UNIVERSITY OF MARYLAND
SCHOOL OF NURSING

CURRICULUM VITAE

February 20, 2017

I. Hammersla, Margaret

Email: Hammersla@son.umaryland.edu

II. Education

Degree and Date to be conferred: PhD, 2017

Degree	Institution	Major	Date Completed
PhD	University of Maryland School	Nursing	PhD Defense Dec 6, 2016
Post MS Certificate	University of Maryland School of Nursing	Teaching in Health Care Certificate	May 2008
MS	University of Maryland School of Nursing	Adult Primary Care	December 2005
BSN	University of Maryland School of Nursing	Nursing	May 1995

Inducted Sigma Theta Tau – May 16, 2012

States in which licensed, including registration numbers.

Maryland: Registered Nurse / Adult Nurse Practitioner
American Nurses Credentialing Center / Adult Primary Care

III. Experience in Higher Education

From-To (Mo.-Year)	Institution	Nature of Work	Academic Status (Rank/Position/Title)
February 2007-present	University of Maryland School of Nursing	Program and Course Coordination, Teach graduate students in the classroom, lab, and clinical setting	Co-Program Director, AGNP, Assistant Professor Organizational Systems Adult Health

IV. Clinical Practice.

From-To (Mo.-Year)	Institution	Nature of Work	Academic Status (Rank/Position/Title)
July 2015 – present	Lifebridge Primary Care, Eldersburg, MD	Responsible for the evaluation and management of at both Copper Ridge and Office settings	Nurse Practitioner
September 2013-June 2015	Copper Ridge (EMA Health Services)	Responsible for the evaluation and management of in both assisted living and long term care settings	Nurse Practitioner
July 2013-present	University of Maryland Medical Center Emergency Room	Evaluation and Management of patients presenting to ER with non-life threatening complaints	Nurse Practitioner
July 2010-June 2013	University of Maryland Medical Center PREP Center	Completion of pre-operative physical and	Nurse Practitioner

		anesthesia clearance	
June 2008- June 2010	Office of Dr. Vinu Ganti	Internal medicine practice; evaluate patients for a variety of acute and chronic conditions in both outpatient and long term care settings	Nurse Practitioner
February 2007 – July 2008	Copper Ridge (EMA Health Services)	Responsible for the evaluation and management of patients with dementia and associated psychiatric symptoms in both outpatient and long term care settings.	Nurse Practitioner
August 2006 – February 2007	Fairhaven (CCRC) (EMA Health Services)	Diagnosis and management of elderly patients in independent living, assisted living and long term care	Nurse Practitioner
August 2005 - February 2007	Copper Ridge Institute	Provided educational programs to facilities in dementia care and management	Nurse Educator
January 2004 – August 2005	Buckingham's Choice	Provided care to 35 patients in a nursing home with a variety of co-morbidities as well as supervision of 4-6 assistants	Staff Nurse

April 2002 – January 2004	Buckingham's Choice	Managed a 35 bed nursing home and 40 bed AL. Also provided oversight to the independent living community	Assistant Director of Nursing
November 2000 – March 2002	Copper Ridge	Managed staff and patients for a 36 bed dementia unit.	Unit Manager
April 1998 – November 2002	Copper Ridge	Provided direct patient care to patients of a 36 bed dementia unit	Staff Nurse
January 1996 – April 1998	Golden Age Guest Home	Provided direct patient care to patients in the nursing home	Staff Nurse

V. Professional Activities

A. Membership in Professional Organizations:

Gerontological Advanced Practice Nurses Association
- Vice Chair, Research Committee 2011-2012
- Maryland Chapter President-Elect August 2009 – August 2010
- Maryland Chapter President August 2010-2011

National Organization of Nurse Practitioner Faculty
- Member Resources Committee 2010 to present, Chair April 2015 – April 2017
- Conference Planning Committee 2014 to present

Nurse Practitioner Association of Maryland
- Membership Committee 2009 to 2012
- Conference Committee 2009

American Academy of Nurse Practitioners

B. Academic Service

DNP Curriculum Committee Chair November 2016 to present
MS/DNP Curriculum Committee July 2016 to November 2016
MS/DNP Curriculum Committee July 2013 to June 2015
MS Judicial Board July 2012 to May 2014
Faculty Council September 2011 to June 2015
DNP Transition Task Force 2010 to June 2014
Co-Chair - SD sub group of the DNP transition task force 2011 to June 2014
Student Affairs Committee Member September 2008 to May 2011

C. Public Service

Maryland Area Heath Education Center: Advisory Board Member. September 2015 to present
Annual Sister to Sister Health Fair Volunteer. Baltimore, Maryland. 2008-2009
Maryland Area Health Education Centers. Advisory Board Member 2015 to present
Journal of Geriatric Medicine Research: Editorial Board. September 2016 to present

VI. Presentations

A. Effective Strategies to Promote Generational Cohesion in the Workplace. Amanda Vessart, PhD, RN, CNE, Margaret Hammersla MS, PhD-c, Holly Buchanan, DNP, ANP-BC. STTI Leadership Connection. Indianapolis, Indiana. September 17-20, 2016.

B. Carnival Games and Diagnostic Reasoning. National Organization of Nurse Practitioner Faculty Annual Conference. Denver, Colorado. April 2014.
C. Dissemination and Implementing PRAISEDD in Multiple Senior Housing Facilities. The Gerontological Society of America's Annual Scientific Meeting. New Orleans, Louisiana, November 2013.
D. Interprofessional Education: Using Standardized Patients and Providers for Primary Care Simulation. National Organization of Nurse Practitioner Faculty Annual Conference. Pittsburgh, Pennsylvania, April 2013
E. Incorporating Obesity Education into Adult Primary and Acute Care Nurse Practitioner Programs. National Organization of Nurse Practitioner Faculty Annual Conference. Charleston, South Carolina, April 2012.
F. Physical Activity in Older Adults. The Gerontological Society of America's Annual Scientific Meeting, Boston, Massachusetts, November 2011
G. Using AGNP Competencies to Enhance Precepting of NP Students. Geriatric Advance Practice Nursing Association Conference, Washington DC, September, 2011.
H. Preoperative evaluation in the older adult. Geriatric Advance Practice Nursing Association Conference, Washington DC, September, 2011.
I. Resources for teaching research to DNP students. Symposium with Elizabeth Carlson PhD, CRNP. National Organization of Nurse Practitioner Faculty Annual Conference. Albuquerque, New Mexico, April 2011
J. Using Simulation to Enhance Gerontological Content in the AGNP Curriculum. Podium Presentation with Shannon Idzik DNP, CRNP. National Organization of Nurse Practitioner Faculty Annual Conference. Albuquerque, New Mexico, April 2011
K. Using Nurse Practitioner Faculty Practice In The Scholarship Of Teaching. Podium Presentation. Global Alliance for Leadership in Nursing Education and Science. Washington, DC, December 2010.
L. Pilot Testing of a Function Focused Care Intervention in an Acute Care Setting: Impact on Nursing. Gerontological Society of America Annual Meeting, November 2010
M. Using Nurse Practitioner Faculty Practices In The Scholarship Of Teaching. Poster Presentation. Excellence in Teaching Conference. University of Maryland School of Nursing. Baltimore, Maryland. March 12, 2010.
N. Inappropriate Sexual Behavior in Older Adults with Dementia. Geriatric Advance Practice Nursing Association Conference. Savannah, Georgia. October 1, 2009.
O. Multi-modal approach to Physical Activity Measurement in Older Adults. Southern Nursing Research Society Conference. Baltimore Maryland. February 13, 2009
P. Challenges in Care: treating sleep disorders in Alzheimer's patients. Alzheimer's Association Care Conference. Frederick, Maryland. October 29, 2008.
Q. Dementia Development. Brightview Eldercare Facilities. Nurse Educator for the Copper Ridge Institute. Baltimore, Maryland. October 2006 – January 2007.

R. Dementia Intensive Course. The Glen System. Nurse Educator for the Copper Ridge Institute. Shreveport, Louisiana. November 2005 – September 2006.

V. Publications

A. Koo, L., Layson-Wolf, C., Brandt, N., Hammersla, M., Idzik, S., Rocafort, P., Tran, D., Wilkerson, R., Windemuth, B. (2014). Qualitative evaluation of a standardized patient clinical simulation for nurse practitioner and pharmacy students. Nurse Education in Practice, 14, p. 740-746. DOI: 10.1016/j.nepr.2014.10.005

B. Resnick, B., Hammersla, M., Michael, K., Galik, E., Klinedinst, J., & Demehin, M. (2014). Changing behavior in senior housing residents: Testing of phase I of the PRAISEDD-2 intervention. Applied Nursing Research. doi:10.1016/j.apnr.2013.12.005

C. *Optimizing Function and Physical Activity Among Nursing Home Residents With Dementia: Testing the Impact of Function-Focused Care*
Elizabeth Galik; Barbara Resnick; **Margaret Hammersla**; Joanna Brightwater
The Gerontologist 2013; doi: 10.1093/geront/gnt108

D. Koo, L. W., Idzik, S. R., Hammersla, M. B., & Windemuth, B. F. (2013). Developing Standardized Patient Clinical Simulations to Apply Concepts of Interdisciplinary Collaboration. Journal of Nursing Education. doi:10.3928/01484834-20131121-04

E. Buchholz, S. W., Budd, G. M., Courtney, M. R., Neiheisel, M. B., Hammersla, M., & Carlson, E. D. (2013). Preparing practice scholars: Teaching knowledge application in the Doctor of Nursing Practice Curriculum. Journal of the American Association of Nurse Practitioners, 25(9), 473–480. doi:10.1002/2327-6924.12050

F. Sabol, V., **Hammersla, M**. & Idzik, S. (2012). Incorporating Obesity Education into Adult Primary and Acute Care Nurse Practitioner Programs. *Bariatric Nursing and Surgical Care* 7(2).

G. **Hammersla, M**. & Kapustin, J. (2012). Peripheral Neuropathy: Evidence Based Treatment of a Complex Disorder. *The Nurse Practitioner* 37(5): 32-39.

H. **Hammersla, M.** (2011). Health Assessment. In Gellman, M. & Turner, J. (Eds.), *Encyclopedia of Behavioral Medicine* (1st ed). New York: Springer Publishing Co.

I. Resnick, B., Galik, E., Enders, H., Sobol, K., **Hammersla, M.**, Dustin, I., Boltz, M., Miner, L., & Trotman, S. (2011). Pilot Testing of Function Focused Care for Acute Care Intervention. Journal of Nursing Care Quality 26(2):169-177

VI. Research and Evaluation Activities:

Nurse Educator Doctoral Grant for Practice and Dissertation Research, $30,000, 1/6/14 – 7/30/15, Hammersla (Doctoral Student; Dr Barbara Resnick – Dissertation Chair), Evaluating the effect and relationship of diet and physical activity on body composition and Sarcopenia in older adults living in senior housing in Baltimore, Maryland.

“Interprofessional Education: A Faculty Development Initiative, $299,928 by the Health Services Cost Review Commission of the Maryland and the Maryland Higher Education Commission, 2013-2015.
Idzik, S.: Principal Investigator
Project Team: Mary Fey, PhD, RN, Margaret Hammersla, MS, PhD-c, CRNP, Edward Pecukonis, MSW, PhD

Doctoral Dissertation: The Association of Diet and Physical Activity with Body Composition in Older Adults living in an Urban Senior Living Complex; Dissertation Chair – Dr. Barbara Resnick; November 2012 – December 2016

Dean’s Teaching Scholars Program: Developing a Formative Standardized Patient Clinical Simulation to Apply Concepts of Communication: A step toward interprofessional collaboration
Project Team Leader: Laura Koo MS, CRNP
Project Team: Rosemarie Brager PhD, CRNP, Beth Galik PhD, CRNP, Margaret Hammersla MS, CRNP, Shannon Idzik DNP, CRNP, Barbara Resnick PhD, CRNP,Brenda Windemuth DNP, CRNP
Award Amount: $2,000

Friedmann (PI)
Funding agency: ISAZ Waltham
Title: Pet Assisted Living Study
Objective: The purpose of this quasi-experimental, comparison group study is to explore the impact of pet dog therapy intervention designed to improve the physical function, activity, mood and behavior of assisted living residents with dementia.
Award amount: $30,000
Award dates: -July 2010-June 2012
Role: Research assistant

Resnick (PI) 2008-2009
Funded by University of Maryland School of Nursing and University of Maryland Medical System
Agencies: University of Maryland School of Nursing and University of Maryland Medical System
Testing the Feasibility and Impact of Restorative Care in Acute Care
Summary: The purpose this single group, pilot study is to test the feasibility and impact of a restorative care intervention designed for older adults during an acute care hospital admission.
Role: Research Assistant

Galik (PI) December 2005- May 2007
Funded by the American Medical Directors Association **(**$13,500)
and the American Academy of Nurse Practitioners ($2,000)
Agency: The Copper Ridge Institute/University of Maryland School of Nursing
Testing the Feasibility and Impact of the Res-Care-CI
Summary: The purpose of this two-tiered, single-group, time series study is to explore the feasibility of the Res-Care-CI (a restorative care intervention adapted for cognitively impaired) and measure initial outcomes for nursing assistants and cognitively impaired residents.
Role: Interventionist: Restorative Care Nurse

Awards and Honors

Completion of NLN Lead 2015 Program for Nurse Educators and Emerging Leadership Roles

Award for Excellence in Gerontological Nursing, Geriatrics and Gerontology Education and Research Program, University of Maryland, Baltimore, 2016

Abstract

Title: Sarcopenia and PRAISEDD-2 Intervention's Impact on Diet, Physical Activity, and Body Composition

Margaret Hammersla, Doctor of Philosophy, 2017

Dissertation Directed by: Dr. Barbara Resnick PhD, CRNP, FAAN, FAANP, Professor

Background: Older adults with a low socioeconomic status and African Americans are more sedentary than the general population. This contributes to the development of sarcopenia and has a negative impact on the health and function of these individuals. PRAISEDD-2 was a 24-month quasi-experimental study of low income adults living in senior housing. A focused 3-month intervention included education about stroke prevention and heart health through adherence to heart healthy diets, regular exercise, and prescribed medication combined with exercise classes that included verbal encouragement, blood pressure feedback, and role modeling. Classes continued to be offered in months 4-24 but only included a monthly motivational intervention. The impact of the PRAISEDD-2 intervention on diet (fat, sodium, and protein intake), time spent in physical activity, and body composition are examined in the study reported here.

Design: Diet and body composition measures were collected at baseline, 3, 6, 12, and 24 months. Sample included 29 residents of a low-income senior housing complex in Baltimore, MD. Complete data was obtain from 13 participants. Generalized estimating equations (GEE) were used to examine change over the time periods. An intention-to-treat (ITT) paradigm was followed.

Results: At 3 months, participants experienced a decrease in sodium ($p<0.01$) and fat intake ($p<0.01$), as well as in a decrease in percent body fat ($p<.001$). However, at 24 months, fat intake ($p<0.001$) and percent body fat ($p<0.001$) increased, although protein intake increased ($p<.001$). No significant change was noted in physical activity ($p=.056$) or sodium intake ($p=0.69$) at 24 months.

Conclusions: The findings from this study provided some support for the feasibility and preliminary efficacy of the PRAISEDD-2 intervention. The changes that occurred in the early 3 month period were likely due to the intensive nature of the education and exercise classes. Future research should focus on building a stronger self-efficacy based motivational component into the exercise classes to strengthen long term adherence to the recommended dietary change and physical activity, essential to promote decrease in body fat and increases in muscle mass. Interventions may need to be sustained longer to achieve more permanent changes in diet and exercise.

Sarcopenia and PRAISEDD-2 Intervention's Impact on Diet, Physical Activity, and Body Composition

by
Margaret Hammersla

Dissertation submitted to the Faculty of the Graduate School of the
University of Maryland, Baltimore in partial fulfillment
of the requirements for the degree of
Doctor of Philosophy
2017

Table of Contents

Chapter Page

I. Significance and Aims..1

A. Overview and Significance...1

B. Purpose and Overview of Manuscripts...2

1. Assessment and Management of Sarcopenia..2

2. Reliability and Validity of the Diet Self-efficacy Expectations Scale Among Low Income Older Adults..6

3. Impact of PRAISEDD on dietary intake, physical activity and body composition and self-efficacy in older adults living in senior housing...8

II. Assessment and Management in Sarcopenia in African Americans.................................13

A. Epidemiology of Sarcopenia Among Older Adults...13

B. The Definition of Sarcopenia and Diagnosis in Clinical Settings........................14

C. Measurement of Muscle Mass..15

D. Measurement of Strength..16

E. Measurement of Physical Performance...17

F. Management of Sarcopenia...19

G. Challenges in Sarcopenic Management in Older African Americans.................22

H. Summary...23

III. Reliability and Validity of the Diet Self-efficacy Expectations Scale..............................26

A. Theoretical Support for Behavior Change..26

B. Methods..29

1. Design and Sample..29

2. Procedures and Measures......30
3. Data Analysis......31
4. Results......32
5. Discussion......34

IV. Feasibility and Impact of PRAISEDD on dietary intake, physical activity and body composition and self-efficacy in older adults living in senior housing......40

A. Methods......42
B. Measures......44
C. Data Analysis......46
D. Results......46
E. Discussion......47
F. Study Limitations......49
G. Clinical Implications and Conclusion......50

V. Discussion and Future Direction......55

A. Body Composition, Diet, and Exercise......56
B. Self-Efficacy for Eating Behaviors Scale......62
C. PRAISEDD Intervention to impact Diet and Body Composition......65
D. Conclusions......68

VI. References......69

List of Tables

Table 1: Diagnosis algorithm for Sarcopenia..24

Table 2: Criteria for Physical Performance based on the SPPB..25

Table 3: Item Mapping...38

Table 4: Description of the PRAIDEDD Intervention..51

Table 5: Demographic Data of Study Participants..52

Table 6: Comparison of Baseline Outcome and Descriptive Data Between Participants With and Without Missing Data..53

Table 7: Changes in Outcomes from Baseline to Twenty-four Months in outcome variables over time..54

Chapter One: Significance and Aims

Overview and Significance

Despite the clear benefits of both aerobic and resistance exercise, older adults spend an average of 60% or greater of their time in sedentary behaviors[1]. Older adults with a low socioeconomic status and African Americans are also more sedentary than the general population[2]. This results in a significantly negative impact on the health and function of these individuals. In addition to sedentary behavior among older adults there is a particularly high rate of both sarcopenia, an age related loss of muscle mass and strength, and obesity, defined as a body mass index greater than 30. Sarcopenia and obesity are especially prevalent among those living in low-income housing. The population based estimates of sarcopenia in older adults range from 52-69% among all older adults and approximately 38% of are overweight or obese[3]. Those with a low socioeconomic status and those who are African American are disproportionally affected[3]. Sarcopenia and obesity result in an increased risk of morbidity and mortality due to cardiovascular disease, diabetes, frailty, falls and disability[4].

Although sarcopenia and obesity result in serious negative health outcomes they are both modifiable through life style change. Specifically, there is prior evidence to support the effectiveness of increased protein intake and exercise that includes resistance training as a way to decrease both sarcopenia and obesity[5]. The USDA recommends a protein intake of 0.8g/kg/day for adults[6]. In addition to total intake older adults should spread protein intake equally throughout the day to improve absorption and metabolism[7,8]. Resistance training is also a key component in increasing muscle mass and decreasing body fat. Muscle contraction, especially against resistance, results in activation of satellite cells and the myogenic regulatory factors that play a key role in the generation of new multinucleated myofibers important in skeletal muscle hypertrophy[9].

Challenges to Exercise and Dietary Interventions for Sarcopenia and Obesity

Despite these relatively inexpensive, straightforward interventions to treat and prevent sarcopenia and obesity, older adults are not meeting national recommendations for protein intake and exercise[10]. Lack of resources such as decreased access to health care, limited healthy food options in living situations and neighborhoods, cultural food preferences that are not consistent with heart healthy diets and beliefs that exercise may cause them harm in terms of exacerbation of joint pain, sensations of shortness of breath or fear of trauma/falls are all barriers to meeting diet and exercise recommendations. In addition, there is often inconsistent support from family, friends and even health care providers or workers in senior housing facilities in terms of encouraging adherence to heart healthy behaviors[11,12]. Furthermore the purchase of heart healthy food such as fresh vegetables, lean meats and low-fat dairy products are relatively expensive compared to prepackaged processed foods available at grocery and convenience stores. All of these combine to place significant barriers to a heart healthy life style.

Purpose and Overview of Manuscripts

Assessment and Management of Sarcopenia

Sarcopenia is a complex condition caused by declines in physical activity, decreased protein intake, a variety of disease triggers, inflammation, declines in neuromuscular junctions, age related changes in muscle cell mitochondria, and alterations in the angiotensin system[13]. Exact prevalence of sarcopenia among older adults is not easily accessible due to challenges in evaluating muscle mass and function physical function and performance. Current estimates suggest that 52-69% of older adults (>60 years old) have sarcopenia[14]. These high rates result in a significant health care burden. In the United States, an estimated $18.5 billion dollars is spent annually on health care costs related to sarcopenia[7].

The diagnosis of sarcopenia is generally made based on the presence of low skeletal muscle mass accompanied by poor physical function[15]. A lack of standardized measures of functional skeletal muscle mass, inability of measures of skeletal muscle mass to optimally capture functionality and a lack of consensus in the research and clinical communities have resulted in difficulty establishing usable diagnostic criteria in clinical practice. To address these challenges the European Work Group on Sarcopenia in Older People (EWGSOP) and The International Working Group on Sarcopenia (IWGS) convened to develop operational definitions and diagnostic criteria that could be used in real world settings, as well as be appropriate for research studies[16]. Based on consensus of these two expert panels it was confirmed that the diagnosis of sarcopenia should be based on having a low muscle mass in combination with low muscle strength and performance[16,17].

The gold standard for measurement of muscle mass by volume is computed tomography (CT), dual x-ray absorption (DXA), or magnetic resonance imaging (MRI)[18]. While these methods of assessing muscle mass are extremely accurate, they are costly, not covered by insurance and, not readily available in primary care offices or community research settings. For this reason, the use of bioelectrical impedance analysis (BIA) is increasingly being used as it is inexpensive, easy to use, and found to correlate will with both MRI and DXA measures[19,20]. BIA utilizes low-level electrical impulses and measures the body's resistance to this alternating electrical current[20]. These measures are then used to calculate measures of body composition such as fat-free mass (FFM), muscle mass and percent body fat.

Evaluation of strength and physical performance is easily captured in clinical and field research settings. The EWGSOP proposed that measures of knee flexion/extension and handgrip be utilized as indicators of strength[16]. Both are measurable with commercially available dynamometer[16] and were found to correlate will with physical function measures and self-reported difficulties[21]. Cut off scores for low muscle strength for men are <30kg and for women they are <20kg[22]. Both the IWGS and the EWGSOP recommend that habitual gait speed be used to evaluate physical performance[16]. This decision was based on evidence that in older adults small declines in usual gait speed provide an indication of onset of disability[23]. Alternatively a Timed Get Up and Go Test can be utilized as a measure of physical performance in individuals with impaired or limited mobility[24].

Management of sarcopenia currently focuses on dietary and exercises based interventions. While there is some evidence that hormones and vitamin supplementations may be beneficial for the treatment of sarcopenia, the safety and efficacy has not been well supported and is not approved by the Food and Drug Administration[25–29]. Increased dietary protein effects protein synthesis and muscle mass in a variety of ways. Higher levels of insulin-like growth factor 1 (IGF-1) have been noted with higher levels of protein intake[30]. Daily intake of 10-35 grams of protein per day spread out equally throughout the day will result in increased bioavailability for muscle repair and generation. Activation of muscle regeneration is needed to utilize these building blocks is triggered muscle contraction, especially against resistance[9]. Resistance /strength training three times per week increased the cross sectional area of type I and type II muscle fibers as well as individual muscle fiber size[31]. This counter weight can be supplied by using free weights, machines, elastic bands or the individual's own body weight.

Sarcopenia is under diagnosed and under treated among older adults, and this is particularly true among AA and those with low socioeconomic status. Currently, there is insufficient information about whether the same diagnostic criteria and assessments for sarcopenia should be used across different races. In addition to diagnostic challenges, treatment of sarcopenia is likewise challenging. There are currently no pharmacological or nutraceutical products approved for treatment of sarcopenia. It is difficult to facilitate adherence to the recommended behavioral interventions focused on high protein diets and exercise. Despite these challenges, it is vital that health care providers understand the complex nature of this geriatric syndrome and consider this as a differential diagnosis for functional changes that commonly present in patients. Given the relatively limited amount of work done exploring incidence and management of sarcopenia among AA older adults and those with low socioeconomic status, on-going research focused on sarcopenia in this at risk population is clearly needed.

Understanding the ways in which sarcopenia can be measured and establishing evidence based treatment approaches across a heterogeneous group of older adults is an important first step to facilitate prevention and management of this problem among older adults, particularly those at highest risk including low income and African American older adults.

Reliability and Validity of the Diet Self-efficacy Expectations Scale Among Low Income Older Adults

Theoretically driven interventions can effectively change behavior among low income older adults[12,32,33]. The most commonly used theoretical framework to support behavior change in older adults is Bandura's Theory of Self-Efficacy[34]. A number of scales have been developed to measure self-efficacy for diet. Many use a single response item in which participants are asked to rate how confident they are that they could consume at least five daily fruit and vegetable servings[35,36]. The Self-Efficacy for Health Related Diet contains 61 items and uses a 5-point Likert-type response scale [37]. Development of this measure was based on interviews with 40 participants (32 female, 8 male) who were 45 years of age or younger, had a child aged 8-16 living in the home, and were in the process of attempting to change dietary patterns. Reliability and validity testing has primarily been completed on middle aged (<60) or young populations [38–40]. The purpose of this study was to test the reliability and validity of a revised Self-Efficacy for Eating Behavior scale consisting of 20 items among a group of low-income older adults living in senior housing.

This study utilized data Self-Efficacy for Eating Behavior Scale, Diet Outcome Expectation and the Modified Block Brief Dietary Questionnaire data collected from studies testing the People Reducing Risk and Improving Strength through Exercise, Diet and Drug Adherence (PRAISEDD) intervention at two low-income senior housing sites[12,33]. Residents of the facility were eligible to participate if there were living in the facilities at the time of recruitment, were 65 years of age and older, could read and write English and scored a two out of three on the Mini-Cog[41]. Individuals were excluded if they had not seen a primary care provider in the past 2 years or they could not pass the Physical Activity and Screening for You (EASY) screening test [42] and the Evaluation to Sign Consent [43]. The majority of the participants were female (N=33, 60%) and either widowed or divorced (N=37, 65%). The average age of the participants was 78 years of age (SD =8.7) with a range of 65 to 95 years of age.

Evidence of reliability for the full Dietary Self-Efficacy Scale was supported by a Person Separation Index of 1.22, which was consistent with a Cronbach Alpha of 0.83. Construct validity of the Modified Self-Efficacy for Eating Behavior was evaluated by testing the Rasch measurement model and the fit of the items to the model. Based on the Rasch measurement model, there was evidence of construct validity with a good fit of each item to the measurement model. Item mapping was done to establish if the items included comprehensively addressed the concept of sodium and fat intake in diet self-efficacy. Controlling for age, gender, and race, diet self-efficacy was not significantly associated with salt intake (t= -1.37, p=0.18). Diet self-efficacy was, however, significantly associated with fat intake (t= -3.48, p=0.001) and explained 16.3% of the variance in fat intake.

The Modified Self-Efficacy for Eating Behavior demonstrated good reliability and validity when administered to older adults living in senior housing. The data fit the model indicating that the data accurately reflected the individuals' self-efficacy expectation for diet. There were several questions that would benefit from rewording in order to more accurately reflect the population. The lack of a significant association between self-efficacy expectations for sodium intake and reported sodium intake may be influenced by the use of a 24-hour diet recall measure. Challenges to accurate recall of dietary intake include being able to remember all of the food consumed, social desirability and the participants desire to provide answers that are believed to be socially desirable and acceptable or what the evaluator might want to hear. Despite its limitations, this study provides preliminary support that Modified Self-Efficacy for Eating Behavior is reliable and valid and can be used with older adults living in Senior Housing.

Impact of PRAISEDD on dietary intake, physical activity and body composition and self-efficacy in older adults living in senior housing

For individuals with obesity, the reduction of fat mass and the maintenance or increase in muscle mass can lead to improvements in morbidity and mortality and reduction in CVD risk [5]. Health related behavior such as increased physical activity (especially resistance training), increased protein intake, and reduction of dietary salt and fat content have been shown to decrease fat mass, stabilize or increase muscle mass [44,45], and decrease CVD [46]. Unfortunately, lack of resources such as access to health care, limited healthy food options in living situations and neighborhoods, cultural food preferences that are not consistent with heart healthy diets and beliefs that exercise may cause them harm in terms of exacerbation of joint pain, sensations of shortness of breath or fear of trauma/falls. Further, it is these individuals who are least likely to receive education and support to make lifestyle changes that would reduce their risk of CVD [47,48].

Interventions that target heart healthy education and community support have been shown to improve short-term adherence to heart healthy behaviors [49–51]. Social cognitive theory (SCT) is one of the major theoretical frameworks used to change behavior in older adults. SCT is a behavior change theory suggesting that the stronger the individual’s self-efficacy and outcome expectations, the more likely it is that he or she will initiate and persist with a given activity[34]. Unfortunately, when used alone, this framework has not been successful in changing behavior among groups of individuals living in single communities such as senior housing facilities or assisted living [52,53]. To optimally change behavior among older adults in senior housing we combined use of SCT with a social ecological model (SEM) as the theoretical basis for the People Reducing Risk and Improving Strength through Physical Activity, Diet, and Drug Adherence (PRAISEDD-2) intervention. The purpose of this study was to examine the impact of the PRAISEDD-2 intervention, on body composition, specifically percent body fat, dietary intake of sodium, fat and protein, and time spent in physical activity over a 24-month study period.

This was a 24-month single site quasi-experimental design study. A pre and posttest design was used to test the impact of the intervention at 3 months, 6, 12 and 24 months post intervention. Participants were recruited from a low-income senior housing facility in Baltimore, Maryland. Residents currently living in the facility were eligible to participate if they were 55 years of age or older, could read and write English and could recall 2 out of 3 words per the Mini-Cog [41]. A total of 32 residents were consented. Of the 32 consented individuals one was determined to be ineligible, and 2 consented individuals refused to participate in the intervention activities or allow for further follow up data collection after completing the baseline assessment. The remaining 29 participants completed the study and are included in data analysis.

All measures were completed via a face-to-face interview between the participants and research evaluators. Each interview took approximately 30 minutes to complete. Participant demographics were collected during the initial baseline interview and included gender, marital status, education, and race. All other measures were completed at baseline, 3, 6, 12 and 24 months. Collected measures included body composition via an Omron Full Body Composition Monitor Scale, Self-efficacy for Health Related Diet [37], Yale Physical Activity Survey (YPAS) [54], and Block Fat and Block Sodium screeners [55].

The majority of participants were female (65%), self-reported as black (73%), and had a minimum of a high school education (59%). The mean age of participants was 74 (SD=8) years old. Over half of the participants were either widowed or divorced (76%). There was a significant decrease (6.5%, p<0.001) in percent body fat initially at 3 months to an average of 28.2% (SE=1.05) which rose to 35.6% (SE=1.47) at 24 months. Overall time spent in physical activity did not significantly change across any time point. Generally the participants had a high level of baseline diet self-efficacy with a score of 16.6 (SE=0.3) and this remained consistently high across the time points through to 24 months. Weekly sodium intake at baseline was 5307.5 (SE=619) and this dropped to 3092.9mg, (SE=1098.43) at 3 months and then gradually rose to 8402.4mg (SE=2168.3) at 24 months. Weekly fat intake decreased significantly from 173.9 (SE=13.37) at baseline to 115.3gm (SE=20.52) at 3 months showing a significant decrease of 58.6gm (p=0.002). Despite a drop in protein intake from base line to 3 months of 40.6gm (SE=16.3, p=0.013) there was an overall significant increase of 142.9gms (chi-square 20.833, p=0.000) with baseline weekly intake of 148.8gm (SE=16.24) and weekly intake at 24 months being 291.8gm (SE=61.99).

The findings from this study suggest that the PRAISEDD-2 intervention helped to decrease overall percent body fat and an increase in protein intake at 3 months as well.

The changes that occurred in the early 3 month period were due to the intensive nature of the education and exercise classes during that time point. In months 4 through 24 participants outcome measures trended back to baseline which is likely a reflection of lack of an intensive ongoing motivational intervention. In addition to a decrease in exposure to motivational interventions, other reasons behind poor long term adherence to changing behavior with regard to decreasing CVD risks include a lack of belief in the outcomes (e.g., that adherence will ultimately decrease risk of stroke), inability to see immediate results from the change in behavior, a lack of focus on process/behavior versus the outcome (e.g., the importance of decreasing salt intake versus achieving a lowered BP), and the unpleasant sensations associated with behavior change such as missing the pleasure associated with eating unhealthy food choices such as fried foods[56]. Future research should build a longer self-efficacy based motivational component into the exercise classes to help build self-efficacy, outcome expectations and thereby strengthen long term adherence to adhering to the recommended diet as well as physical activity and medication use that are needed to decrease CVD risk over time. A lifetime of sedentary behavior and poor dietary choices can result in a belief that behavior change is not possible or will not result in positive health outcomes is a common reason for the low rate of sustained physical activity and heart healthy diet choices[57]. Six months of consistently engaging in healthy diet and physical activity is necessary for the behavior to become firmly established and the risk of returning to unhealthy behaviors is reduced[58]. Additionally, some barriers are outside an individual's ability to change. In this population access to fresh foods, safe walking space and a lack of social support are barriers that will specifically need to be addressed in the education and motivational components of the intervention.

Chapter 2: Assessment and Management in Sarcopenia in African American

Sarcopenia, an age related loss of muscle mass and strength[13,59], was first introduced in 1995 by Rosenberg and Roubenoff[60]. It is a complex condition caused by declines in activity, decreased protein intake, a variety of disease triggers, inflammation, declines in neuromuscular junctions, age related changes in muscle cell mitochondria, and alterations in the angiotensin system[13]. This loss of muscle mass is progressive, generalized and associated with a loss of strength and performance[16]. The diagnosis of sarcopenia is generally made based on the presence of low skeletal muscle mass accompanied by poor physical function[15]. A clinical definition of sarcopenia, however, has been challenging due to a lack of standardized measures of functional skeletal muscle mass, inability of measures of skeletal muscle mass to optimally capture functionality and a lack of consensus in the research and clinical communities[13].

In the United States, an estimated $18.5 billion dollars is spent annually on health care costs related to sarcopenia[61]. These costs are due to the clinical impact of sarcopenia and the associated loss of muscle mass and strength. Specifically, the physical changes associated with sarcopenia result in declines in physical performance, increased need for assistance with personal care activities due to progressive disability, fatigue and falls[13]. Individuals with severe sarcopenia have a 79% greater risk of disability than those with normal muscle mass[17].

Epidemiology of Sarcopenia Among Older Adults

Based on the definition of sarcopenia as a loss of muscle mass and strength, approximately 52-69% of older adults (>60 years old) have sarcopenia[14]. It is challenging, however, to find true prevalence rates, particularly in minority populations.

The African American Health Study (AAH) found a prevalence of 4% among AAs, but acknowledged that the deceptively low prevalence was likely due to sample selectivity in that the mean age of participants was 59.17 (±4.4) years of age[62]. Alternatively, the findings from the Healthy Aging in Neighborhoods of Diversity across the Life Span (HANDLS) study, which included a sample of African Americans age 51-64, reported a prevalence rate of sarcopenia that was higher with 19.6% of these individuals diagnosed as pre-sarcopenic and 10.3% were noted to have sarcopenia[63]. These rates are lower than the national average of 52-69% across all ethnicities and races[14]. This difference in prevalence rates is likely due to the sample having a primarily younger population and sarcopenia rates tend to rise with age.

The Definition of Sarcopenia and Diagnosis in Clinical Settings

Early definitions of sarcopenia were proposed as a lean mass that is less than the 20th percentile of a healthy young adult[64] or two standard deviations less than the mean for young persons[59]. However this definition only addresses loss of muscle mass, a measure that may be difficult to obtain and therefore is not practical in real world clinical settings. In real world settings, skeletal muscle mass is not commonly evaluated. Moreover, to routinely obtain an objective measure of muscle mass would be costly and is not covered by insurance, nor is it needed to refer a patient for physical therapy, dietary counseling or further medical managment[65].

To address the limitations of early definitions of sarcopenia and the lack of accepted clinical definition, the European Union Geriatric Medicine Society established a European Work Group on Sarcopenia in Older People (EWGSOP) to develop operational definitions and diagnostic criteria that could be used in real world clinical settings, as well as be appropriate for research studies[16]. An international group of scientists and geriatricians, The International Working Group on Sarcopenia (IWGS), also met during the same time to develop diagnostic criteria. Based on consensus of these two expert panels it was confirmed that the diagnosis of sarcopenia should be based on having a low muscle mass in combination with low muscle strength and performance[16,17]. An algorithm for diagnosing sarcopenia has been proposed by the EWGSOP (see Table 1)[66]. Muscle strength and performance are measures that provide vital information into not only the size of the muscle but its health and performance. The inclusion of muscle strength and performance is important as the relationship between muscle mass and strength/performance is not linear[16]. Any abnormal finding in strength or performance should be followed by a direct measure of muscle mass to establish if sarcopenia is truly present.

Measurement of Muscle Mass

The gold standard for measurement of muscle mass by volume is computed tomography (CT), dual x-ray absorption (DXA), or magnetic resonance imaging (MRI)[18]. Calculation of muscle mass through measurement of urinary excretion of creatinine has also been used[67]. The calculation of muscle mass via excretion of creatinine is challenging, however, as it requires a detailed diet record and urinary collection. While these methods are the gold standard, they are costly, not covered by insurance and, not readily available in primary care offices or community research settings. For this reason other options must be explored. One such option is bioelectrical impedance analysis.

Bioelectrical Impedance Analysis (BIA) may be reasonable alternative to the use of CT or DXA. BIA is inexpensive, easy to use, particularly in primary care settings, and found to correlate well with both MRI and DXA measures[19,20]. BIA has been well validated for both healthy subjects as well as those with chronic disease across age, sex and race[68]. BIA utilizes low level electrical impulses and measures the body's resistance to this alternating electrical current[20]. These measures are then used to calculate measures of body composition such as fat-free mass (FFM), muscle mass and percent body fat.

Identification of low muscle mass can also be made by calculating the skeletal muscle mass index (SMI). The SMI is calculated by dividing the an individual's muscle mass by their height squared[16]. A SMI less than the 20th percentile ($\leq$7.23kg/m^2 in men or $\leq$5.67kg/m^2 in women) of that of healthy young adults is considered the cut point for making a diagnosis of sarcopenia[17].

Measurement of Strength

The EWGSOP proposed three measures that can be utilized as indicators of strength: peak expiratory flow, knee flexion/extension, and handgrip[16]. Peak flow is an indication of the strength of the respiratory muscles and is proposed as an inexpensive simple technique with the potential to have prognostic value as an indication of overall strength[16]. Unfortunately this was not substantiated in clinical testing with weak correlations between handgrip strength ($r=0.326$, $p<0.001$) and knee extension strength ($r=0.411$, $p<0.001$)[69]. For this reason, the EWGSOP now recommends using peak expiratory flow as a supplementary tool rather than an isolated measure of strength[16].

Both handgrip strength and knee flexion/extension strength are direct measures of extremity strength and related to loss of total body protein[69]. Isometric handgrip strength is easily measured with a hand held dynamometer[66] and has been shown to be a strong predictor of clinical outcomes[16]. Knee flexion and extension strength can be determined using commercially available dynamometers which were noted to correlate ($r > 0.7$) with physical function measures as well as self-reported functional difficulties[21]. Cut off scores for low muscle strength for men are < 30 kg and for women they are <20kg . From a practical perspective and since grip strength and knee flexion are correlated ($r=0.75$, $p<0.001$, $n=2,468$) it is reasonable to utilize grip strength as a single measure of muscle strength in a clinical setting [22].

Measurement of Physical Performance

Both the IWGS and the EWGSOP recommended that muscle function and physical performance also be evaluated to establish evidence of sarcopenia. The recommended way in which to evaluate physical performance is to use habitual gait speed[16]. Habitual gait speed is measured by having the individual walk across a 4-meter course at a comfortable walking speed. The IWGS suggest that anyone with a habitual gait speed of less than 1meter per second should be referred for quantitative measurement of muscle mass[17]. This decision was based on evidence that in older adults small declines in usual gait speed provide an indication of onset of disability[23]. Although the EWGSOP supported the use of gait speed as a criteria for sarcopenia, the group recommended a slower gait speed of < 0.8m per second[16] as the criteria or definition of poor physical performance. This was based on a finding that a gait speed of <0.8m per second was most predictive of mobility and ADL disability within a subsequent two year period [70].

Measurement of usual gait speed can be obtained by either using a home monitoring system or a timed 6-meter walk. At home monitors[71] utilize an infrared motion sensor in a linear pattern and record a person’s typical home gait speed over an often-travelled area such as a hallway. The monitor averages the pace while walking the often-travel area over multiple days[71]. While this method provides an accurate measure of usual gait it can be expensive, time consuming, and not realistic for typical clinical practice. A more practical measure is a timed 6-meter or 6 minute walk which can be easily accomplished in most clinical settings and has previously established evidence of reliability and validity [72,73]. Detailed instructions for administration can be found at https://www.thoracic.org/statements/resources/pfet/sixminute.pdf.

For older adults with impaired or limited mobility, it has been suggested that a Timed Get Up and Go Test (TUG) be used instead of a 6 minute walk. The TUG is more easily administered measure of muscle mass in real world clinical settings with regard to sarcopenia as TUG has better predictive value for evidence of falls and disability[24], both of which are results of sarcopenia (see Text Box 1). The TUG is completed by timing the patient progressing from a seated position to standing, walking 3 meters, turning and then returning to a seated position. The task is typically preformed twice and the times are averaged. A challenge to using this measure is that no cut-points have been recommended[24] and so the clinician or researcher would need to monitor for individual changes over time.

The Short Physical Performance Battery (SPPB) is another way in which to practically measure physical performance. The EWGSOP recommended that the SPPB be used as a standard tool to measure physical performance in the evaluation of Sarcopenia with specific cut points for levels of performance (see table 2)[16]. The SPPB which is available online (at http://www.grc.nia.nih.gov/branches/leps/sppb/) is a composite of nine individual measures of physical performance including balance, strength, endurance, walking, and sit to stand. It can be used to obtain an overall conceptualization of physical performance[16]. The SPPB incorporates multiple domains of physical performance and is therefore more likely to identify clinical changes than would be detected by a single item measure. Therefore, while more time intensive to administer, the SPPB includes the usual gait speed and the activities within the TUG test and gives the most comprehensive assessment of the patient's overall performance. Lastly, the SPPB has the added advantage of having been validated in a variety of populations including older African Americans[72,73].

Management of Sarcopenia

There is some evidence that hormones such as testosterone, dehydroepiandrosterone (DHEA) and growth hormone can increase muscle mass[25,26] and thus may be effective in treating sarcopenia. Unfortunately, the efficacy and safety of use of these hormones has not been well supported and their use for sarcopenia is not approved by the Food and Drug Administration [25–27]. It has also been suggested that supplementation with vitamin D may increases muscle mass[28], although this has not been well substantiated based on multiple systematic reviews of the literature[28,29]. Research with regard to vitamin D use and impact on muscle mass and function continue, however, as smaller studies have demonstrated minor increases in strength with vitamin D supplementation[28,29,74]. There is also limited evidence to suggest that vitamin D supplementation may decrease postural sway and improve TUG scores[29].

Dietary recommendations and Protein Intake

Diet and exercise, specifically protein intake and resistance/strength training, are the key components of prevention and management of sarcopenia[15,31]. Both are necessary to maintain and increase muscle mass[75]. Increased dietary protein effects protein synthesis and muscle mass in a variety of ways. Higher levels of insulin-like growth factor 1 (IGF-1) have been noted with higher levels of protein intake[30]. This increase in IGF-1, as a result of increased protein intake, has a direct and positive effect on muscle mass. Consumption of higher levels of a leucine-enriched mix of essential amino acids may also stimulate protein synthesis through the rapamycin pathway[15]. Therefore leucine rich foods such as milk, tuna, soybeans and eggs are important components of any dietary plan to facilitate increase and maintenance of muscle mass.

Unfortunately, the all too common decline in dietary intake among older adults[15] leads to a decrease in key nutrients, specifically protein, necessary for maintenance and building muscle mass[15]. It is recommended that older adults consume 0.2-1.4g/kg of protein per day to maintain muscle mass[15,76]. The USDA recommends a protein intake of 0.8g/kg/day or 10-35 grams per day for adults[6]. 22-41% of adults older than 50 years of age consumed less than the daily recommendation of protein[61]. This is especially problematic in the African American population where up to 90% have protein deficient diets[77].

Timing of protein intake is also particularly important for older individuals. Consumption of large portions of the daily recommended allowance of protein in a single sitting may result in significant amounts not being absorbed in the gut and therefore not available for building muscle mass[8]. Daily protein intake should be spread equally throughout the day[8,61] with average sized adults consuming 30 grams at each meal. Consumption of greater than 30 grams of protein in a single meal has not demonstrated higher levels of muscle synthesis[8]. Protein intake can be augmented with high protein between meals or a protein supplement such as a protein rich beverage. There are many commercially available products such as Special K Protein Shake (10g), Odwalla Super Protein (15g), and GNC Total Lean Shake (25g).

While a dietary intervention as part of a management plan is important, evidence of its effect alone on muscle mass is inconsistent[78–80]. Adequate protein intake is vital to the maintenance of muscle mass however, dietary intervention alone is not sufficient. Activation of muscle regeneration is needed to utilize these building blocks. Physical activity, specifically resistance/strength training, is the most direct, easily implemented method to stimulate protein synthesis[44]. While ensuring consumption of protein thought the day is important, consuming the protein prior to exercise provides an added benefit. Multiple studies have found increased muscle mass when subjects consumed a protein supplement prior to resistance training as compared to after resistance training[81–83]. Additionally, ingestion of at least 30 grams of protein 60 minutes prior to strength training exercise produces a 2 fold greater increase in muscle synthesis than protein intake alone[84].

Resistance/Strength Training and Muscle Mass

Increased physical activity, specifically aerobic exercise, has been stressed as part of a healthy life style. For example, The American Heart Association and the World Health Organization have national campaigns to encourage aerobic activity to optimize cardiovascular health. Aerobic exercise improves cardiorespiratory fitness and decrease overall body weight[85] but has limited effect on muscle mass or strength. To increase muscle mass and strength, resistance or strength training activities [86] are needed. Muscle contraction, especially against resistance, results in activation of satellite cells and the myogenic regulatory factors that play a key role in the generation of new multinucleated myofibers important in skeletal muscle hypertrophy[9]. Studies have shown that resistance training, done for 30 minutes 3 times per week, increases both muscle strength and mass[87,88]. Resistance /strength training three times per week increased the cross sectional area of type I and type II muscle fibers as well as individual muscle fiber size[31]. Resistance/strength training consists of a variety of range of motion movements against a counter weight or resistance[31]. This counter weight can be supplied by using free weights, machines, elastic bands or the individual's own body weight.

Challenges in Sarcopenic Management in Older African Americans

Despite the clear benefits of both aerobic and resistance exercise, older adults spend an average of 60% or greater of their time in sedentary behaviours[10]. This is especially true in older African Americans. Several studies have shown that older African Americans are less physically active than other ethnicities[1,89] with Caucasians being 1.2 times more likely to meet physical activity recommendations than African Americans[90]. African Americans are less likely to meet recommended levels of moderate or vigorous physical activity than their Caucasian counterparts[1] and have a 19-50% lower energy expenditure from physical activity[91]. Research focusing on exercise among African Americans has primarily focused on cardiovascular or aerobic types of exercise as a function of weight management and cardiovascular disease risk reduction. As with all older adults, African Americans most commonly report walking for leisure or transportation[91] . Walking, while beneficial for aerobic purposes, provides little benefit in terms of helping to maintain or increase muscle mass. It may be particularly critical to encourage older African Americans to engage in combined exercise programs that includes aerobic as well as resistance training such as those recommended by the

National Institute of Aging[92]. The NIA resource provides an easy to follow and comprehensive combined aerobic, resistive and balance exercise program for older adults to follow.

Summary / Conclusion

Sarcopenia is a complex disorder that impacts quality of life. Sarcopenia is under diagnosed and under treated among older adults, and this is particularly true among AA. Currently, there is insufficient information about whether the same diagnostic criteria and assessments for sarcopenia should be used across different races. In addition to diagnostic challenges, treatment of sarcopenia is likewise challenging. There are currently no pharmacological or nutriceutical products approved for treatment of sarcopenia. It is difficult to facilitate adherence to the recommended behavioural interventions focused on high protein diets and exercise. Despite these challenges, it is vital that health care providers understand the complex nature of this geriatric syndrome and consider this as a differential diagnosis for functional changes that present in patients. Given the relatively limited amount of work done exploring incidence and management of sarcopenia among AA older adults, on-going research focused on sarcopenia in older AA adults is clearly needed. Establishing practical diagnostic measures of sarcopenia and optimal treatment approaches across a heterogenous group of older adults will help facilitate successful aging among these individuals nationally and internationally.

Table 1: Diagnosis algorithm for Sarcopenia[66]

Muscle Function or Strength

- Gait Speed ≥0.8ms^{-1} – STOP No Sarcopenia
- Gait Speed <0.8ms^{-1} – DXA/BIA
- OR
- Grip Strength
  - Women
    - > 19.3 kg – STOP No Sarcopenia
    - ≤ 19.3 kg – DXA/BIA
  - Men
    - > 30.3 kg – STOP No Sarcopenia
    - ≤ 30.3 kg – DXA/BIA

Muscle Mass

- Women
  - <5.67 kgm^{-2} = Sarcopenia
  - ≥5.67 kgm^{-2} = No Sarcopenia
- Men
  - <7.25 kgm^{-2} = Sarcopenia
  - ≥7.25 kgm^{-2} = No Sarcopenia

Table 2: Criteria for Physical Performance based on the SPPB[16]

Low Performance	• SBBP 0-6
Intermediate Performance	• SBBP 7-9
High Performance	• SBBP 10-12

Text Box 1

- Equipment Needed
    - Stopwatch/timer
    - Worksheet for counting laps
    - Chair that can be easily moved along the course
    - Emergency equipment (according to local policy)
- Measure a 30 meter section of straight, unimpeded walking space
- Markers should be place at the endpoints and at 3 meter intervals along the route
- Prior to testing – participant should sit for at least 10 minutes
- Instruct the participant to walk as far as they can (back and forth on the marked course) for 6 minutes. Rest breaks are permitted as necessary
- Each minute provide timing updates and encouraging comments such as “Keep up the good work” (Do not influence gait speed.)
- After 6 minutes the participant should stop and the distance walked recorded.

Chapter 3: Reliability and Validity of the Diet Self-efficacy Expectations Scale

Among African American and Low Income Older AdultsHeart Healthy diets have been shown to lower blood pressure and reduce cardiovascular and metabolic risk[93]. Currently, the 2010 USDA Dietary Guidelines for Americans recommends a daily intake of less than 1500 grams of sodium for individuals over the age of 50[94]. The World Health Organization and the 2010 USDA Dietary Guidelines for Americans recommend a cholesterol intake of less than 300mg per day[95]. It has been shown that greater than 98% of the United States population is not meeting this goal and approximately 60% of adults over the age of 50 consume greater than 3,000mg of sodium daily[96].

Unfortunately, despite evidence supporting behavioral interventions as a way to prevent and treat cardiovascular disease (CVD), 36.7% to 88.8% of older adults do not adhere to heart healthy diets (ref CDC data). Low income older adults have a greater than threefold higher mortality rate for stroke and CVD compared to high and middle income adults [97]. Adoption and adherence to CVD prevention behaviors, specifically adhering to diets that are low in salt and fat, is particularly challenging among these individuals. Major challenges include inconsistent support/encouragement from family and community members, lack of recreational facilities, healthy food options, medical resources, taste preferences, convenience, cost, cultural preferences, and not knowing how to appropriately change their diet [11].

Theoretical Support for Behavior Change

Theoretically driven interventions have been shown to effectively change behavior among minority older adults [12,32,33]. The most commonly used theoretical framework to support behavior change in older adults is Bandora's Theory of Self-Efficacy [34]. The theory of self-efficacy differentiates self-efficacy expectations, which are beliefs in the individual's capability to perform a course of action to attain a desired outcome, and outcome expectations, which are the beliefs that a certain consequence will be produced by personal action. Specifically, the theory of self-efficacy states that the stronger one believes in his or her ability to engage in a behavior and believes there are benefits to performing the behavior, the more likely he or she will initiate and adhere to that behavior. Four sources of information have been shown to strengthen self-efficacy expectations including: (1) performance of the behavior; (2) verbal encouragement; (3) role modeling; and (4) elimination of unpleasant sensations [98,99].

A number of scales have been developed to measure Self-Efficacy for Diet. Many use a single response item in which participants are asked to rate how sure they were that they could consume at least five daily fruit and vegetable servings [35,36]. Vereecken, Damme and Maes [100] developed a Self-Efficacy for diet in children which was also used in and validated in college age females [101]. Other scales have been developed to address specific areas of diet that relate to a given diagnosis such as The Cholesterol-Lowering Diet Self-Efficacy Scale [38,102], Self-Efficacy for Restricting Dietary Salt in Hemodialysis [39] and The Diabetes Self-Efficacy Scale [103]. However these measures focus only on the consumption of fruits and vegetables rather than healthy dietary behaviors to reduce CVD and they do not address the full spectrum of challenges associated with heart healthy diets among minority older adults. Additionally these measures were only validated in a relatively young and primarily Caucasian population.

The only diet measure to consider a broader range of heart healthy dietary behaviors is the Self-efficacy for Health Related Diet, a 61 item measure [37]. Development of this measure was based on work done with 40 participants (32 female, 8 male) who were 45 years of age or younger, had a child aged 8-16 living in the home, and in the process of attempting to change dietary patterns. Items were initially generated via an individual 1 hour structured interview using a series of fixed open ended questions about various behaviors they used to adhere to heart healthy diet and exercise habits. Additionally all 40 participants were asked about challenges to initiate and maintain the behavior change. The results of these interviews were used to construct 89 items specifically geared to measuring self-efficacy for diet related behavior. Each item was constructed as a 5-point Likert-type scale. Participants were asked to rate their confidence that they could motivate themselves to adhere to the given behavior for the next 6 months. Scores ranged from 1 ("Sure I could not do it") to 5 (Sure I could do it). Participants also had the option to respond, "does not apply".

This initial 89-item Self-Efficacy for Eating Behaviors Scale was administered to 171 participants (mean age of 21.3 years of age, SD=6.5). A Principle-component analysis was done and the 89 items were reduced to 61 items with 5 factors (resisting relapse, reducing calories, reducing salt, reducing fat, and behavioral skills). Together these five factors accounted for 44% of the variance in diet self-efficacy. To test reliability, the scale was administered to a subgroup of 52 participants 1-2weeks later for reliability testing. Test-retest reliabilities for each of the subscales within the Self-Efficacy for Eating Behavior ranged from 0.43 – 0.64 ($p<0.001$) [37]. This scale has been widely used as the bases for measurement of Self-Efficacy in a variety of interventional studies to improve participants' eating behavior. However additional reliability and validity testing has primarily been completed on middle aged (<60) or young populations [38–40] rather than older adults living in subsidized housing. The purpose of this study was to test the reliability and validity of the Modified Self-Efficacy for Eating Behavior, a modified version of the original Self-Efficacy for Eating Behavior, which focuses on eating behavior to reduce CVD risk.

Methods

Design

This study utilized data collected from two studies testing the PRAISEDD intervention. The PRAISEDD intervention focused on decreasing CVD risk via three heart healthy behaviors: diet, exercise and medication adherence [12,33]. The intervention has been described in detail elsewhere and described as noted in Table 1. Baseline data collected in both studies was used for this analysis.

Sample

The participants from both studies were recruited from senior housing facilities (Resnick et al., 2009; Resnick et al., 2014). Residents were eligible to participate in the studies if they were living in the facilities at the time of recruitment, were 65 years of age and older, could read and write English and scored a 2/3 on the Minicog (Borson et al, 2003). Individuals were excluded if they had not seen a primary care provider in the past 2 years or they could not pass the Physical activity and Screening for you (EASY) screening test [42] or the Evaluation to Sign Consent. Across both studies a total of 57 individuals participated. The majority of the participants were female (N=33, 60%) and either widowed or divorced (N=37, 65%). The average age of the participants was 78 years of age (SD =8.7) with a range of 65 – 95 years of age.

Procedure

Following consent, participants completed a face-to-face survey with research evaluators to obtain all data. Interviews were set up at a time that was convenient for the participant. Study personnel conducted individual interviews with participants and entered responses onto the survey forms.

Measures

Descriptive data included age, gender, race, marital status, and educational level. In addition to descriptive data, participants completed the Modified Self-Efficacy for Eating Behavior, Diet Outcome Expectation and the Modified Block Brief Dietary Questionnaire.

This original Self-Efficacy for Eating Behaviors Scale was revised in an effort to decrease the time burden on participants as well as to more specifically target items that focused on dietary issues related to reducing cardiovascular disease risk. The original 61 items were reviewed and questions that specifically are related to older adults living in subsidized housing, addressed decreasing CVD risk, and are related to DASH dietary guidelines were identified for inclusion in the revised scale. Specifically, nine items were selected from the “resisting relapse” factor, 3 from the “reducing salt” factor, 5 from the “reducing fat” factor, and 3 from the “behavioral skills” factor. One additional item not included in the original measure was added (How confident are you that you can maintain a low fat low salt diet if only high fat, high salt foods are all that is available to you?) based on dietary challenges identified through work with older African Americans (AA).

These revisions resulted in a 20-item Likert based Modified Self-Efficacy for Eating Behavior.

Diet Outcome Expectations was measured with a single question. Participants were asked, "On a scale of 0 to 10, 0 being the least confident to 10 being the most confident, how confident are you that adhering to a low fat, low sodium diet will help you prevent a stroke?" Dietary intake was measured utilizing the Modified Block Brief Dietary Questionnaire (http://nutritionquest.com/). Participants were asked to recall the portion and number of times they ate specific food over the past week. These values were then used to calculate sodium and cholesterol content based on the United States Dietary Association National Nutrient Data Base.

Data Analysis

Descriptive statistics were done using SPSS and psychometric testing was done using Rasch analysis via Winsteps program. Specifically, reliability was based on internal consistency calculated based on the Person Separation Index. The Person Separation index addresses how well the scale being tested is able to separate individuals into ability level or in this case the amount of dietary self-efficacy. The Person Separation Index is similar to the traditional alpha coefficient with 0.7 or greater considered as evidence of reliability.

Validity Testing

Construct validity of the Modified Self-Efficacy for Eating Behavior was evaluated by testing the Rasch measurement model and the fit of the items to the model. Item fit was based on INFIT and OUTFIT statistics. INFIT and OUTFIT statistics are based on a chi-square statistics. INFIT and OUTFIT scores were deemed acceptable if they were between 0.6 and 1.4 [104]. If the item is very difficult relative to the examinee's ability level, the probability of a correct response will be low. INFIT statistics are sensitive to unexpected behavior affecting responses to items near the persons' ability level. Conversely, OUTFIT statistics are more sensitive to unexpected observations by persons on items that are very easy or hard.

In addition to fit statistics, item mapping was done to establish if the items included comprehensively addressed the concept of sodium intake in diet self-efficacy. Item mapping via Rasch model transforms raw item difficulties and raw person scores to equal interval measures of logits on a line in a "meter stick." The equal interval measures transformed by the Rasch Model are used to map items onto a linear interval scale. The mapping results in establishing the difficulty of each item and comparisons between item difficulties. In addition, mapping helps to determine if there are individuals that are particularly high or low in the trait (e.g., diet self efficacy) that could not be differentiated by the items currently included in the measure [104].

Finally, a linear regression model was tested using SPSS software. Controlling for age, gender and race using a blocked regression approach, the amount of variance accounted for by diet self-efficacy for sodium and fat intake was evaluated. Decisions about variable significant were based on an entry level of a p= 0.05 and removal at 0.1.

Results

Of the 57 participants that completed the study, 51 completed the Self-Efficacy Expectations for Diet Survey and were included in this analysis. Total Modified Self-Efficacy for Eating Behavior scores ranged from 6 – 20 with a mean of 16.3 and a standard deviation of 3.6. One item (Eat chicken or fish rather than red meat for dinner) was endorsed by all participants (i.e., all participants were confident that they would eat chicken or fish rather than agreed with the items). Participant agreement of the remaining items varied from 7% - 49%. Frequencies for the number of participants who agreed with a specific item are provided in table 3.

Reliability and Validity Testing

Evidence of reliability for the full Dietary Self-Efficacy Scale was supported by a Person Separation Index of 1.22, which was consistent with a Cronbach Alpha of 0.83. The Rasch measurement model was used to test construct validity and showed a good fit of the items to the measurement model. Fit statistics are provided in Table 3. The INFIT statistics ranged from 0.63(-2.4) for item number 8 (Somebody offers you a high fat, high salt food) to 1.29(0.7) for item number 17 (Choose baked, broiled, barbecued, or steamed food instead of fried food). OUTFIT statistics ranged from 0.6 (-1) for item #7 (You have visitors in your home) to 2.63(1.3) for item #17 (Choose baked, broiled, barbecued, or steamed food instead of fried food). All items had appropriate OUTFIT statistics with the exception of #5 which was – 1.49(0.9) (You are alone and there is no one to watch you), #8 – 0.53(-1.9) (Somebody offers you a high fat, high salt food, #14 – 1.53(0.8) (Substitute low fat or nonfat milk for whole milk), #17 – 2.63(1.3) Choose baked, broiled, barbecued, or steamed food instead of fried food and #18 – 1.57(1.2) (Read and understand food labels for fat content).

Results of Item mapping are shown in Table 3 below. The most difficult item to endorse/agree with was item #4, “Only high fat, high salt foods are all that is available to you” with only 25% of participants agreeing with this item. The easiest item to endorse was item #16, “eat chicken or fish rather than red meat for dinner” with 100% of participants agreeing with this item. Twenty-two out of 51 participants (43%) scored high on the self-efficacy for diet measure and based on the items in this measure could not be differentiated.

Controlling for age gender and race, diet self-efficacy was not significantly associated with salt intake (t= -1.37, p=0.18). Diet self-efficacy was, however, associated with fat intake (t= -3.48, p=0.001) and explained 16.3% of the variance in fat intake.

Discussion

The Modified Self-Efficacy for Eating Behavior demonstrated good reliability and validity when administered to older adults living in senior housing. Data fit the model indicating that the data accurately reflect the level of individuals' self-efficacy expectation for diet. All of the items INFIT statistics were within the accepted range indicating that respondents' answers were in line with actual abilities. Four items had OUTFIT statistics that were outside the acceptable range. High or low OUTFIT statistics are less of a threat to measurement than high or low INFIT statistics. OUTFIT statistics evaluate the sensitivity of the item to responses far from the ability of the person, thus being less relevant or important [104]. In addition, there was some evidence that reported dietary intake was related to their level of self-efficacy expectation for diet.

The endorsement of Question 14, substitute low fat or nonfat milk for whole milk may be less related to self-efficacy expectation for diet and more to societal trends. According to the USDA the consumption of milk in general and more specifically whole milk has dropped significantly since 1970. The ability of this item to better differentiate ability may be enhanced by adding other dairy products such as cheese to the item.

Cheese consumption has risen in the past 40 years and not as readily available in a low or non-fat option.

Item number 18 (Read and understand food labels for fat), which had high OUTFIT results, might be strengthened by revising it to state “Read and understand food labels for total fat content”. Conversely, the item that asked about ability to understand food labels with regard to sodium content (number 19) fit the model well. It is likely that the reason for these differences is due to the fact that salt content on food labels is very straight forward with labels stating number of milligrams contained in the food and the percentage of the daily recommended allowance. Fat content on the other hand provides information on total fat, saturated fat, trans fat, and cholesterol. Rewording the question to ask only about how confident they are to read and understand food labels for total fat content may improve the items fit.

Rewording of item 5 may likewise help to strengthen the reliability and validity of this measure. Simplifying item 5 from “you are alone and there is no one to watch you” to “When you are home alone” may make it easier to understand and improve the fit of the item. Simplifying item 17 from “Choose baked, broiled, barbecued, or steamed food instead of fried food” to “Choose baked or broiled food instead of fried” may also make it easier to understand and improve the fit if the item. This also targets the choices that are low in fat and sodium as the addition of Bar-B-Qu sauce adds approximately 180mg of sodium.

Finally item #16, eat chicken or fish rather than red meat for dinner, was endorsed by all participants providing no variance in the item. This endorsement may be due to cost as chicken is less expensive than red meat and the participants lived in subsidized senior housing and there for had limited financial resources. While this item could be reworded to exclude fried options, choosing baked over fried foods is captured in item 17 as discussed above. This item should be removed from the tool.

The lack of a significant association between self-efficacy expectations for sodium intake and reported sodium intake may be influenced by the challenges associated with accurate recall of food and particularly sodium intake. On average participants reported consuming approximately 5,386 milligrams (200 – 13720 milligrams) of sodium per week. Intake was determined using a self-report of the past week's intake and here are known challenges with accurate recall of dietary intake (Freedman et al., 2014). These challenges include such this as memory and social desirability and the tendency to ant to provide the answers that the evaluator might want to hear and thus to leave out the foods that might be particularly high in sodium. The other confounding factor is that average sodium values for categories of foods were used to calculate sodium intake and does not account for individuals selecting items that are particularly low in sodium rather than the regular item.

Study Limitations

There were several limitations of this study. This was a small sample of mostly AA older adults all of who lived in one of two, urban senior housing facilities. Testing was done during a single one time evaluation and we did not evaluate the reliability of the measure over time. Most notably, the majority of the sample had a high level of dietary self-efficacy. This limits ability to determine how helpful the scale is in differentiating individuals with lower levels of self-efficacy. Finally, data was all based on self-report and recall which, as noted, may not be accurate. Future research needs to test this measure following some minor revisions using a larger more heterogeneous sample of older adults across multiple regions and cultures. Despite its limitations, this study provides preliminary support that Modified Self-Efficacy for Eating Behavior is reliable and valid in older adults living in Senior Housing.

Table 3: Item Mapping

#	Item	Agree	Disagree	InFit	OutFit	Mapping
		N(%)	N(%)	MNSQ (ZSTD)	MNSQ (ZSTD)	
1	You feel depressed, bored or tense	42	9	0.83 (-0.7)	0.76(-0.4)	10
2	There is high fat, high salt food readily available	32	19	1(0.1)	0.98(0.0)	19
3	Eating with friends and family	40	11	0.88 (-0.5)	1.06(0.3)	15
4	Only high fat, high salt foods are all that is available to you	25	26	1.08 (0.6)	0.94(-0.1)	20
5	You are alone and there is no one to watch you	7	44	0.91 (-0.2)	1.49(0.9)	8
6	You feel too lazy to prepare something healthy	33	18	1.08 (0.5)	1.02(0.2)	18
7	You have visitors in your home	41	10	0.69 (-1.4)	0.6(-1)	13
8	Somebody offers you a high fat, high salt food	36	15	0.63 (-2.4)	0.53(-1.9)	17
9	Someone eats a high fat, high salt food in front of you	38	13	0.76 (-1.2)	0.6(-1.3)	16
10	Eat unsalted peanuts, chips, crackers, pretzels, cereals, cheese, and other items	41	10	1.11 (0.5)	1.24(0.7)	13
11	Avoid adding salt at the table	45	6	1.08 (0.4)	0.8(-0.1)	6

	Table 3 Continued					
12	Buy fewer high salt snack items	42	9	0.88 (-0.4)	0.73(-0.5)	10
13	Eat a meatless dinner	46	5	1.08 (0.3)	0.75(-0.1)	5
14	Substitute low fat or nonfat milk for whole milk	47	4	1.36(1)	1.53(0.8)	3
15	Cut down on gravies and cream sauces	45	6	1.12 (0.5)	0.92(0.1)	6
16	Eat chicken or fish rather than red meat for dinner	51	0			1
17	Choose baked, broiled, barbecued, or steamed food instead of fried food	49	2	1.29 (0.7)	2.63(1.3)	2
18	Read and understand food labels for fat content	42	9	1.3(1.2)	1.57(1.2)	10
19	Read and understand food labels for sodium content	43	8	1.19 (0.8)	0.94(0.1)	9
20	Say encouraging things to yourself if you begin to slip into bad high fat, high salt food habits	47	4	0.89 (-0.2)	0.93(0.2)	3

Chapter 3: Feasibility and Impact of PRAISEDD on dietary intake, physical activity and body composition and self-efficacy in older adults living in senior housing

Cardiovascular disease (CVD) and obesity disproportionately affect low-income adults, especially African-Americans [105]. For individuals with obesity, the reduction of fat mass and the maintenance or increase in muscle mass can lead to improvements in morbidity and mortality and reduction in CVD risk [5]. Health related behavior such as increased physical activity (especially resistance training) and increased protein intake[44,45] and reduction of dietary salt and fat content have been shown to decrease fat mass and decrease CVD [46].

Lack of resources such as access to health care, limited healthy food options in living situations and neighborhoods, cultural food preferences that are not consistent with heart healthy diets, and beliefs that exercise may cause them harm in terms of exacerbation of joint pain, sensations of shortness of breath or fear of trauma/falls serve as barriers to reduction in CVD risk. In addition, there is often inconsistent support from family, friends and even health care providers or workers in senior housing facilities in terms of encouraging adherence to heart healthy behaviors [33]. Furthermore low income adults are least likely to receive education and support to make lifestyle changes that would reduce their risk of CVD [47,48]. For these reasons the development of culturally sensitive programs that target health related behaviors, specifically diet and physical activity, are needed to prevent or manage CVD in this vulnerable population.

Interventions that target heart healthy education and community support improve short-term adherence to heart healthy behaviors [49–51]. Social cognitive theory (SCT) is one of the major theoretical frameworks used to change behavior in older adults. SCT is a behavior change theory suggesting that the stronger the individual's self-efficacy and outcome expectations, the more likely it is that he or she will initiate and persist with a given activity[34]. Self-efficacy expectations are the individual's beliefs in his or her capabilities to perform a course of action to attain a desired outcome; outcome expectations are the beliefs that certain consequences will be produced by personal action. Efficacy expectations are dynamic and enhanced by four mechanisms: (1) successful performance of the activity; (2) verbal encouragement; (3) seeing like individuals perform the activity; and (4) elimination of unpleasant physiological and affective states associated with the activity [98].

When used alone, this framework has not been successful in changing behavior among groups of individuals living in communities such as senior housing facilities or assisted living [52,53]. When used alone, SCT focuses on persuading individuals to change without adequate consideration of environments, organizational policies and/procedures, attributes of the innovation, and the social systems in which dissemination and implementation occur. To optimally change behavior among older adults in a senior housing community we combined SCT with a social ecological model (SEM) as the theoretical basis for People Reducing Risk and Improving Strength through Physical Activity, Diet, and Drug Adherence (PRAISEDD-2) intervention. The SEM includes intrapersonal (e.g., physical disease and capability), interpersonal (e.g., trainer and resident-to-resident interactions), environmental (e.g., clear pathways for walking), and policy factors (e.g., inclusion of healthy food options and eating events) that influence behavior. SCT guides the interpersonal interactions that motivate direct care workers and residents.

Utilizing both the Social Cognitive Theory and the Social Ecological Model we developed and tested the PRAISEDD-2 intervention. PRAISEDD-2 provides education and regular ongoing instruction and exercise programs to low income older adults to improve health related behavior to reduce CVD risk. The intervention focused on intrapersonal, interpersonal, environment and policy factors within the setting (Table 4). These activities included educational classes on diet and physical activity, regular group exercise programing, free blood pressure checks, ongoing educational support and assistance with personal goal setting. The primary study outcomes were strengthening self-efficacy and outcome expectations and improving behavior across three behaviors known to prevent and manage CVD: adhering to a heart healthy diet, regular exercise, and prescribed medication adherence to control hypertension and dyslipidemia at 3, 6, 12, and 24 months post implementation of the intervention [33]. The purpose of this study was to examine the feasibly and impact of the PRAISEDD-2 intervention, on body composition, specifically percent body fat, dietary intake of sodium, fat and protein, and time spent in physical activity over a 24-month study period. It was hypothesized that participation in the PRAISEDD-2 intervention would result in increased diet self-efficacy leading to decreased consumption of fat and sodium, increase time spent in physical activity and thereby resulting in a decreased percentage of body fat at 3, 6, 12 and 24 months post implementation of PRAISEDD-2.

Methods

Design

This was a 24-month single site quasi-experimental design study. A longitudinal design was used to test the impact of the intervention at baseline and 3, 6, 12 and 24 months post intervention. The study was approved by a University based Institutional Review Board.

Sample

Participants were recruited from a low-income senior housing facility in Baltimore, Maryland. Residents currently living in the facility were eligible to participate if they were 55 years of age or older, could read and write English and could recall 2 out of 3 words per the Mini-Cog [41]. Residents were excluded if the were unable to pass the Evaluation to Sign Consent [43] or the Exercise and Screening for You (EASY) Screening Tool [106].

Residents were invited, via fliers distributed by facility staff, to learn about the study during a single meet and greet session held at the senior housing site. Fifty-four out of 200 (27% of the total residents) residents attended this meet and greet session. Forty-two of these attendees remained to discuss participation with research staff. A total of 32 residents provided consent (59% of the total “meet and greet” attendees) with the remaining 10 individuals declining to participate. Of the 32 consented individuals one was determined to be ineligible, and 2 consented individuals refused to participate in the intervention activities or allow for further follow up data collection after completing the baseline assessment. The remaining 29 participants completed the study and are included in data analysis.

The PRAISEDD-2 intervention (Table 4) consisted of two phases. Phase I, which occurred during the first week of the intervention period, focused on education. Three classes were provided to address each of the behavior areas (diet, exercise and medication adherence). The classes focused on strengthening self-efficacy for diet (low sodium and low fat), exercise and medication adherence and improving adherence to these behaviors and thereby optimally managing CVD. Interventions to strengthen self-efficacy included verbal support and encouragement, praise for attending and participating activities, and reinforcing positive outcomes such as improved blood pressure or being able to be more active. In addition to using the sources of information known to strengthen self-efficacy as established by Bandura (1997), these activities also addressed intrapersonal barriers such as low motivation [107], and interpersonal barriers commonly noted in this population by providing extensive social support [108] as well as being culturally sensitive [109]. The education was provided on three different days with an hour devoted to each area. Educational materials were developed by an interdisciplinary team that included advanced practice nurses, an exercise trainer and a pharmacist with expertise in working with low income individuals with CVD. The educational sessions were provided by an advanced practice nurse with expertise in cardiovascular health and behavior change.

Phase I also involved providing exercise classes two days a week for three months. Exercise classes were 60 minutes in length and include a warm up, resistance training, aerobic dance, and a cool down. A lay trainer and an advanced practice nurse led the classes. Prior to the exercise activities the advanced practice nurse checked the participants' blood pressures and reinforced key points presented during the educational classes, as well as motivational support using self-efficacy based approaches. For example, the advanced practice nurses provided individualized verbal support and encouragement to continue to adhere to diet and medication, and exercise goals. Individuals were praised for attending and participating activities, and reinforcement was provided for evidence of positive outcomes such as improved blood pressure or being able to be more active.

Measures

All measures were completed via a face-to-face interview between the participants and research evaluators. Each interview took approximately 30 minutes to complete. Participant demographics were collected during the initial baseline interview and included gender, marital status, education, and race. All other measures were completed at baseline, 3, 6, 12 and 24 months. Body composition measures were obtained via an Omron Full Body Composition Monitor Scale. This scale utilized full bioelectrical impedance analysis (BIA) with 4-point sensor (hand to foot). BIA has been well validated for both healthy subjects as well as those with chronic disease across age, sex and race [68]. This scale provided information on total body fat percentage and body-mass index (BMI). BMI was calculated as weight (kilograms) divided by height (centimeters) squared. Height used in the calculation of BMI was self-reported by the participant.

Diet self efficacy was evaluated utilizing the Self-efficacy for Health Related Diet [37]. This is a 20-item measure that asks individuals to state if they believe that they can adhere to a low fat, low salt diet in a variety of challenging situations such as when they feel bored or when others are eating high salt or high fat food in front of them. This measure includes 5 subscales: revisiting relapse, reducing calories, reducing salt, reducing fat and behavior skills related to eating a healthy diet. Prior research established the reliability and criterion validity of the of the Self-efficacy for Health Related Diet (r=0.24-0.43) [12].

Total physical activity was measured using the Yale Physical Activity Survey (YPAS) [54]. This survey includes five categories of physical activity: housework, yard work, caretaking, moderate intensity physical activity and recreation activities. Participants were asked to report the number of minutes that they engaged in each activity over the past week. These amounts were then summed to provide a total number of minutes engaged in any physical activity in the prior week. Validity of the YPAS was demonstrated based on a significant correlation with physiological measures indicative of habitual activity [54] as well as with other physical activity surveys [110].

Intake of protein, sodium and fat was calculated using the Block Fat and Block Sodium screeners [55]. These two screeners were combined into one 25-item questionnaire. Participants were asked to report the amount of a variety of foods consumed over the past week. The total grams of protein and fat and milligrams of sodium from each food source consumed over the prior week were calculated using estimates established by the United States Department of

Agriculture. Evidence of validity of this measure was established based on positive correlations with fat (r=0.6-0.7; p<0.001) and sodium intake (r=0.75; p<0.001) [111].

Data Analysis

Descriptive analysis of the data was done at each time point with regard to demographics and baseline variables to assess potential bias created by differential attrition. Generalized estimating equations (GEE) were used to perform repeated measures analyses with outcome measures as the dependent variable. An intention-to-treat (ITT) paradigm was followed. For each outcome, exploratory analyses (scatterplots, frequencies, and boxplots) were performed to assess model assumptions. All tests were one-sided with a 5% significance level.

Multiple imputation was utilized to predict all incomplete variables within the data set through the GEE process. Little's MCAR test showed that the data were not missing completely at random (MCAR). However the high rate of missing variables (10-79% with higher rates of missing data at later time points) creates difficulty in accurately determining randomness. Comparison of outcome variables at baseline failed to demonstrate any significant differences between participants who completed 24-month data compared to those who did not complete the 24-month data (see table 6).

Results

The majority of participants were female (65%), self reported as black (73%), and had a minimum of a high school education (59%). The mean age of participants was 74 (SD=8) years old. Over half of the participants were either widowed or divorced (76%). Complete demographic information is provided in Table 5.

Body composition at baseline showed that participants had on average 33.5% (SE=0.46) percent body fat. There was a significant decrease (6.5%, p<0.001) in percent body fat initially at

3 months to an average of 28.2% (SE=1.05) which rose to 35.6% (SE=1.47) at 24 months. Overall time spent in physical activity did not significantly change across any time point with time spent in physical activity being 800.7 minutes per week (SE=99.08) at baseline, 848.5 (SE=94.35) at 3 months, 636.7 (SE=77.65) at 6 months, 495.9 (SE=81.82) at 12 months, and 758.5 minutes (SE=108.24) at 24 months. Generally, the participants had a high level of baseline diet self-efficacy with a score of 16.6 (SE=0.3) and this remained consistently high across the time points through to 24 months. (See table 7)

Weekly sodium intake at baseline was 5307.5mg (SE=619) and this dropped to 3092.9mg, (SE=1098.43) at 3 months, and was 4186.5mg (SE=728.76) at 6 months and 8402.4mg (SE=2168.3) at 24 months. Weekly fat intake decreased significantly from 173.9 (SE=13.37) at baseline to 115.3gm (SE=20.52) at 3 months showing a significant decrease of 58.6gm (p=0.002). Weekly fat intake was stable at 6 months (115.6gm, SE=17.93). Fat intake then rose 66.1gm (p=0.04) to 181.3 (SE=31.25) at 12 months then rose to 209.4gm (SE=44.5) at 24 months (p=0.12). Despite a drop in protein intake from base line to 3 months of 40.6gm (SE=16.3, p=0.013) there was an overall significant increase of 142.9gms (chi-square 20.833, p=0.000) with baseline weekly intake of 148.8gm (SE=16.24) and weekly intake at 24 months being 291.8gm (SE=61.99).

Discussion

The findings from this study suggest that the PRAISEDD-2 intervention helped to decrease percent body fat, sodium and fat intake, and increase in protein intake at 3 months. Despite these initial improvements noted at 3 months participants' dietary intake sodium and percent body fat essentially returned to baseline by 24 months. The changes that occurred in the early 3 month period were due to the intensive nature of the education and exercise classes during that time point. In months 4 through 24 exercise classes were still offered in the setting but there was only a monthly motivational intervention.

In addition to a decrease in exposure to motivational interventions, other reasons behind poor long term adherence to changing behavior with regard to decreasing CVD risks include a lack of belief in the outcomes (e.g., that adherence will ultimately decrease risk of stroke), results are not always tangible and do not occur quickly, a lack of focus on process (e.g., decreasing salt intake versus lowering BP), and missing pleasure associated with unhealthy food choices such as fried foods [56]. This decrease in adherence to heart healthy behaviors and return to base line is seen in other studies that follow participants after the intensive intervention period is over [112,113].

Participants' baseline sodium intake on average was 76mg of sodium daily. While intake varied across all time points the highest average daily sodium was 1,200mg at 24 months. This is below the ambitious goal of 1,500mg that is recommended by the American Heart Association [105]. While these results are commendable, the accuracy of reporting must be questioned. There are known issues with self-report of intake including poor delayed recall, social desirability and participants desire to provide answers that the evaluator might want to hear [114–116]. Another issue may have been that participants did not report all food types and so some sodium intake may have been missed in data collection. Additionally the estimates of portion size may have been inaccurate despite showing participants examples of what constituted a "portion".

In general, participants had a high level of dietary self-efficacy across all time points. The lack of change in self-efficacy may be due to a ceiling effect in the measure. The high baseline levels may be due to social desirability and the fact that the participants provided the research evaluators with the responses they believed the evaluator wanted to receive. Selection bias may also have impacted high self efficacy scores as all participants were volunteers for a heart healthy program. Alternatively, the more challenging items may need to be added to the Self-efficacy for Health Related Diet measure. For example, addition items could address barriers to adhering to a heart healthy diet that included taste associated with the food, convenience of obtaining the food, cost, cultural preferences and lack of will power [11].

Participants in the study were receptive to participation in the educational and exercise classes. Comments from participants during and after exercise class to the research staff were positive and indicated that they eagerly looked forward to class time. Attrition from this study was consistent with other similar programs [117,118]. While specific attendance at exercise classes during phase 2 was not captured, attendance at the monthly motivation and exercise class typically ranged from 10-14 individuals. In addition to the research staff the senior housing facility was incredibly supportive of the program and provided funding to maintain the lay trainer throughout the study period. Activity staff also encourage all residents to participate in exercise activities offered at the facility.

Study Limitations

Due to the feasibility nature of this work there are several limitations of the study. The small sample size in this study resulted in it being underpowered. Additionally, as previously mentioned there is the significant probability of selection bias given the residents of the senior living complex who joined the study were those most interested in healthy behavior change. Measures of self-report, such as those used in this study, are at risk for errors in recall [119], social desirability and comprehension [120]. The issues of recall and comprehension are increased in older adults, as there are concerns with cognitive impairment as individual's age. The BIA analyzer that was utilized in this study provided information on percent body fat only. The collection of fat free mass and fat mass would have provided more accurate indications of change in body composition, especially in relation to identification of sarcopenia.

Clinical Implications and Conclusion

The findings from this study supported the feasibility and preliminary efficacy of the PRAISEDD-2 intervention which incorporated culturally appropriate interventions for low income older adults in senior housing. Specifically we found that following exposure to PRAISEDD-2 can facilitate initial heart health healthy behavior change with regard to diet and physical activity that impact body composition. The initial changes, however, occurred after an intensive intervention period and participants returned to baseline behavior and body composition without the ongoing intensive motivational components of the intervention.

Future research should focus on building a stronger self-efficacy based motivational component into the exercise classes to help build self-efficacy, outcome expectations and thereby strengthen long term adherence to adhering to the recommended diet, physical activity and medication use that is needed to decrease CVD risk over time. Focus on continued involvement in treatment beyond the initial 3 months will need to be included in the motivational component. Closer attention to treatment fidelity beyond the initial 3 months may also help to identify areas for improvement. Finally, the addition of measures of fat free mass and physical function would provide useful information with regard to the impact of participants' changes in diet and exercise behavior. This is would help support the implementation of PRAISEDD-2 intervention in senior housing to help support the value of the intervention on maintaining muscle mass and preventing/treating sarcopenia.

Table 4: Description of the PRAIDEDD Intervention

Intervention	Description of Activities
Week 1: **Education**	-During week one, two classes were held on heart healthy behaviors with each class being 60 minutes in length. -Education on heart healthy behaviors included information on diet, exercise and medication adherence.
Weeks 2-12: **Weekly motivation and exercise classes**	-Twice weekly classes provided Health Tips that reinforced prior learning and an exercise class led by a Lay Exercise Trainer (LET) and a PRAISEDD Research Nurse. -Identification of an internal champion was done to facilitate the ongoing maintenance of the exercise program at the end of the initial 12-week activities.
Months 4 to 24: **Month motivation and exercise**	-Monthly inoculation visits by the PRAISEDD Research Nurse (PRN) joining the LET during an exercise class. -The inoculation visit included blood pressure checks, motivational reinforcement, a Health Tip and encouragement of participate in the ongoing twice-weekly exercise program. -Flyers were provided to the facility manager and activities director to disseminate through the facility to remind residents to attend.

Table 5: Demographic Data of Study Participants

Variable	N	%
Gender		
Male	10	35
Female	19	65
Marital Status		
Never Married	5	17
Married	2	7
Widowed	13	45
Divorced	9	31
Education		
Less than 12th grade	12	41
12th grade	7	24
Some college	6	21
Post graduate	2	7
Trade school	2	7
Race		
Caucasian	7	24
African American	21	73
Multi-racial	1	3
BMI		
Underweight (<18.5)	0	0
Normal Weight (18.5–24.9)	7	24.1
Overweight (25 – 29.9)	8	31
Obese (30 or Greater)	13	44.8

Table 6: Comparison of Baseline Outcome and Descriptive Data Between Participants With and Without Missing Data

Variable	No Missing Data (n=13) Mean(sd)/frequency	Missing Data (n=16) Mean(sd)/frequency	t(p)/X^2(p)
BMI	30.0(6.8)	33.4(18.7)	0.62(.53)
% Body Fat	33.3(12.2)	36.0(19.8	0.43(.67)
Physical Activity (min)	509.6(400.0)	1037.3(1024.7)	1.75(.09)
Protein Intake	131.8(86.5)	172.2(115.2)	1.01(.32)
Sodium Intake	5376.5(3757.1)	5251.4(3218.4)	-.10(.92)
Fat Intake	177.6(102.4)	170.8(79.9)	-.20(.84)
Diet Self-efficacy	17.0(2.3)	16.2(3.0)	-.80(.43)
Age	74.3(9.0)	76.4(8.3)	-0.663(.53)
Female	9	10	0.144(.71)

Table 7: Changes in Outcomes from Baseline to Twenty-four Months in outcome variables over time

Measure	Base Mean (se)	3 months mean (se)	Δ from base	6 months mean (se)	Δ from 3 m	12 months mean (se)	Δ from 3 m	24 months mean(se)	Δ from 3 m	X^2
% Body Fat	34.8 (0.5)	28.2 (1.0)	-6.6*	35.5 (0.5)	7.3*	35.9 (0.3)	7.7*	35.6 (1.5)	7.4*	58.0 *
Physical Activity	800.7 (99.1)	848.5 (94.3)	47.8	636.7 (77.6)	-211.8	496.0 (81.8)	-352.6	758.5 (108.2)	-90.0	9.2
Protein Intake	148.8 (16.2)	108.2 (18.7)	-40.6*	169.1 (27.7)	60.9	237.8 (34.7)	129.5 *	291.8 (66.0)	183.5 *	20.8 *
Sodium Intake	5307 (619)	3093 (1098)	-2215*	4186 (729)	1093	3928 (897)	835	8402 (2168)	5309	8.7
Fat Intake	173.9 (13.4)	115.3 (20.5)	-58.6*	115.6 (17.9)	0.3	181.4 (31.2)	66.1*	209.4 (44.5)	94.1	22.4 *
Diet Self-efficacy	16.6 (0.3)	16.3	-0.2	16.6 (0.3)	0.3	16.3 (0.6)	0	16.3 (0.6)	-0.3	0.3

Key:

Physical Activity is reported in minutes
Protein Intake is reported in grams
Sodium is reported in milligrams
Fat Intake is reported in grams
* indicates p<0.5

Chapter 5: Discussion and Future Direction

Introduction

Despite the clear benefits of both aerobic and resistance exercise, older adults spend an average of 60% or greater of their time in sedentary behaviors[1]. Older adults with a low socioeconomic status and African Americans are also more sedentary than the general population[2]. This results in a significantly negative impact on the health and function of these individuals. In addition to sedentary behavior among older adults there is a particularly high rate of both sarcopenia, an age related loss of muscle mass and strength, and obesity, defined as a body mass index greater than 30. Sarcopenia and obesity are especially prevalent among those living in low-income housing. The population based estimates of sarcopenia in older adults range from 52-69% among all older adults and approximately 38% of are overweight or obese[3]. Those with a low socioeconomic status and those who are African American are disproportionally affected[3]. Sarcopenia and obesity result in an increased risk of morbidity and mortality due to cardiovascular disease, diabetes, frailty, falls and disability[4].

The purpose of this work was to provide an overview of the diagnosis and management of sarcopenia among older adults, specifically low income and African American older adults, provide evidence of reliability and validity for the Self-Efficacy for Eating Behaviors Scale, and to evaluate the impact of the PRAISEDD-2 intervention on diet (fat, sodium, and protein intake), time spent in physical activity, and body composition on older adults living in senior housing. A clinical definition of sarcopenia, however, has been challenging due to a lack of standardized measures of functional skeletal muscle mass, inability of measures of skeletal muscle mass to optimally capture functionality and a lack of consensus in the research and clinical communities[13]. The efforts by the European Work Group on Sarcopenia in Older People

(EWGSOP) and The International Working Group on Sarcopenia (IWGS) sarcopenia has been defined as having a low muscle mass in combination with low muscle strength and performance[16,17]. While this provides researchers and health care providers with diagnostic criteria for sarcopenia, the shift to measuring muscle mass through use of bioelectrical impedance analysis (BIA) has not been widely embraced, especially in clinical practice.

PRAISEDD-2 was a focused 3-month intervention that included education about stroke prevention and heart health through adherence to heart healthy diets, regular exercise, and prescribed medication. The PRAISEDD-2 intervention included education about heart healthy diets, exercise and medication for stroke prevention, a nurse led exercise classes 2 days a week for 3 months combined with a motivational intervention that included verbal encouragement (e.g., tips about the ways it incorporate heart healthy behaviors into routine life activities; benefits of heart healthy behavior), blood pressure feedback, and role modeling. At the end of the initial 3-month program, a lay exercise trainer continued the exercise classes twice a week for a full 24-month period along with a monthly motivational intervention by nursing. The monthly motivational intervention included the same components as noted above (verbal encouragement, blood pressure feedback and role modeling) and a monthly nurse led exercise class to act as a bolus to the weekly exercise classes offered by the lay exercise trainer. Specifically, it was hypothesized that participation in the PRAISEDD-2 intervention would result in decreased consumption of fat and sodium, increased consumption of protein, increased time spent in physical activity, decreased percent body fat, and an increase in diet self-efficacy over the 24 month period.

Body Composition, Diet, and Exercise

Body Composition

Health issues surrounding alterations in body composition have achieved increased focus in the past decade, particularly as it relates to increases in body fat and decreases in muscle mass. There is extensive evidence supporting the relationship between increased fat mass, especially visceral fat, and cardiovascular risk. Individuals who are overweight or obese are at significantly increased risk for diabetes, hypertension, cardiovascular disease and stroke[2,46,121]. While the majority of research and news coverage has been on increased body fat and obesity, decreases in muscle mass known as sarcopenia have a drastic impact on disability, morbidity and quality of life in older adults. The cost of health care related to sarcopenia is estimated to be $18.5 billion dollars annually in the United States[7]

Sarcopenia, an age related loss of muscle mass and strength[13,59], was first introduced in 1995 by Rosenberg and Roubenoff[60]. It is a complex condition caused by declines in activity, decreased protein intake, a variety of disease triggers, inflammation, declines in neuromuscular junctions, age related changes in muscle cell mitochondria, and alterations in the angiotensin system[13]. This loss of muscle mass is progressive, generalized and associated with a loss of strength and performance[16]. It has been proposed that sarcopenia is a biological cause of frailty as well as the pathway that negative health related outcomes present[122]. Examples of these negative health related outcomes include weakness, decline in walking speed, impaired balance, and falls.

Assessment of Body Composition

Despite the significant health implications associated with sarcopenia, there is limited assessment of body composition in clinical practice. The most commonly assessed measure of body composition is Body Mass Index (BMI). This is a value determined by height and weight (weight in kilograms divided by height in meters^2). This measure has been well validated as a screening tool for obesity as well as correlating with cardiovascular disease risk, morbidity and mortality. However it does not capture issues of altered body fat and muscle mass ratio. For instance, those with an elevated BMI may have a high muscle mass which does not increase cardiovascular risk; or those with a normal BMI may have a higher than desirable body fat percentage but have low muscle mass. For this reason it is important to look at alternative methods of evaluating body composition for older adults, particularly those who are at risk for sarcopenia.

In research settings radiological imaging has consistently been used in the measurement of body composition[123,124]. The gold standard for measurement of muscle mass by volume is computed tomography (CT), dual x-ray absorption (DXA), or magnetic resonance imaging (MRI)[16,18]. These techniques are extremely precise in differentiating muscle mass from other body tissue including fat and solid organs. While these methods are the gold standard, they are costly, not covered by insurance and, are not readily available in primary care offices or community research settings. For these reasons other options must be explored. One such option is bioelectrical impedance analysis (BIA).

BIA utilizes low level electrical impulses and measures the body's resistance to this alternating electrical current[20]. Data on the speed of the electrical impulse is collected via contact of two to four sensors to an individual's feet (and hands if four sensors are used) via a scale similar to those that measure weight. These measures are then used to calculate measures of body composition such as fat-free mass (FFM), muscle mass and percent body fat. There is no unpleasant sensation perceived by the individual and testing poses provides no health risk. BIA has been well validated for both healthy subjects as well as those with chronic disease across age, sex and race[68]. Given the ease of use and low cost of

BIA scales, this is a cost effective alternative to evaluation of body composition in both primary care practices and community-based research.

Impact of Diet on Body Composition

Sodium, fat, and protein are key components of individuals' diet that have direct impact on health. Sodium and fat play a key role in cardiovascular health and risk of heart disease and stroke[125]. High fat diets have contributed to obesity with higher than desired percent body fat[126]. Protein is one of the key dietary macronutrients that make up an individuals' dietary intake.

The United States Department of Agriculture (USDA) recommends a daily sodium intake is 3,440mg per day. For prevention of heart disease the American Heart Association (AHA) recommends a goal of less than 1,500mg of sodium daily. Despite these clear recommendations the average consumption of sodium in the US is 3610 mg daily with men having higher sodium intake than women[127].

Protein plays a key role in a variety of physiological functions including growth, muscle development, muscle function, and immunity[128]. For this reason, consumption of protein is central to the maintenance of muscle mass and prevention of sarcopenia. With regard to protein intake it is recommended that older adults consume 0.2-1.4g/kg of protein per day to maintain muscle mass[15,76]. The USDA recommends a protein intake of 0.8g/kg/day or 10-35 grams per day for adults[6]. Twenty-two to forty-one percent of adults older than 50 years of age consumed less than the daily recommendation of protein[61]. This is especially problematic in the African American population where up to 90% have protein deficient diets[77].

Reasons for the differences seen in recommended intake of dietary components and actual intake are multifactorial. Lack of resources such as access to health care, limited healthy food options in living situations and neighborhoods, and cultural food preferences that are not consistent with heart healthy diets result in higher sodium and fat intake as well as lower protein intake[129]. In addition, there is often inconsistent support from family, friends and even health care providers or workers in senior housing facilities in terms of encouraging adherence to heart healthy behaviors [33]. Furthermore low income adults are least likely to receive education and support to make lifestyle changes that would reduce their risk of CVD[130].

Impact of Exercise on Body Composition

The American Heart Association (AHA) and the World Health Organization (WHO) have national campaigns to encourage aerobic activity to optimize cardiovascular health. In addition the American College of Sports Medicine (ACSM) and the American Medical Association have partnered to develop and implement the Exercise is Medicine program. Aerobic exercise improves cardiorespiratory fitness and decreases overall body weight[131]. The ACSM and the AHA recommend older adults need 30 minutes of moderate intensity aerobic physical activity on five days each week or 30 minutes of vigorous aerobic activity for 20 minutes on 3 days per week to promote and maintain health[132]. As shown in Table 1, low level of activity includes sitting types of activity such as reading, computer use and knitting. Moderate level activity includes walking briskly, biking, making the bed, heavy housework and vigorous activity includes jogging, hiking or fast biking.

The ACSM and AHA also recommend 8-10 strength training activities be performed on 2 or more non-consecutive days per week that target all major muscle groups. Resistance or strength training activities increase muscle mass and strength [86]. Studies have shown that resistance training, done for 30 minutes 3 times per week, increases both muscle strength and mass[87,88]. Strength training decreases cardiovascular disease risk and builds strength and function.

Barriers to Physical Activity

Despite these recommendations older adults spend 60% of their waking time in sedentary pursuits with females demonstrating more time in sedentary pursuits than men[10]. Barriers to moderate level physical activity include lack of time, lack of motivation, pain or prior injury, competing responsibilities and lack of access to exercise space/equipment[90]. For older adults living in low-income senior housing, the challenges are more pronounced. Barriers to physical activity include safety of the neighbourhood, monetary /socio-ecomonic issues, adverse weather, poorly maintained sidewalks and heavy traffic concerns[90,133]. While these barriers are not insignificant, efforts have been made to better enable and encourage older adults to participate in healthy physical activity. Positive health benefits, health care providers' advise, group exercise such as those organized by the church or community, and easy access to walkable space have been shown to increase physical activity in older adults[90].

Social Cognitive Theory and Behavior Change

Social cognitive theory (SCT) is one of the major theoretical frameworks used to change behavior in older adults. SCT is a behavior change theory suggesting that the stronger the individual's self-efficacy and outcome expectations, the more likely it is that he or she will initiate and persist with a given activity[34]. Self-efficacy expectations are the individual's beliefs in his or her capabilities to perform a course of action to attain a desired outcome; outcome expectations are the beliefs that certain consequences will be produced by personal action.

Efficacy expectations are dynamic and enhanced by four mechanisms: (1) successful performance of the activity; (2) verbal encouragement; (3) seeing like individuals perform the activity; and (4) elimination of unpleasant physiological and affective states associated with the activity [98].

The use of SCT to facilitate healthy behavior change has been well documented. Some examples are smoking cessation[134], weight loss[135], and medication adherence[136]. SCT has also been used in behavior change surrounding physical activity in a variety of populations including adolescents[137], young adults[138], older adults[12], African Americans[139], and Hispanics[140]. Prior success using SCT to facilitate behavior change among low income older adults[12] made it an ideal theoretical approach for use in the PRAISEDD-2 study which focused on changing health behavior to optimize cardiovascular health and prevent stroke through the use of heart healthy diets, and physical activity.

Self-Efficacy for Eating Behaviors Scale

The Self-Efficacy for Eating Behaviors Scale was initially developed to determine an individual's level of self-efficacy for health-related eating and exercise behaviors[37]. The initial 89-item Self-Efficacy for Eating Behaviors Scale was administered to 171 participants (mean age of 21.3 years of age, SD=6.5). A Principle-component analysis was done and the 89 items were reduced to 61 items with five factors or subscales that included: resisting relapse, reducing calories, reducing salt, reducing fat, and behavioral skills. Together these five factors accounted for 44% of the variance in diet self-efficacy. To test reliability, the scale was administered to a subgroup of 52 participants at baseline and then two weeks later. There was fair evidence of test-retest reliability for each subscale within the Self-Efficacy for Eating Behavior with bivariate correlations ranging from 0.43 – 0.64 ($p<0.001$) [37].

For applicability to the PRAISEDD-2 intervention study, the original Self-Efficacy for Eating Behaviors Scale was modified to decrease the time burden on participants as well as to more specifically target items that focused on dietary issues related to reducing cardiovascular disease risk. The original 61 items were reviewed and questions that specifically were relevant to the Dietary Approaches to Stop Hypertension (DASH) dietary guidelines, were consistent with the diets commonly eaten by older adults living in subsidized housing and were focused on decreasing CVD risk were identified and included in the revised scale. Specifically, nine items were selected from the "resisting relapse" factor, three from the "reducing salt" factor, five from the "reducing fat" factor, and three from the "behavioral skills" factor. Based on challenges identified by older adults living in senior housing [38], one additional item not included in the original measure was added (How confident are you that you can maintain a low fat low salt diet if only high fat, high salt foods are all that is available to you?). The Modified Self-Efficacy for Eating Behavior included 20-items with a simplified yes/no response format. Specifically participants stated that either they were or were not confident that they could carry out the specific behavior.

Reliability and Validity Testing of the Revised Self-efficacy for Eating Behaviors Scale

Rasch analysis was utilized to evaluate reliability and validity of the Modified Self-Efficacy for Eating behavior scale. To be appropriate for Rasch analysis it was first essential to establish that the modified measure was unidimensional. Since there is no single recommended method of determining dimensionality (Smith & Smith, 2004; Waugh & Chapman, 2005), dimensionality was considered by both confirmatory factor analysis and Rasch analysis. Before conducting the factor analysis the correlations matrix was examined to investigate whether there was sufficient shared variance among the items for a factor analysis to be useful. Given that the

Kaiser-Meyer-Olkin (KMO) value was .85 a factor analysis was done and a confirmatory factor analysis supported a single factor. In addition a Principal Components of the Standardized Residuals was done using Rasch analysis. To evaluate the unidimensionality, the amount of unexplained variance by the first factor is divided by the number of items in the scale. The findings should indicate that that only 10 to 15% of the variance should be explained by additional factors if the measure is truly unidimensional. For the Dietary Self-efficacy for Eating Behavior Measure the unexplained variance by the first factor was 2.6 and divided by the 20 items this showed that only 11% of the variance would be explained by a second factor. Thus we concluded that this was a unidimensional measure.

Evidence of reliability for the full Dietary Self-Efficacy Scale for Eating behavior scale was supported by a Person Separation Index of 1.22, which was consistent with a Cronbach Alpha of 0.83[104]. This demonstrates that if a parallel scale measuring the same construct (self-efficacy for eating behavior) was administered to the same sample, they would have the same result.

Validity of the Modified Diet Self-efficacy Scale was based on construct validity and evidence that the items fit the data use the Rasch model. Evidence of fit was based on the INFIT and OUTFIT statistics as described previously. While all of the INFIT statistics were within the accepted range, four items had OUTFIT statistics that were outside the accepted range. OUTFIT statistics and their lack of fit is of less concern as they evaluate the sensitivity of the item to responses far from the ability of the person [104]. Therefore, it was concluded that the items all had a good fit to the data. Finally, the majority of the respondents were clustered at the upper range of the scale. Future revisions to the scale would need to include questions that are more difficult to endorse to better differentiate levels of self-efficacy.

PRAISEDD Intervention to impact Diet and Body Composition

People Reducing Risk and Improving Strength though Exercise, Diet and Drug Adherence (PRAISEDD) was a community based intervention geared towards increasing adherence to cardiovascular disease (CVD) prevention behaviors among low-income adults. PRAISEDD was based on the Social Ecological Model and Social Cognitive Theory with the goal of impacting specific health related behaviors. The feasibility of PRAISEDD was initially tested in a senior housing site in Baltimore, Maryland[12]. The initial PRAISEDD intervention was conducted over 12 weeks. During week one and advance practice nurse delivered three one-hour educational class on exercise, diet, and medication. At the end of the first week, study personnel helped each participant develop goals for exercise, diet, and medication. For the following 11 weeks participants attended three one-hour exercise classes per week. Exercise classes consisted of a combination of simple strength training motions, 20 minutes of aerobic dance, as well as a warm up and cool down period. At the end of each week goals were reviewed and adjusted as appropriate.

A total of 22 of residents of the senior housing facility participated in the feasibility study. While attendance at the exercise classes varied, 60% of participants attended more than half of the sessions and 33% attended more than 90% of the sessions. Reasons for not attending included illness, work-related conflicts, or family/caregiving responsibilities. At the end of the 12 week intervention period there was a significant decrease in mean systolic and diastolic blood pressure among participants. Thus the feasibility study showed that low-income adults would participate in regular exercise and educational classes on a weekly basis and there was some benefit to participation in terms of improvement in blood pressure. Further, the feasibility trial led to recommendations for future work which included implementing changes in the environmental and policy within the senior housing centers to facilitate behavior change and evaluation of additional clinical outcomes for further evaluation of PRAISEDD impact on CVD prevention such as dietary intake and time spent in physical activity.

Building off the feasibility study and incorporating Social Cognitive Theory and the Social Ecological Model, the PRAISEDD intervention was revised into PRAISEDD-2. The overall focus of PRAISEDD-2 was to strengthen self-efficacy and outcome expectations and improve behavior across three behaviors known to prevent and manage CVD: adhering to a heart healthy diet, regular exercise, and prescribed medication adherence to control hypertension and dyslipidemia at 3, 6, 12, and 24 months post implementation of the intervention[33]. Added to this focus was the evaluation of changes in body composition following the implementation of PRAISEDD-2. In PRAISEDD-2 the initial 3-month intensive exercise intervention was expanded such that the exercise classes continued for a full 24 month period at two times per week and we continued to provide monthly motivational booster visits from a research nurse . The PRAISEDD-2 intervention was implemented in an approximately 200 person occupancy low-income senior housing facility in Baltimore, Maryland. Further, in addition to self-efficacy and behavior outcomes measurements of body composition were added. These measures included Self-efficacy for Health Related Diet scale, the Yale Physical Activity Survey, the Block Fat and Block Sodium Screeners, and Bioelectrical Impedance Analysis scale to measure body composition.

With regard to body composition findings following implementation of the PRAISEDD-2 intervention there was a mean decrease in percent body fat, sodium and fat intake among study participants at 3 months post implementation of the intervention. While these changes are encouraging and suggest that regular exercise class with a nurse promotes behavior change, the results were not sustained during the subsequent follow up period. The reduction of percent body fat was encouraging however this does not provide information on the change in muscle mass. However given the lack of change in physical activity it is unlikely that any significant change in muscle mass occurred. Future work will need to include measures of muscle mass and muscle strength in the outcomes. The addition of specific strength training activities should also be included in the physical activity survey. This would provide stronger evidence of the PRAISEDD-2 intervention on muscle mass in addition to percent body fat.

The PRAISEDD-2 study provided support for the feasibility of a self-efficacy based education, motivation, and exercise intervention to improve dietary behaviors, participation in exercise, and impact body composition. This reinforces the need for health care providers to include specific dietary and exercise teaching in the management of older adults with sarcopenia and cardiovascular risk. Moreover, ongoing work is needed to address ways in which to sustain any changes in health behaviors that decrease cardiovascular risk.

Due to the feasibility nature of this work there are several limitations of the study. The small sample size in this study resulted in it being underpowered. Additionally, as previously mentioned there is the significant probability of selection bias given the residents of the senior living complex who joined the study were those most interested in healthy behavior change. Measures of self-report, such as those used in this study, are at risk for errors in recall [119], social desirability and comprehension [120]. The issues of recall and comprehension are increased in older adults, as there are concerns with cognitive impairment as individual's age. The BIA analyzer that was utilized in this study provided information on percent body fat only. The collection of fat free mass and fat mass would have provided more accurate indications of change in body composition, especially in relation to identification of sarcopenia.

Conclusions

This work supports the need to continue to explore and treat sarcopenia among older adults, particularly low income older individuals. This includes health behavior related treatment modalities such as diet and exercise. Community based health promotion programs and activities help to educate low income older adults about the health risks associated with sedentary behavior and high fat, high salt, and low protein diets. This increased awareness and knowledge will facilitate conversations will their health care provider to have discussions about treatment options. Future research should include targeted interventions to facilitate communication with health care providers, which is a necessary component of a comprehensive health care plan. Additionally, the close attention to measurement of diet, activity, and body composition will be fundamental. Many studies looking at diet and exercise focus on participants losing weight. Looking at body composition from a more comprehensive standpoint and evaluating changes in muscle mass and body fat will provide a more accurate indication of health and fragility status of older adults.

Policy change that promotes both clinical attention to the negative outcomes of muscle mass loss and research to identify improved treatment modalities could have a profound impact on quality of life among older adults and ultimately impact overall health care cost. Changes in policy should be implemented to facilitate reimbursement for assessment, diagnosis and treatment of sarcopenia in the clinical setting. These changes should take into consideration factors that impact self-efficacy with a specific focus on low-income older adults who are most vulnerable and have a lack of access to resource.

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