problems with your work or other regular daily activities **as a result of any emotional problems** (such as feeling depressed or anxious?)

CIRCLE ONE NUMBER ON EACH LINE

	Yes	No
17. Cut down the amount of time you spend on work or other activities	1	2
18. Accomplished less than you would like	1	2
19. Didn't do work or other activities as carefully as usual	1	2

20. During the **past 4 weeks**, to what extent has your physical health or emotional problems interfered with your normal social activities with family, friends, neighbors or groups?

(circle 1 number)

- Not at all..... 1
- Slightly..... 2
- Moderately..... 3
- Quite a bit..... 4
- Extremely..... 5

21. How much **bodily** pain have you had in the **past 4 weeks**?

(circle 1 number)

- None..... 1
- Very mild..... 2
- Mild..... 3
- Moderate..... 4
- Severe..... 5
- Very Severe..... 6

22. During the **past 4 weeks**, how much did **pain** interfere with your normal work? (Including work outside the house **and** housework).

(circle 1 number)

- Not at all..... 1
- Slightly..... 2
- Moderately..... 3
- Quite a bit..... 4
- Extremely..... 5

These questions are about how you feel and how things have been with you **during the last 4 weeks**. For each question, please give the 1 answer that comes closest to the way you have been feeling. **How much of the time during the last 4 weeks...**

CIRCLE ONE NUMBER ON EACH LINE

	All of the time	Most of the time	A good bit of time	Some of the time	A little of the time	None of the time
--	-----------------------	------------------------	--------------------------	------------------------	----------------------------	------------------------

- | | | | | | | |
|---|---|---|---|---|---|---|
| 23. Did you feel full of pep? | 1 | 2 | 3 | 4 | 5 | 6 |
| 24. Have you been a very nervous person? | 1 | 2 | 3 | 4 | 5 | 6 |
| 25. Have you felt so down in the dumps that nothing could cheer you up? | 1 | 2 | 3 | 4 | 5 | 6 |
| 26. Have you felt calm and peaceful? | 1 | 2 | 3 | 4 | 5 | 6 |
| 27. Did you have a lot of energy? | 1 | 2 | 3 | 4 | 5 | 6 |
| 28. Have you felt downhearted and blue? | 1 | 2 | 3 | 4 | 5 | 6 |
| 29. Did you feel worn out? | 1 | 2 | 3 | 4 | 5 | 6 |
| 30. Have you been a happy person? | 1 | 2 | 3 | 4 | 5 | 6 |
| 31. Did you feel tired? | 1 | 2 | 3 | 4 | 5 | 6 |
| 32. During the past 4 weeks , how much of the time has your physical health or emotional problems interfered with your social activities (like visiting with friends, relatives, etc.)? | | | | | | |

(circle 1 number)

- | | |
|----------------------------|---|
| All of the time | 1 |
| Most of the time..... | 2 |
| Some of the time | 3 |
| A little of the time | 4 |
| None of the time..... | 5 |

How TRUE or FALSE is *each* of the following statements to you?

CIRCLE ONE NUMBER ON EACH LINE

	Definitely true	Mostly true	Don't know	Mostly false	Definitely false
33. I seem to get sick a lot easier than other people	1	2	3	4	5
34. I am as healthy as anybody I know	1	2	3	4	5
35. I expect my health to get worse	1	2	3	4	5
36. My health is excellent	1	2	3	4	5

APPENDIX C. Reflux Symptom Index

Reflux Symptom Index (RSI; Belafsky, Postma & Koufman, 2002)

Validity and reliability of the Reflux
Symptom index (RSI). *Journal of Voice*, 16(2), 274-277.

Within the last MONTH, how did the following problems affect you?
Circle the appropriate response.

0 = No Problem
5 = Severe Problem

- | | |
|---|-------------|
| 1. Hoarseness or a problem with your voice | 0 1 2 3 4 5 |
| 2. Clearing your throat | 0 1 2 3 4 5 |
| 3. Excess throat mucus or postnasal drip | 0 1 2 3 4 5 |
| 4. Difficulty swallowing food, liquids, or pills | 0 1 2 3 4 5 |
| 5. Coughing after you ate or after lying down | 0 1 2 3 4 5 |
| 6. Breathing difficulties or choking episodes | 0 1 2 3 4 5 |
| 7. Troublesome or annoying cough | 0 1 2 3 4 5 |
| 8. Sensations of something sticking in your throat or a lump in your throat | 0 1 2 3 4 5 |
| 9. Heartburn, chest pain, indigestion or stomach acid coming up | 0 1 2 3 4 5 |

APPENDIX D. Nutrition Quality of Life Survey

Nutrition Quality of Life Survey (NQOL; Barr & Schumacher, 2003)

For each question, place an “X” in the box indicating how often each statement applies to you. Although we know that adjusting to nutritional changes will take time, we are asking you to think about what has happened to you only over **the last TWO weeks**.

All of the time	Most of the time	Some of the time	A little of the time	None of the time
-----------------	------------------	------------------	----------------------	------------------

During the last two weeks:

1. I ate enough food to be satisfied.
2. I had plenty of choice in the food I ate.
3. I was hungry.
4. Food was on my mind.
5. I sneaked food.
6. I tasted and enjoyed food without guilt
7. I could afford to buy the food that was best for me.
8. I took time to eat the food that was best best for me.
9. I, or someone else, took time to shop and prepare the food that was best for me.

During the last two weeks, I

10. I ate enough food to be satisfied.
11. Liked the way my clothes fit.
12. Beat myself up when I ate the food I felt I shouldn't have.
13. Took time for myself.

All of the time	Most of the time	Some of the time	A little of the time	None of the time
-----------------	------------------	------------------	----------------------	------------------

During the last 2 weeks:

- 14. Was proud of the way I managed what I had eaten.
- 15. Was confused about the food I should eat
- 16. Rewarded myself
- 17. Was happy with the food I ate
- 18. Felt guilty about the food I ate
- 19. Felt that food was controlling me
- 20. Felt depressed about the way I look
- 21. Felt depressed about the food I ate
- 22. Felt that changing the food I ate would life more enjoyable for me
- 23. Was frustrated about limiting the food I ate.
- 24. Was frustrated about how long it took to improve my food-related condition
- 25. Was angry that I had to change what and how I ate

During the last 2 weeks:

- 26. My family/friends have nagged me about food I ate
- 27. My food needs have created stress with my family/friends.
- 28. I had problems going out to eat with my family/friends.
- 29. I have cut down the amount of time I spend on work or other activities because of my food related condition

All of the time	Most of the time	Some of the time	A little of the time	None of the time
-----------------	------------------	------------------	----------------------	------------------

During the last 2 weeks:

30. I had someone I could talk to who understood the struggles I have had with food.

31. My family/friends made it difficult to stick to the food I thought I should eat

32. My food-related condition has caused problems with sexual relations.

During the last 2 weeks, my food-related condition has given me trouble in

33. Walking at a moderate pace for 30 minutes

34. Walking slowly for 10 minutes.

35. Walking up a flight of stairs.

36. Bending or kneeling to pick things up.

37. Getting up off the floor.

38. Needing to use the bathroom so often I couldn't go out of the house.

39. Getting a good night's sleep.

40. Breathing comfortably.

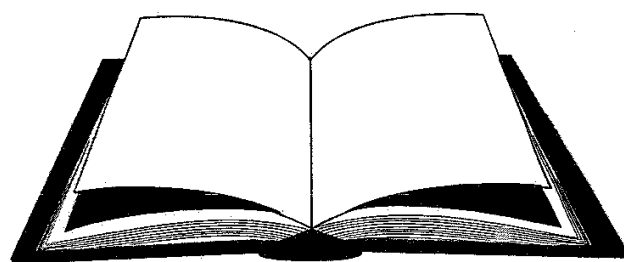
41. Having enough energy to do what I wanted to do.

All of the time	Most of the time	Some of the time	A little of the time	None of the time
-----------------	------------------	------------------	----------------------	------------------

During the last 2 weeks, I was confident that I

42. Knew what type of food I should have been eating for my healthy lifestyle.
43. Knew the amount of food I could eat.
44. Knew when to eat.
45. Made healthy food choices.
46. Ate the recommended amount of food
47. Was eating when I should be eating.
48. Planned ahead to have healthy food when I needed it.
49. Trusted myself when faced with difficult food choices.
50. Would be able to live the rest of my life with these changes in my food.

The SWAL-QOL SURVEY



**Understanding
Quality of Life
in Swallowing Disorders**

Instructions for Completing the SWAL-QOL Survey

This questionnaire is designed to find out how your swallowing problem has been affecting your day-to-day quality of life.

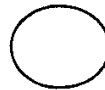
Please take the time to carefully read and answer each question. Some questions may look like others, but each one is different.

Here's an example of how the questions in the survey will look.

1. In the last month how often have you experienced each of the symptoms below.

	All of the time	Most of the time	Some of the time	A little of the time	None of the time
Feel weak	1	2	3	4	5

Thank you for your help in taking part in this survey!



IMPORTANT NOTE: We understand that you may have a number of physical problems. Sometimes it is hard to separate these from swallowing difficulties, but we hope that you can do your best to concentrate **only** on your **swallowing problem**. Thank you for your efforts in completing this questionnaire.

1. Below are some general statements that people with **swallowing problems** might mention. In the last month, **how true** have the following statements been for you.

(circle one number on each line)

	Very much true	Quite a bit true	Somewhat true	A little true	Not at all true
Dealing with my swallowing problem is very difficult.	1	2	3	4	5
My swallowing problem is a major distraction in my life.	1	2	3	4	5

2. Below are aspects of day-to-day eating that people with **swallowing problems** sometimes talk about. In the last month, **how true** have the following statements been for you?

(circle one number on each line)

	Very much true	Quite a bit true	Somewhat true	A little true	Not at all true
Most days, I don't care if I eat or not.	1	2	3	4	5
It takes me longer to eat than other people.	1	2	3	4	5
I'm rarely hungry anymore.	1	2	3	4	5
It takes me forever to eat a meal.	1	2	3	4	5
I don't enjoy eating anymore.	1	2	3	4	5

3. Below are some physical problems that people with **swallowing problems** sometimes experience. In the last month, **how often** you have experienced each problem as a result of your swallowing problem?

(circle one number on each line)

	Almost always	Often	Sometimes	Hardly ever	Never
Coughing	1	2	3	4	5
Choking when you eat food	1	2	3	4	5
Choking when you take liquids	1	2	3	4	5
Having thick saliva or phlegm	1	2	3	4	5
Gagging	1	2	3	4	5
Drooling	1	2	3	4	5
Problems chewing	1	2	3	4	5
Having excess saliva or phlegm	1	2	3	4	5
Having to clear your throat	1	2	3	4	5
Food sticking in your throat	1	2	3	4	5
Food sticking in your mouth	1	2	3	4	5
Food or liquid dribbling out of your mouth	1	2	3	4	5
Food or liquid coming out your nose	1	2	3	4	5
Coughing food or liquid out of your mouth when it gets stuck	1	2	3	4	5

4. Next, please answer a few questions about how your **swallowing problem** has affected your diet and eating in the last month.

(circle one number on each line)

	Strongly agree	Agree	Uncertain	Disagree	Strongly disagree
Figuring out what I can and can't eat is a problem for me.	1	2	3	4	5
It is difficult to find foods that I both like and can eat.	1	2	3	4	5

5. In the last month, **how often** have the following statements about communication applied to you because of your **swallowing problem**?

(circle one number on each line)

	All of the time	Most of the time	Some of the time	A little of the time	None of the time
People have a hard time understanding me.	1	2	3	4	5
It's been difficult for me to speak clearly.	1	2	3	4	5

6. Below are some concerns that people with **swallowing problems** sometimes mention. In the last month, **how often** have you experienced each feeling?

(circle one number on each line)

	Almost always	Often	Sometimes	Hardly ever	Never
I fear I may start choking when I eat food.	1	2	3	4	5
I worry about getting pneumonia.	1	2	3	4	5
I am afraid of choking when I drink liquids.	1	2	3	4	5
I never know when I am going to choke.	1	2	3	4	5

7. In the last month, how often have the following statements **been true** for you because of your **swallowing problem**?

(circle one number on each line)

	Always true	Often true	Sometimes true	Hardly ever true	Never true
My swallowing problem depresses me.	1	2	3	4	5
Having to be so careful when I eat or drink annoys me.	1	2	3	4	5
I've been discouraged by my swallowing problem.	1	2	3	4	5
My swallowing problem frustrates me.	1	2	3	4	5
I get impatient dealing with my swallowing problem.	1	2	3	4	5

8. Think about your social life in the last month. How strongly would you agree or disagree with the following statements?

(circle one number on each line)

	Strongly agree	Agree	Uncertain	Disagree	Strongly disagree
I do not go out to eat because of my swallowing problem.	1	2	3	4	5
My swallowing problem makes it hard to have a social life.	1	2	3	4	5
My usual work or leisure activities have changed because of my swallowing problem.	1	2	3	4	5
Social gatherings (like holidays or get-togethers) are not enjoyable because of my swallowing problem.	1	2	3	4	5
My role with family and friends has changed because of my swallowing problem.	1	2	3	4	5

9. In the last month, **how often** have you experienced each of the following physical symptoms?

(circle one number on each line)

	All of the time	Most of the time	Some of the time	A little of the time	None of the time
Feel weak?	1	2	3	4	5
Have trouble falling asleep?	1	2	3	4	5
Feel tired?	1	2	3	4	5
Have trouble staying asleep?	1	2	3	4	5
Feel exhausted?	1	2	3	4	5

10. Do you now take any food or liquid through a feeding tube?

(circle one)

No 1

Yes..... 2

11. Please circle the letter of the one description below that best describes the consistency or texture of the food you have been eating most often in the last week.

Circle one:

- A. Circle this one if you are eating a full normal diet, which would include a wide variety of foods, including hard to chew items like steak, carrots, bread, salad, and popcorn.
- B. Circle this one if you are eating soft, easy to chew foods like casseroles, canned fruits, soft cooked vegetables, ground meat, or cream soups.
- C. Circle this one if you are eating food that is put through a blender or food processor or anything that is like pudding or pureed foods.
- D. Circle this one if you take most of your nutrition by tube, but sometimes eat ice cream, pudding, apple sauce, or other pleasure foods.
- E. Circle this one if you take all of your nourishment through a tube.

12. Please circle the letter of the one description below that best describes the consistency of liquids you have been drinking most often in the last week.

Circle one:

- A. Circle this if you drink liquids such as water, milk, tea, fruit juice, and coffee.
- B. Circle this if the majority of liquids you drink are thick, like tomato juice or apricot nectar. Such thick liquids drip off your spoon in a slow steady stream when you turn it upside down.
- C. Circle this if your liquids are moderately thick, like a thick milkshake or smoothie. Such moderately thick liquids are difficult to suck through a straw, like a very thick milkshake, or drip off your spoon slowly drop by drop when you turn it upside down, such as honey.
- D. Circle this if your liquids are very thick, like pudding. Such very thick liquids will stick to a spoon when you turn it upside down, such as pudding.
- E. Circle this if you did not take any liquids by mouth or if you have been limited to ice chips.

13. In general, would you say your health is:

(circle one)

- Poor 1
- Fair..... 2
- Good..... 3
- Very Good..... 4
- Excellent 5

What is your current marital status?

(circle one)

- Never married 1
- Married..... 2
- Divorced..... 3
- Separated 4
- Widowed..... 5

Did anybody help you complete this questionnaire?

(circle one)

- No, I did it myself..... 1
- Yes, someone helped me fill it out..... 2

IF SOMEONE HELPED YOU FILL OUT THIS QUESTIONNAIRE, how did that person help you?

(circle one)

- Read you the questions and/or wrote down the answers you gave..... 1
- Answered the questions for you 2
- Helped in some other way 3

Please write today's date here:

____/____/____
month / day / year

Last Page

COMMENTS:

Do you have any comments about this questionnaire? We welcome your comments about the questionnaire in general or about specific questions, especially any that were unclear or confusing to you.

Thank you for completing this questionnaire!

APPENDIX F. Institutional Review Board Application

IRB No. _____
Expedited? _____
Reviewer's Initials _____
Date to Reviewer _____

**Wichita State University Institutional Review Board (IRB)
for the Protection of Human Subjects**

--

Application for Approval of Research Involving Human Subjects

Name of Principal Investigator(s): Lyn Goldberg, PhD, CCC-SLP (CSD)
(For a student project, Principal Investigator **must** be a WSU faculty member; student is listed as Co-Investigator.)

Departmental/Program Affiliation of PI: Communication Science and Disorders Campus Box: 75
Phone: 6115 E-mail: Lyn.goldberg@wichita.edu

Name(s) of Co-Investigator(s): Ashley Fisher
Co-Investigator(s) is/are: ___ Faculty Member Graduate Student ___ Undergraduate Student

Type of Project: ___ Class Project ___ Capstone Project Thesis or Dissertation ___ Funded Research ___ Unfunded Research ___ Secondary Data Collection/Analysis ___ Program Evaluation

Title of Project/Proposal: Objective and Perceptual Measures of Swallowing and Effects on Quality of Life in Older Adults: A Pilot Study

Expected Completion Date: May 2012 **Funding Agency (if applicable):** NA at present

1. Describe the research in non-technical language.

Aging affects all physiological processes. The expected changes in these processes (i.e., healthy aging) can be compounded by disease-related conditions (e.g., stroke). One particular area of difficulty that can be associated with both healthy and disease-related aging is that of swallowing. Being able to swallow safely is vital for adequate nourishment and hydration. A disruption in swallowing (dysphagia) can result in serious complications such as malnutrition and dehydration. These complications adversely affect brain and body functions and quality of life.

When swallowing difficulties occur, individuals generally are referred to speech pathologists for evaluation. While comprehensive, the evaluations conducted by speech pathologists do not include objective measurements of the effects of the dysphagia on physical health, nutrition and hydration. Further, the perspective of the older adult with the swallowing disorder frequently is not investigated. Without this perspective, it is not possible to gauge the effect of the dysphagia on an older adult's quality of life, and increased quality of life is the determining factor of effective intervention.

It is well-recognized that the population of older adults, defined as those 65+ years of age, is increasing exponentially. Many of these older adults will move into continuing care facilities. Current intake

procedures at continuing care facilities focus on documenting the physical vulnerabilities of older adults. These intake procedures do not include objective measurements of older adults' swallowing ability, nor do they document older adults' perspectives of their physical and nutritional health and swallowing ability.

The purpose of the proposed study is to identify a set of practical objective and perceptual measures that can document older adults' physical and nutritional health relative to swallowing ability. These objective and perceptual measures then can be incorporated into the intake evaluation that is completed as older adults move into continuing care communities. The inclusion of these objective and perceptual measures will enable an immediate focus on older adults' swallowing abilities, their risk of developing dysphagia, their physical and nutritional health, and the factors they consider essential to optimize their quality of life. Identifying measures that reliably detect older adults at-risk for dysphagia prior to their physical health and nutritional status being compromised will reduce the risk of further health complications, improve the adults' overall well-being, and reduce healthcare costs. The intake evaluation thus will focus on effective prevention as well as appropriate intervention strategies. The intake evaluation also will establish baseline data for each resident with which data from future evaluations can be compared.

Participants in the proposed study will be 20 adults aged 65+ years who have moved into a continuing care community and who report no immediate health concerns.

2. Describe the benefits of the research to the human subjects, if any, and of the benefits to human or scientific knowledge.

All participants will benefit from being asked about their perceptions of their physical health, nutrition, swallowing status and quality of life. Participants also will benefit from receiving and understanding the results of objective measures of their physical health, nutrition, and swallowing status. As part of the objective measurements, each participant will receive a free Bioelectronic Impedance Analysis of body fat and hydration levels. This test would otherwise cost up to \$150.00.

The study will assist in identifying any areas of concern for participants and alert healthcare staff at the facility to arrange appropriate intervention. Early detection and intervention is beneficial to the overall well-being of all older adults and can be life saving when dealing with the risk of dysphagia. Further, documentation of the importance of including the objective and perceptual measures in any intake evaluation will increase staffs' understanding of the complexity of dysphagia in older adults and promote the importance of interprofessional collaboration in its evaluation and intervention.

To date, there are no published reports of objective and perceptual measures of physical health and nutrition and hydration status as they relate to swallowing ability in older adults. Publication of the results of the proposed study will add to the scientific knowledge of potentially effective strategies in the prevention of dysphagia in older adults and these adults' perceptions of factors critical to optimizing their quality of life.

3. Describe the subjects, how the subjects are to be selected, how many are to be used, and indicate explicitly whether any are minors (under age 18 per Kansas law) or otherwise members of "vulnerable" populations, including, but not limited to, pregnant women, prisoners, psychiatric patients, etc.

Participants will be 20 older adults (65+years) who have moved into a continuing care facility, the Kansas Masonic Home (KMH) in Wichita. Participants will report no immediate health concerns and will be residents of the Independent Living section of KMH.

A colorful recruitment flyer will be developed and placed in the mailbox of each resident in Independent Living. With the permission of the administrators at KMH, the investigators will invite all potential participants to an informal meeting at KMH at which the study will be explained.

All participants in the study will have signed an Informed Consent form (Appendix A) and achieved a passing score (>21/30) on the *Mini-Mental Status Examination (MMSE)* (Folstein, Folstein, & Fanjiang, 2001; Appendix B). This passing score indicates that each participant has the cognitive ability to understand the purpose of the testing and provide his/her agreement to participate (Milman et al. 2008). If a participant agrees to help in the study but does not achieve a passing score on the *MMSE* (the next step in the study), this participant will be removed from the study. In addition, all participants will have passed a hearing screening test.

4. Describe each procedure step-by-step, including the frequency, duration, and location of each procedure.

All procedures will be completed at KMH in a comfortable, private room chosen by each participant. The following table delineates the objective and perceptual measures that will be completed by each participant:

Objective Measures of Body Composition and Function as Indicators of Physical Health and Nutrition and Hydration Status Relative to Swallowing	Perceptual (Self-Report) Measures
Energy expenditure at rest and during a meal (SenseWear®) Respiratory support (spirometry) Blood pressure and pulse oxygenation (before and after a meal) Tongue strength and endurance (IOPI; before and after a meal)	<i>Short Form-36 (SF-36; Ware & Sherbourne, 1992)</i> <i>Reflux Symptom Index (RSI; Belafsky et al., 2002)</i>
Body Mass Index (including height and weight) Mid Arm Muscle Circumference Bioelectric Impedance Analysis	<i>Nutritional Quality of Life (NQOL; Barr & Schumacher, 2003)</i>
<i>Functional Communication Measure: Swallowing (FCM-S; ASHA, 2003)</i>	<i>Swallowing Quality of Life (SWAL-QOL; McHorney et al., 2002)</i>

The order in which these objective and perceptual measures will be administered and documented is outlined in the *Procedure Protocol* (Appendix C) and *Participant Measurement Recording Sheet* (Appendix D).

From pilot testing:

Perceptual (self-report) measures will take approximately 60 minutes for each participant to complete. These perceptual measures are detailed in Appendix E. If any participant is unable to complete the instruments independently, the investigator may assist by reading the items aloud and/or marking the participant's dictated responses. The order of presentation of these measures will be randomized to control for any effects of participant fatigue. Should any participant become fatigued, he or she will be encouraged to take a break before testing continues.

Objective measures will take an additional 60 minutes. These objective measures are detailed in Appendix F. For all participants, an independent speech-language pathologist will complete the *FCM-S*

during a mealtime to identify the presence and severity of any swallowing difficulty. Measures of nutritional health will be completed by the investigator under the guidance of a certified exercise physiologist. The testing of spirometry and IOPI measures will be counter-balanced to control for effects of participant fatigue. As with perceptual measures, should any participant become fatigued, he or she will be encouraged to take a break before testing continues.

5. Describe any risks or discomforts (physical, psychological, or social) and how they will be minimized.

Perceptual Measures: Participants may become fatigued while completing the questionnaires. To note any fatigue, the investigators will monitor participants' behavior and responsiveness. If fatigue occurs, participants will be encouraged to take a break before continuing. Participants will be reminded that their name and personal information will be coded for privacy, but if they choose, they may skip any question they find difficult. As an example, the *SF-36* asks participants about physical activities they have begun to find difficult. Some participants may be troubled by this focus on things they no longer can do.

Objective Measures: There are minimal risks associated with the objective measures in this study. No measure is invasive. Each participant will have their weight and body fat measurements taken. Some participants may feel embarrassed or uncomfortable having this information revealed. They will be reassured that all tests are to take place in a private room of their choosing, that records will be confidential, and that reported data will be of group, not individual, results. Bioelectric Impedance Analysis measures the time it takes for the natural electrical currents (energy) in the body to travel from one place to the other. Participants will be reminded that the current between the electrodes on their hand and foot is a natural current and not felt. Participants also will be reminded that isolation transformers are in place within the equipment to prevent exposure to any intense currents. There is a minimal risk of injuring skin when removing the bioelectrical impedance electrodes if a participant's skin is particularly dry or thin due to aging. Investigators will take special care in removing the electrodes. Each participant will be tested with a new set of electrodes that will be thrown away after testing.

Blood pressure monitoring and pulse oxygenation levels are measures each participant undergoes routinely at KMH. The SenseWear® system that will be used to document energy expenditure during a meal requires the participant to wear a soft, computerized armband against the skin. This armband collects physiologic data through multiple sensors that touch the skin. It estimates energy expenditure by tracking movement/body position, body heat loss, skin temperature, and electrical resistance of the skin. These data are used along with participants' gender, age, height, and weight to estimate energy expenditure (in total kcal) with a regression equation developed by the manufacturer. The IOPI will be used to determine participants' tongue strength and endurance. Each participant will insert the tip of a device about the length of a toothbrush into their mouth. At the tip of this device is a small plastic bulb. Each participant will be asked to push this bulb against their hard palate (behind the ridge of their upper teeth) as hard as they can for 1-2 seconds. Three consecutive trials will be run to obtain this "peak pressure." Participants will be given as much rest as they need between the trials. Participants then will be asked to re-insert the tongue bulb and push against it to maintain 50% of their peak pressure for as long as they can. This will be done one time. For spirometry (a test of breath support for swallowing), participants will be asked to take a deep breath and then blow air out as hard as they can. To minimize the possibility of light headedness, participants will be seated for this task. The FCM-Swallowing is completed by an experienced speech-language pathologist as each participant eats. To minimize participants' feeling that they are being watched, the speech-language pathologist also will be enjoying a meal with the participant.

6. Would subjects undergo these or similar procedures (medical, psychological, educational, etc.) if they were not taking part in this research? Yes No

Yes: Participants will be accustomed to having their height and weight measured, their blood pressure and blood oxygen levels monitored, and being asked about their food and liquid intake.

No: The remaining measurements are for purposes of this research. However, many of the residents at KMH have participated in earlier pilot testing for this study and are familiar with the planned procedures. Further, it is hoped that these procedures will be shown to be sufficiently valuable for inclusion in future intake procedures for all residents.

7. Describe how the subject's personal privacy is to be protected and confidentiality of information guaranteed (e.g. disposition of questionnaires, interview notes, recorded audio or videotapes, etc.).

Participants' personal privacy will be protected by all testing being conducted individually and in a private place of the participant's choosing. Confidentiality of information will be guaranteed by maintaining all data in a locked cabinet in the primary investigator's office. There will be no recorded audio or videotapes. When data are entered into a spreadsheet for analysis, each participant will be identified by a particular number. When the investigators present or publish data from this study, the data will not be shown in any way that would identify any participant. Once the study is published, the data will be shredded. Per regulations, participants' signed Informed Consent forms will be retained in a locked cabinet for 3 years post-study. Any students who assist the investigator with this study will have completed and passed HIPAA training and the documentation of their training will be on file.

8. Describe the informed consent process and attach a copy of all consent and/or assent documents. These documents **must** be retained for three years beyond completion of the study. Any waiver of written informed consent must be justified.

The investigator will read the informed consent form aloud while the participant follows along. The informed consent form will detail each of the procedures to be completed, the order in which this will be done, and the expected time each will take. Any potential risks will be explained. Participants will be assured that the information gathered in this study will be kept confidential. Further, participants will be re-assured that, if they choose, they may withdraw from the study at any time without any negative repercussions. Participants will be invited to ask any questions to make sure they understand the study and the procedures. If a participant does not achieve a passing score on the *MMSE* (the next step in the study), this participant will be removed from the study. Each participant will receive a copy of the signed informed consent form.

9. Attach all supporting material, including, but not limited to, questionnaire or survey forms and letters of approval from cooperating institutions.
 - Appendix A - Informed Consent
 - Appendix B - Mini-Mental Status Examination
 - Appendix C - Procedure Protocol
 - Appendix D - Participant Measurement Recording Sheet
 - Appendix E - Perceptual Measures
 - Appendix F - Objective Measures

The Principal Investigator agrees to abide by the federal regulations for the protection of human subjects and to retain consent forms for a minimum of three (3) years beyond the completion of the study. If the data collection or testing of subjects is to be performed by student assistants, the

Principal Investigator will assume full responsibility for supervising the students to ensure that human subjects are adequately protected.

Signature of Principal Investigator:

November 7, 2010



Informed Consent Form

Objective and Perceptual Measures of Swallowing and Effects on Quality of Life: A Pilot Study

I, _____, agree to participate in the study, *Objective and Perceptual Measures of Swallowing and Effects on Quality of Life: A Pilot Study*. I understand that the information I provide will assist the investigators to determine factors that play a significant role in the quality of life, health, and nutritional status of older adults who reside in continuing care communities. I will receive \$20 for my participation.

I understand that I will complete the *Mini-Mental Status Examination* to make sure that I understand the tasks I will be asked to do. I then will complete four questionnaires. I understand that these questionnaires will document my perceptions of my general health and what I eat and drink, as well as any difficulties I may have with reflux and/or swallowing. I have been told that completing these questionnaires may take about 60 minutes.

I understand further that I will have my height and weight measured to calculate my Body Mass Index (BMI). My mid-arm muscle circumference (MAMC) will be measured with a plastic measuring tape to estimate my body fat. I also will undergo Bioelectric Impedance Analysis. In this procedure, two surface electrodes will be placed on my foot and my hand. I understand I will be lying down while this test is done. I have been told that the electrodes measure the time it takes for the natural electrical currents (energy) in my body to travel from one place to the other. The time taken is an indicator of whether I am drinking enough.

I understand that two other measurements are: (a) a blood pressure test, and (b) a test to measure the level of oxygen in my blood. For this blood oxygen measurement, I will have a small comfortable hood placed over the tip of my index finger for one minute. This is a noninvasive procedure – no skin will be broken. This measurement will be taken before and after I eat lunch. Further measures are: (c) a test of my breathing capacity (I will hold a breathing device, a spirometer, and blow hard into it while holding my nose closed), and (d) a test of the strength of my tongue. For this tongue strength test, I understand I will place a small plastic bulb against the roof of my mouth and press hard against it with my tongue for 1-2 seconds. I will do this three times. I know that I can take as much rest time between pushes as I need. Following this, I will see how long I can push the tongue bulb when I am pushing half as hard as I did before. I understand that this tongue strength test also will be done before and after I eat lunch. I have been told that all these measurements before lunch will take about 60 minutes. The blood oxygen test and tongue strength tests that will be repeated after lunch will take about 10 more minutes.

I understand that I will wear a computerized SenseWear® device to measure the number of calories (energy) I expend while I am eating lunch. I have been shown this device and I understand how this comfortable armband will be positioned on the bicep muscle of my right upper arm. Before I wear this

device during lunch, I understand that I will wear it for 15 minutes while I sit quietly. I have been told that this period of quiet rest is to obtain baseline data on the SenseWear® device.

I understand that the investigators would like me to complete the questionnaires and other measurements during a morning, then over lunch on that day, then for a short period after lunch on the same day. However, I know that I can take a break from data collection whenever I am tired and that it is possible to split the data collection over several days if I need to. I understand further that if I experience any discomfort with any testing or device placement, I can stop the test and/or remove the device immediately. I then can decide if I want to continue with the study or stop.

I have been told that any students who are assisting with this study will be supervised by Dr. Goldberg, the primary investigator. I understand that these students will have completed a test on the importance of maintaining confidentiality and they will not share any information about me.

I do understand that my participation in this study is voluntary. I know that I can withdraw from the study at any time. If I do decide to withdraw from the study, I know any data I have provided will be shredded or deleted and that there will be no negative effects on any other activities in which I am involved at the Kansas Masonic Home or Wichita State University.

I have been assured that any data I provide will remain confidential and be kept in a locked cabinet in Dr. Goldberg's office. When the investigators present or publish data from this study, I understand that my data will not be shown in any way in which I could be identified. I understand further that once the study is published, the data I have provided will be shredded or deleted.

I understand that I can contact Dr. Goldberg at (316) 978-6115 or by e-mail at Lyn.goldberg@wichita.edu if I have questions or concerns about the study. If my concern involves Dr. Goldberg, I understand I can contact staff in the Office of Research Administration at Wichita State University at (316) 978-3285 for assistance.

I agree that the reasons for conducting this study have been explained to me and I understand what I am being asked to do. I have been given the opportunity to ask questions and my questions have been answered to my satisfaction. I understand that I will receive a copy of this form.

Signature

Date

Printed name

Signature of investigator

Date

Printed name

APPENDIX H. Mini-Mental State Examination



Date of Examination _____ / _____ / _____ Examiner _____
 Name _____ Age _____ Years of School Completed _____

Instructions: Words in boldface type should be read aloud clearly and slowly to the examinee. Item substitutions appear in parentheses. Administration should be conducted privately and in the examinee's primary language. Circle 0 if the response is incorrect, or 1 if the response is correct. Begin by asking the following two questions:

Do you have any trouble with your memory? May I ask you some questions about your memory?

ORIENTATION TO TIME	RESPONSE	SCORE <small>(circle one)</small>	
What is the... year?	_____	0	1
season?	_____	0	1
month of the year?	_____	0	1
day of the week?	_____	0	1
date?	_____	0	1

ORIENTATION TO PLACE*

Where are we now? What is the...			
state (province)?	_____	0	1
county (or city/town)?	_____	0	1
city/town (or part of city/neighborhood)?	_____	0	1
building (name or type)?	_____	0	1
floor of the building (room number or address)?	_____	0	1

*Alternative place words that are appropriate for the setting and increasingly precise may be substituted and noted.

REGISTRATION*

Listen carefully. I am going to say three words. You say them back after I stop. Ready?
Here they are... APPLE [pause], PENNY [pause], TABLE [pause]. Now repeat those words back to me.
[Repeat up to 5 times, but score only the first trial.]

APPLE	_____	0	1
PENNY	_____	0	1
TABLE	_____	0	1

Now keep those words in mind. I am going to ask you to say them again in a few minutes.

*Alternative word sets (e.g., PONY, QUARTER, ORANGE) may be substituted and noted when retesting an examinee.

ATTENTION AND CALCULATION [Serial 7s]*

Now I'd like you to subtract 7 from 100. Then keep subtracting 7 from each answer until I tell you to stop.

What is 100 take away 7?	[93]	_____	0	1
<i>If needed, say: Keep going.</i>	[86]	_____	0	1
<i>If needed, say: Keep going.</i>	[79]	_____	0	1
<i>If needed, say: Keep going.</i>	[72]	_____	0	1
<i>If needed, say: Keep going.</i>	[65]	_____	0	1

*Alternative item (WORLD backward) should only be administered if the examinee refuses to perform the Serial 7s task. →

Substitute and score this item only if the examinee refuses to perform the Serial 7s task.

Spell WORLD forward, then backward.

Correct forward spelling if misspelled,
but score only the backward spelling.

_____ (D = 1) _____ (L = 1) _____ (R = 1) _____ (O = 1) _____ (W = 1) _____ (0 to 5)

RECALL

RESPONSE

SCORE
(circle one)

What were those three words I asked you to remember? *[Do not offer any hints.]*

APPLE	_____	0	1
PENNY	_____	0	1
TABLE	_____	0	1

NAMING*

What is this? *[Point to a pencil or pen.]*

_____ 0 1

What is this? *[Point to a watch.]*

_____ 0 1

*Alternative common objects (e.g., eyeglasses, chair, keys) may be substituted and noted.

REPETITION

Now I am going to ask you to repeat what I say. Ready? "NO IFS, ANDS, OR BUTS." Now you say that.

[Repeat up to 5 times, but score only the first trial.]

NO IFS, ANDS, OR BUTS. _____ 0 1

Detach the next page along the lengthwise perforation, and then tear it in half along the horizontal perforation. Use the upper half of the page (blank) for the Comprehension, Writing, and Drawing items that follow. Use the lower half of the page as a stimulus form for the Reading ("CLOSE YOUR EYES") and Drawing (intersecting pentagons) items.

COMPREHENSION

Listen carefully because I am going to ask you to do something.

Take this paper in your right hand *[pause]*, **fold it in half** *[pause]*, **and put it on the floor** *(or table)*.

TAKE IN RIGHT HAND	_____	0	1
FOLD IN HALF	_____	0	1
PUT ON FLOOR <i>(or TABLE)</i>	_____	0	1

READING

Please read this and do what it says. *[Show examinee the words on the stimulus form.]*

CLOSE YOUR EYES _____ 0 1

WRITING

Please write a sentence. *[If examinee does not respond, say: Write about the weather.]*

0 1

Place the blank piece of paper (unfolded) in front of the examinee and provide a pen or pencil. Score 1 point if the sentence is comprehensible and contains a subject and a verb. Ignore errors in grammar or spelling.

DRAWING

Please copy this design. *[Display the intersecting pentagons on the stimulus form.]*

0 1

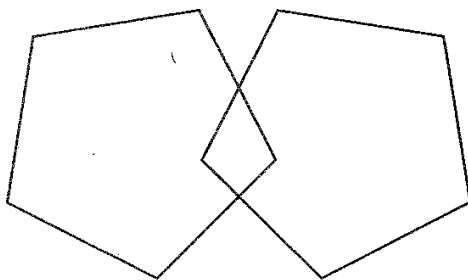
Score 1 point if the drawing consists of two 5-sided figures that intersect to form a 4-sided figure.

Assessment of level of consciousness.

Total Score = _____ <i>(Sum all item scores.)</i> <i>(30 points max.)</i>

Alert/ Responsive	Drowsy	Stuporous	Comatose/ Unresponsive
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CLOSE YOUR EYES



APPENDIX I. Procedure Protocol

Part I – Paper Work and Forms

- Informed Consent **FIRST**
- Mini-Mental **Second**
- All other forms (to be completed in the randomized order placed within each particular folder)
 - Fill out the forms for the participant
 - Read forms to the participant
 - Allow the participant to view the form along with you

Part II – Measurements (**Complete the measurements in the order listed**)

1. Weight
2. Height
3. BMI (calculated from the height and weight)
4. Mid-Arm Circumference on the **RIGHT** arm
5. Lie down for **15 minutes** (may converse during this time)
6. Bioelectrical Impedance
7. Sit-up and rest **5 minutes**
8. Place SenseWear® on the **RIGHT** arm and continue to wait another **15 minutes**. Obtain the Blood Pressure Measurement on the **Left** arm while waiting.
9. Take SenseWear® off and document reading
10. Pulse O₂ PRE
11. IOPI - *PRE*
12. Spirometry
13. Place SenseWear® back on the **Right** arm and rest for **15 minutes**. Measure the Pulse O₂- *PRE* reading while waiting and then go get the participant's lunch.
14. EAT
15. Remove SenseWear® and document
16. Pulse O₂ – *POST*
17. IOPI – *POST*

APPENDIX J. Participant Measurement Recording Sheet

Name: _____ Date of birth: _____ Gender: M F

Mini-Mental State Examination: _____ out of 30

Previous Occupation: _____

When did you move to the Kansas Masonic Home? _____

Race/ethnicity: American Indian or Alaska Native
 Asian
 Black or African American
 White, non-Hispanic
 Hispanic or Latino
 Other

Education: Grade School
 High school: Diploma GED Other _____
 College: Y N Degree: _____

Health:
 Do you smoke? Y N How much?
 Have you ever smoked? Y N Quit date?
 Do you drink? Y N How much?
 Do you exercise? Y N Describe frequency/type of activities.

Heart problems Y N
 Cardiac pacemaker Y N
 COPD Y N
 Arthritis Y N
 Head/neck surgery Y N
 History of stroke Y N

If yes, list date, number, and difficulties:

Other head injury Y N
 If yes, please describe:

Tinnitus Y N
 Hearing aids Y N
 If yes, do you wear them regularly? Y N
 Do you receive audiological care and from whom?

Do you have difficulty understanding conversational speech?	Y	N
Do you wear glasses or contacts?	Y	N
What was the last thing you read that you enjoyed? -		

Do you have dentures?	Y	N
Do you wear them regularly?	Y	N
Do you have any trouble swallowing?	Y	N
If yes, did your trouble start suddenly or gradually?		

Do you believe swallowing difficulties are a natural part of aging?	Y	N
Has your food intake declined over the past three months due to loss of appetite, digestive problems, chewing or swallowing difficulties?	Y	N
Have you unintentionally lost weight in the last 3 months?	Y	N
If yes, how much? _____		

Mobility (assessed by interviewer): Walks independently
 Uses assistance (cane or walker) Uses a wheelchair

Have you felt excessive psychological stress in the last 3 months?	Y	N
Have you been sick in the last 3 months?	Y	N
If yes, how so?		

In general, how do you feel about your physical health?

Are there any other health factors you are concerned about?

Please list all medications and health supplements you use, as well as what they are for.
(Use back side of paper, if needed.)

Questionnaires completed:

SF-36
RSI
NQOL
SWAL-QOL

Height _____

Scale: Weight _____ % Fat _____ BMI _____

Blood pressure _____

Mid-arm circumference _____

Bioelectrical Impedance: Resistance _____ Reactance _____

Spirometer (3x): FEV1 _____ FVC _____ FER _____
PEF _____

Readings before lunch:

IOPI: Tongue strength (3x) _____ Tongue fatigue _____

Oximeter: Oxygen _____ Pulse _____

SenseWear®

Lunch:

SenseWear®

Readings after lunch:

IOPI: Tongue strength (3x) _____ Tongue fatigue _____

Oximeter: Oxygen _____ Pulse _____