

October 2019

**NE1939—IMPROVING THE HEALTHSPAN OF AGING ADULTS THROUGH DIET
AND PHYSICAL ACTIVITY**

POLICY AND PROCEDURE MANUAL

October 2019

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NE1939 PROJECT OVERVIEW

BACKGROUND

As the population of aging adults continues to grow, better understanding of effective strategies aimed toward improving the health span is needed. Aging is a multifaceted area of study that is continually exploring how to promote health and well-being throughout the lifespan. An integrative, interdisciplinary approach toward healthy aging from the metabolic level to translational science is imperative as aging is influenced by our genetics, metabolic processes, environment, and lifestyle practices. In doing so, it is likely we will improve the health span (part of a person's life during which they are generally in good health) of aging adults.

OBJECTIVES

The long-term goal of the NE1939 multistate project is to promote the independence and well-being of community-residing aging adults (ages 40 years and older). We aim to achieve this long-term goal by achieving the following research objectives:

- **Objective 1:** To conduct multidimensional assessments of diet, physical activity and related factors affecting aging adults.
- **Objective 2:** To develop, implement and evaluate interventions that preserve or improve health in aging adults living in rural and urban environments.

Completing research studies under these objectives over the proposed five-year period (2019 through 2024) is expected to provide us with a more thorough understanding of: (1) the issues impacting the health and well-being of adults age 40 years and older; (2) how diet and exercise/physical activity factors influence the body at the molecular and cellular level; and (3) intervention strategies resulting in behavior changes as well as the development of interventions that are deliverable at the community-level nationally.

Please refer to Appendix A to review the full NE1939 Renewal Proposal. This outlines the research foci and proposed methodologies to be utilized by members.

ORGANIZATION AND GOVERNANCE

Administrative oversight and organization for the NE1939 multistate group is provided by an Executive Committee and Regional Administrative Advisor. There are also two subcommittees including the Annual Meeting Planning Committee and the Research Excellence Award Committee.

Election Process

Executive board positions are decided by a vote of membership. Subcommittee membership is based on a voluntary basis.

A call for nominations is made for open positions in the spring before the annual meeting. Candidates may be nominated via self-nominations or from the membership. Elections are held at the annual meeting preceding the term in which the position starts. A voice vote is conducted during the meeting if the election is uncontested; a paper ballot vote is held for contested elections.

The Executive Board is comprised of five members: Chair, Chair-Elect, Past-Chair, Secretary, and Member-at-Large. The term and position are described in Table 1. The subcommittees are made up of three members each and are a one-year committee only (Tables 2-3).

Table 1. Executive Board

Position	Responsibilities	Term	Assumes Position
Chair	<ul style="list-style-type: none"> • Schedule and facilitate bi-monthly online meetings • Schedule and facilitate annual meeting • Schedule and facilitate Executive Board meeting at annual meeting • Develop and post agendas • Compose renewal project proposal (every 4 years) • Oversee annual report completion and submission • Oversee project-related revisions 	3 Years	October 2019
Chair-Elect	<ul style="list-style-type: none"> • Complete duties in the absence of Chair • Assist with writing of renewal proposal if it occurs during term • Attend Executive Board meeting at annual meeting 	3 Years	October 2019
Past Chair	<ul style="list-style-type: none"> • Provide guidance/assistance to Chair and Chair-Elect as needed • Attend Executive Board meeting at annual meeting 	3 Years	October 2019
** Serving as Chair-Elect, Chair, and Past Chair is a 9-year commitment**			
Secretary	<ul style="list-style-type: none"> • Take minutes at annual meeting • Take meeting notes if online meetings are not recorded • Post annual meeting minutes on NIMSS website (https://www.nimss.org/) • Attend Executive Board meeting at annual meeting 	3 Years	October 2018
Member-at-Large	<ul style="list-style-type: none"> • Perform other duties as assigned by the Chair • Attend Executive Board meeting at annual meeting 	3 Years	October 2017

Table 2. Annual Meeting Planning Committee (1 Year Commitment)

Role	Team member	Responsibility
Chair	Team member who resides in location of chosen meeting site	<ul style="list-style-type: none"> • Oversee annual meeting planning: <ul style="list-style-type: none"> ○ Identify meeting facility ○ Secure rooms for team ○ Sign necessary contract • Maintain regular communication with Project Chair • Convene committee meetings as needed to ensure all planning steps are addressed
Member 1	Previous Annual Meeting Planning Committee Chair	<ul style="list-style-type: none"> • Provide guidance to Chair regarding any planning insight • Complete tasks as assigned by Planning Chair
Member 2	Team member who resides in location of chosen meeting site OR who is willing to assist with planning steps	<ul style="list-style-type: none"> • Complete tasks as assigned by Planning Chair

Table 3. Research Excellence Award Committee (1 Year Commitment)

Role	Team member	Responsibility
Chair	Previous year winner	<ul style="list-style-type: none"> • Solicit nominations and applications for award • Facilitate committee meeting to select winner • Notify winner • Edit and prepare award certificate • Edit press release template for winner and send electronically to winner's media relations officer • Moderate presentation at annual meeting
Member 1	Any team member	<ul style="list-style-type: none"> • Complete tasks as assigned by Award Chair
Member 2	Any team member	<ul style="list-style-type: none"> • Complete tasks as assigned by Award Chair
<i>Committee members nominated for the award must recuse themselves from the committee. The Chair and/or Chair-Elect will step in as necessary to replace the recused member.</i>		

MEMBERSHIP CRITERIA AND EXPECTATIONS

Membership Preferences:

- Experience working with older adults and/or conducting age-related research
- Expertise in the areas of nutrition, physical activity, and/or health
- Record of scholarly activity commensurate with their experience in the field
 - Peer-reviewed publications (e.g., journal manuscripts, poster and/or oral presentations at professional conferences, Extension publications)

New members are responsible for working with their university's State Agriculture Experiment Station to complete the Appendix E form. To complete this form:

- Go to the National Information Management Support System (NIMSS) at <http://nimss.umd.edu>
- Select the Member Login and Registration on the left hand side of the screen. You must log in to complete this process. If you have previously participated in a multistate project you are registered. Enter your ID and password. If you have not participated in a project, you will need to register.
- Go to the "Participants" tab. Select the Draft/Edit Participant Info option. Click on the Draft New link. Enter the information requested.

Member Expectations:

Active participation by all NE1939 members is expected. Examples of active participation include:

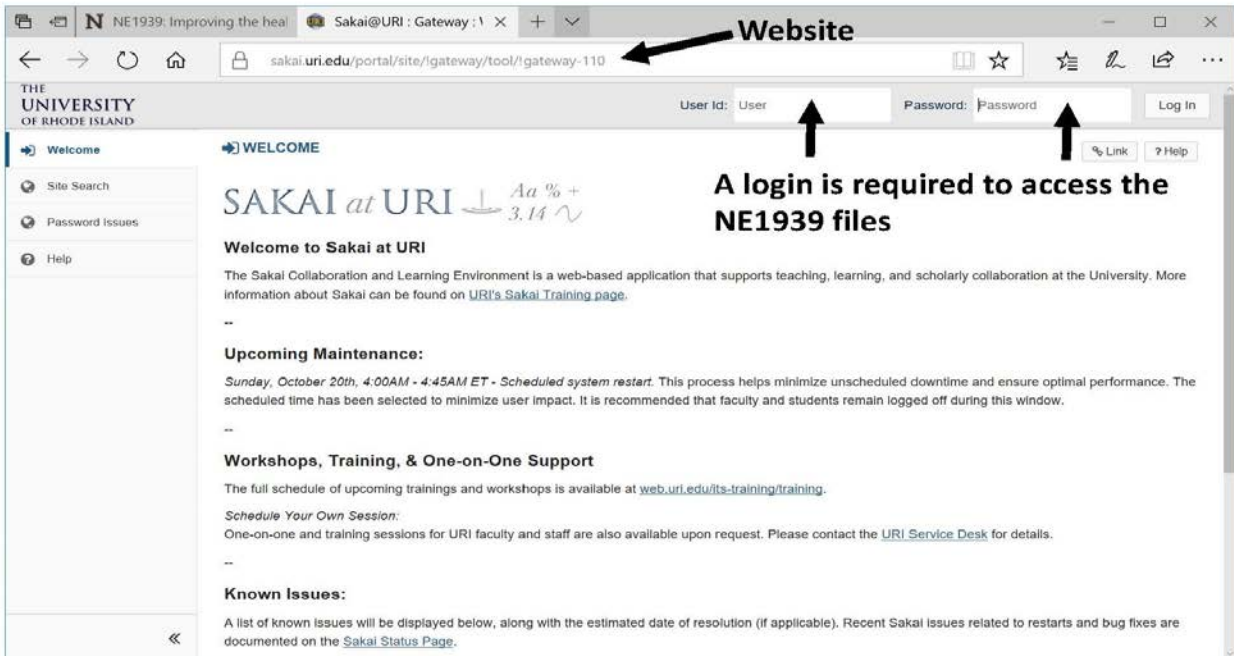
- Taking part in research under one or both of the NE1939 Project's two objectives. This may include collaboration, individual projects or a combination of both.
- Attending meetings, both annual meeting and online meetings. NE1939 members meet on a regular basis (every other month) via online meetings and annually face-to-face at a time and location that is selected by the entire group at the previous annual meeting.
- Serving in leadership roles while involved in the NE1939 project (e.g., executive board, subcommittees, lead multistate research projects, etc.).
- Obtaining funding to support NE1939-related research.

Annual Report:

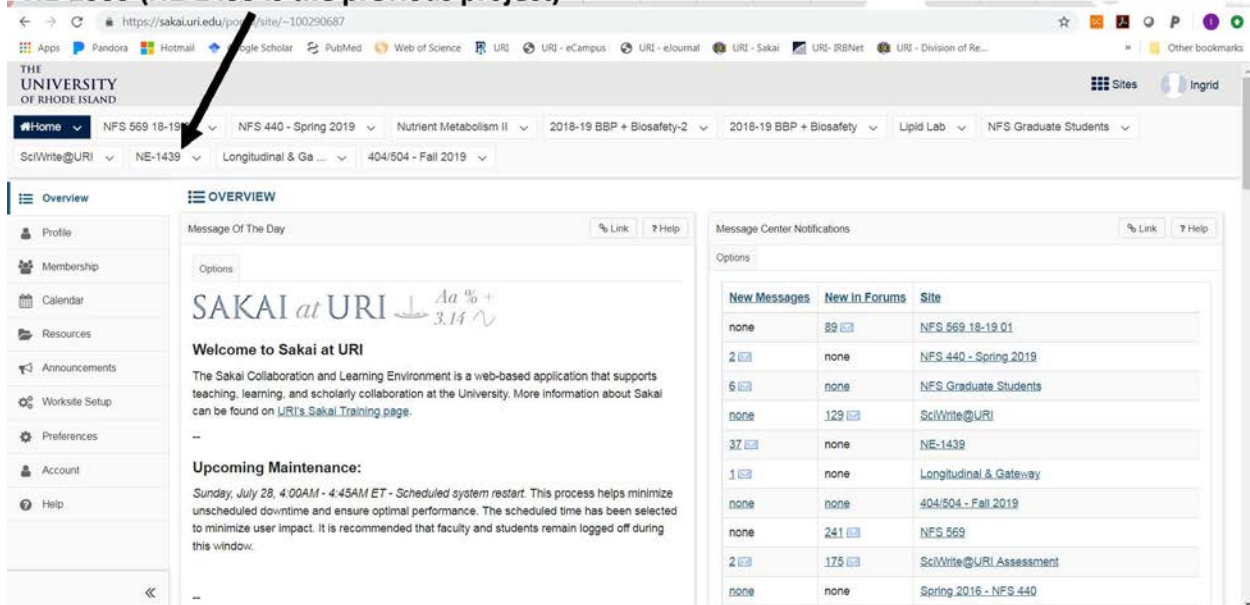
NE1939 Project members or institutions are expected to complete annual reports regarding work related to the NE1939 Project. This annual report is separate from what is submitted to each individual's Agricultural Experiment Station; however, much of the information is the same. The annual report covers NE1939 Project activities from October 1 through September 30. For example, for the 2019-2020 Academic Year, the project report would include activities completed October 1, 2019, through September 30, 2020. The online annual report is completed online via a Qualtrics survey. The link to this survey as well as a hard copy (for review only) will be shared during the annual meeting and in email announcements. The report is due October 15th. If this date falls on the weekend or holiday, it is due the following business day.

ACCESSING NE1939 RESEARCH DOCUMENTS

Currently the files related to this multistate group are stored in Sakai (www.sakai.uri.edu). Examples of these files include past publications related to the current and previous projects, word documents of common survey tools used by team members, and SPSS codebooks related to these survey tools. Below are directions on how to access these files.



The Multistate project page in Sakai will be listed here. For the current project it will be NE-1939 (NE-1439 is the previous project)



Once you click on current project tab– you'll get to our page – with our major areas on the left side

The screenshot shows the Sakai site overview for NE-1439. The left sidebar contains a menu with items: Overview, Calendar, Announcements, USDA Information, NE1439 Proposal, NE1439 Manuscripts, Public Relations, DST, Resources - Websites, NE1039, and Site Info. The main content area is titled 'OVERVIEW' and contains a 'Site Information Display' section with the text: 'This is the NE-1039 Sakai site. Please see the Modules section for group info such as meeting minutes, meeting agenda(s), questionnaires, etc.' To the right of the main content are sections for 'Recent Announcements' (showing no announcements) and a 'Calendar' for July 2019.

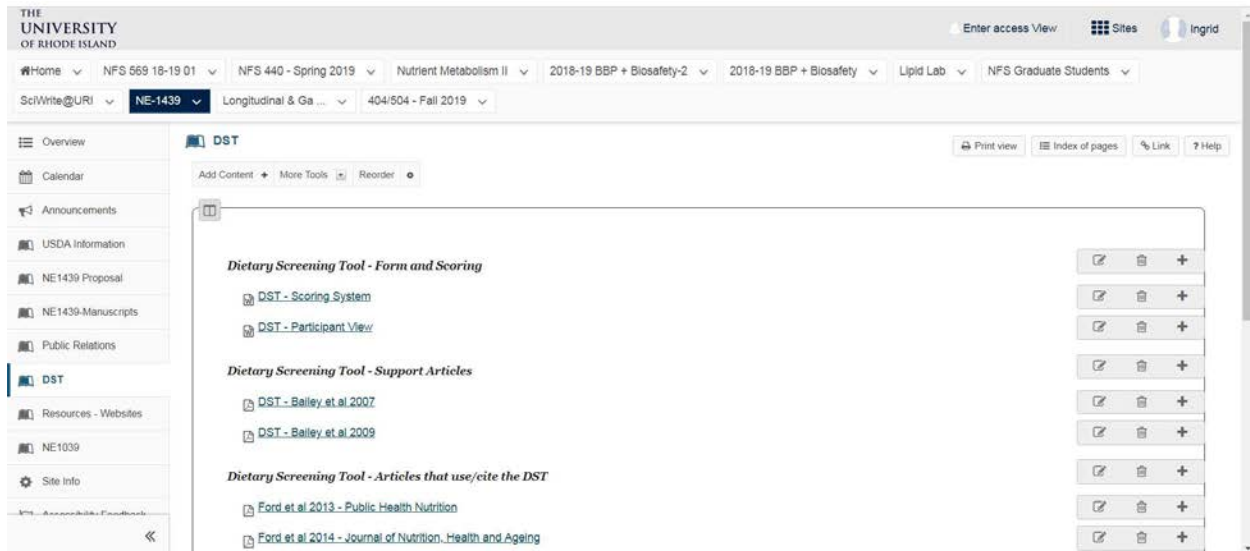
If you click on Site Info on the left, you'll get to this screen and you can add participants, edit site info – BUT to add information – you'll want to go to a topic area on the left and do it within that topic area (see next slide)

The screenshot shows the 'SITE INFO' page for NE-1439. The left sidebar is the same as the previous slide, with 'Site Info' selected. The main content area has a sub-header 'SITE INFO' and a navigation bar with links: Edit Site Information, Manage Tools, Tool Order, Add Participants, Manage Groups, Link to Parent Site, External Tools, Manage Access, Import from Site, Import from Archive File, and User Audit Log. Below this is a table of site information for NE-1439:

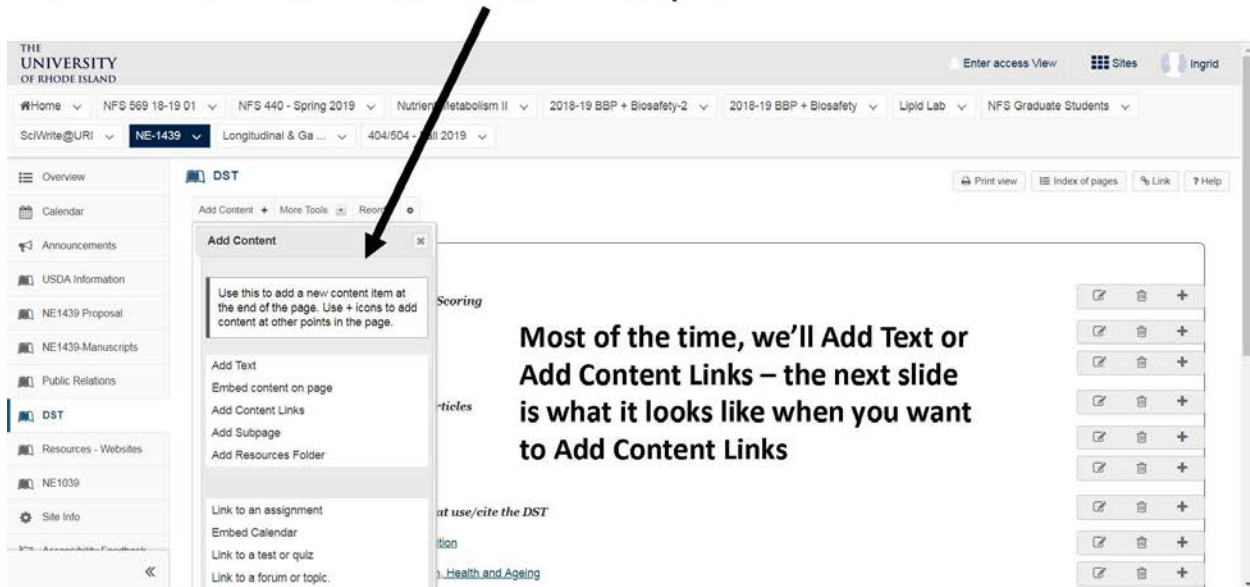
Site URL	https://sakai.uri.edu/portal/site/be56a0df-1cec-419a-b16f-b88d8c3abcd5
Site contact and email	Matthew Delmonico, delmonico@mail.uri.edu
Available to	Site participants only
Modification date	Mar 15, 2019 10:29 am
Modified by	Lofgren, Ingrid
Display in Site Browser	Yes (Tell me more...)
Creation date	Jun 7, 2011 12:46 pm
LaTeX	Disabled

Below the table is a 'Site Description' section with the text: 'This is the NE-1039 Sakai site. Please see the Modules section for group info such as meeting min...' and a '(More)' link. At the bottom, it says 'NE-1439 Participant List (# 24)'.

For example – if you wanted to add something to the DST folder – you would click on the DST folder on the left and this will appear



Click on the Add Content and this menu will drop down



THE UNIVERSITY OF RHODE ISLAND

Enter access View Sites Ingrid

Home NFS 569 18-19 01 NFS 440 - Spring 2019 Nutrient Metabolism II 2018-19 BBP + Biosafety-2 2018-19 BBP + Biosafety Lipid Lab NFS Graduate Students

SciWrite@URI NE-1439 Longitudinal & Ga 404/504 - Fall 2019

Overview Add Content Links

You may upload new files, select existing files from Resources, or supply the address of a page on the web.

Upload files

Choose Files | No file chosen

Or select existing files from Resources

Or add a URL:

Don't Release Item Until All Prerequisites are Completed

Save Cancel

Once you click on Add Content Links

- you can upload a file here or
- you can add a URL here

Dietary Screening Tool - Articles that use/cite the DST

Ford et al 2013 - Public Health Nutrition

Ford et al 2014 - Journal of Nutrition, Health and Ageing

If you just want to access the information – click on the link you want and it will either open in a new window or within Sakai

THE UNIVERSITY OF RHODE ISLAND

Enter access View Sites Ingrid

Home NFS 569 18-19 01 NFS 440 - Spring 2019 Nutrient Metabolism II 2018-19 BBP + Biosafety-2 2018-19 BBP + Biosafety Lipid Lab NFS Graduate Students

SciWrite@URI NE-1439 Longitudinal & Ga 404/504 - Fall 2019

Overview DST

Add Content + More Tools Reorder

Dietary Screening Tool - Form and Scoring

DST - Scoring System

DST - Participant View

Dietary Screening Tool - Support Articles

DST - Bailey et al 2007

DST - Bailey et al 2009

Dietary Screening Tool - Articles that use/cite the DST

Ford et al 2013 - Public Health Nutrition

Ford et al 2014 - Journal of Nutrition, Health and Ageing

APPENDIX A
NE1939 Proposal

ISSUES AND JUSTIFICATION

As the population of aging adults continues to grow, better understanding of effective strategies aimed toward improving the health span is needed. Aging is a multifaceted area of study that is continually exploring how to promote health and well-being throughout the lifespan. An integrative, interdisciplinary approach toward healthy aging from the metabolic level to translational science is imperative as aging is influenced by our genetics, metabolic processes, environment, and lifestyle practices. In doing so, it is likely we will improve the healthspan (part of a person's life during which they are generally in good health) of aging adults.

The need, as indicated by stakeholders

Older adults. Aging adults face numerous barriers towards achieving optimal health and wellness including chronic disease, nutritional risk, food insecurity and functional impairments. The United States (U.S.) population is experiencing a shift in demographics. Adults aged 60 years and older have become the largest growing age group. It is estimated that around 1 in 7 Americans classify as an older adult, with about 20.4% age 60 years and older and 14.5% age 65 years and older⁵⁹. There is also a steady increase of older adults identifying as persons of color. The number of persons of color age 60 years and older increased 23% from 2006 to 2016 and is projected to increase to around 21.1 million¹. Based on these demographics, nutrition, physical activity and biomarker research for aging adults must include a diverse sample. A multistate approach is one strategy in which to achieve this.

Poverty. Poverty affects many older adults. In 2016, 14.5% of older adults were living below the poverty level per the Supplemental Poverty Measure¹. An additional 4.9% were found to be "near-poor" (ACL USDHHS, 2018). Of this proportion of older adults living below the poverty line, roughly half were persons of color¹. Older women are also more likely to be classified as living in a state of poverty, at 10.6% compared to 7.6% among older men¹. Consequently, limited income adversely affects the nutrition intake of older adults³⁰.

Food insecurity. Food insecurity and hunger can have profound impacts on nutritional status and health-related quality of life (QOL). Although food insecurity and hunger are often used interchangeably, the two are different degrees of the same indicators. Food insecurity is characterized by having inconsistent access and uncertainty in obtaining food, putting individuals at higher risk for malnutrition, chronic disease, and low QOL²⁴. The threat of food insecurity and hunger among older adults is rapidly increasing with about 15.8%⁶⁰ being food insecure and 14.7% facing the threat of hunger⁷¹. Older adults at greatest risk include those with a low income, those under the age of 70 years, being a person of color, and residing in the southern states⁷¹. Food insecurity is correlated with lower energy and nutrient intakes, worse health outcomes, increased risk of early mortality and increased health care expenditures^{7, 8, 71}. Food insecurity and hunger affect more aging women than aging men⁷¹. In addition, food insecurity is associated with higher likelihood of having limitations performing activities of daily living (ADLs)⁷². Furthermore, older adults who were facing the threat of hunger are 30% more likely to report at least one ADL limitation⁷¹.

Nutritional Risk. Nutritional risk increases with age due to a variety of factors such as decreased appetite, chewing and swallowing difficulties, physical limitations, limited income, reduced social interaction, and chronic disease. Nutritional risk encompasses both ends of the health spectrum, undernutrition and overnutrition, with each having equally detrimental health consequences. The prevalence of malnutrition among older adults is problematic, since a nutrient-poor diet is related to morbidity and mortality, physical impairments, functional disability and a greater frequency of admittance into hospitals and other long-term care facilities²¹. The USDA NE-1439 Multistate Project "Changing the Health Trajectory for Older Adults through Effective Diet and Activity Modifications" team has conducted various studies examining the dietary practices of older adults. A three-state study revealed that 80.1% of older adults electing to take part in community nutrition programs were classified as "at nutritional risk" or "at possible nutritional risk"³⁹. Poor diets can have a profound effect on cell physiology altering inflammatory markers and oxidative stress, which contribute to telomere erosion and

cellular senescence. Our work demonstrates the need for better understanding of the bidirectional relationships of the nutritional status of aging and the impact of nutritional status on health outcomes. An interdisciplinary approach would enable researchers to examine these issues at the cellular, individual and societal levels.

Dietary Intakes. A primary factor affecting the nutritional status of older adults is inadequate food and nutrient intakes. MyPlate recommendations suggest adults over age 50 years consume 1½ to 2 cups of fruits, 2 to 2½ cups of vegetables, 5 to 6 ounce-equivalents of grains, 5 to 5½ ounce-equivalents of protein and 3 cups of dairy daily⁶¹. However, based on the Healthy Eating Index, only 18% of adults age 60+ years meet grain recommendations, 32% meet recommendations for vegetables, 34% meet total fat recommendations and between 23-27% consume the recommended amount of meat, dairy and fruit¹⁸. Inadequate food intakes and aging can affect micronutrient status. For example, it is estimated that selenium status in 10% of Americans aged 40 or older is sub-optimal. These levels of marginal deficiency increase the susceptibility to many age-related degeneration later in life. High dietary selenium intake has also been reported to increase muscle protein levels by 10-14% in adult pigs⁷⁰. Inversely, whether or not a high protein diet affects body selenium status among aging adults is unknown.

As people age, blood levels of the cardioprotective fatty acid, linoleate (18:2n6) decreases. The decrease of blood levels of linoleic status parallels the loss of skeletal and cardiac muscle function and lean mass³⁰. In addition, diminished linoleate status in older individuals coincides with diminished mitochondrial function in skeletal muscle that accompanies aging^{12,50}. Physical activity and a balanced diet may prevent muscle atrophy by targeting mitochondria⁴⁴.

A dietary intake frequency assessment conducted by the NE-1439 multistate team revealed the majority of community residing older adults surveyed were consuming low intake frequencies of protein-rich foods, produce and whole grains³⁹. In addition to examining whole food consumption among aging adults, the NE-1439 team is exploring specific nutrients including selenium and fatty acids.

Physical Activity. Physical activity is a key modifiable behavior that can attenuate chronic disease risk and improve physical functioning in older adults⁴⁹. It also builds “physical reserves” so that if physical function declines resulting from illness or injury occur, individuals with greater physical reserves would be less likely to fall below the threshold for disability⁵⁵. Thus, physical activity is a key component of healthy aging. Unfortunately, the vast majority of older adults are not engaging in the recommended levels of physical activity⁴⁹.

Sarcopenia. Adults can experience a 3 to 8% decline in muscle mass per decade beginning in the their 40s and 50s⁴⁷; and muscle mass traditionally declines 30% to 50% between the ages of 40 and 80 years¹⁴. For this project, we use the Foundation for the National Institutes of Health Sarcopenia Project (FNIH-SP) definition that uses lean mass (absolute or relative to body mass) and physical function cut points to define sarcopenia⁵⁷. The cut points have been shown to be independent predictors of incident mobility impairment in men and women⁴³. Sarcopenia-related health care costs are substantial, with estimates ranging from \$11.8 to \$26.2 billion³². A 10% reduction in sarcopenia prevalence could save upward of \$1.1 billion annually in the US³². Nearly half (46.6%) of these savings would occur if 10% of those with severe sarcopenia were able to improve to a moderate level of sarcopenia while the remaining 56.4% would occur if 10% of those classified with “moderate sarcopenia” moved to “normal”³². If sarcopenia were to be eradicated, about 26% of disability cases would be eliminated³².

Lifestyle practices of older adults, in particular obesity, physical inactivity and poor nutritional intake, increase sarcopenia risk²². This provides a unique challenge when designing community-based physical activity and nutrition programs. An effective sarcopenia prevention/treatment program must increase physical activity and promote healthy eating while preventing an energy-deficit that promotes weight loss, which can adversely affect sarcopenia²². Establishing successful interventions that preserve and/or improve lean mass and physical function is crucial. There has been a significant effort to determine the most effective and efficacious interventions for treating sarcopenia and its associated symptoms¹⁰; however, many efforts are not easily transferable to the community setting. A study conducted as part of the NE-1439 project demonstrated that a 12-week periodized resistance training intervention strategy was

effective in retaining appendicular lean muscle mass and improving muscle strength in women ages 65-84 years⁵³. The renewal project will further develop this work into a larger scale, multistate intervention.

Importance of Work

A project renewal will provide the opportunity to expand on the work completed thus far by the members of the USDA NE-1439 Multistate Project “Changing the Health Trajectory for Older Adults through Effective Diet and Activity Modifications” from 2014 to the present. Through our collaborative efforts, we identified community supports for produce consumption among older adults³³ and the nutritional deficiencies placing aging adults at increased nutritional and sarcopenia risk³⁹. For example, we found that dietary selenium insufficiency induces age-related diabetes-like symptoms in association with accelerated telomere shortening^{67,69}. Other dietary interventions, such as fortifying diets with high quality oils rich in linoleic acid appear to impact skeletal muscle mass⁴⁶. Additionally, we identified exercise modalities that offer promise in lowering sarcopenia risk and severity⁵³ and that nutritional risk is associated with shorter telomeres, a biological marker of aging⁴⁰. Further work can build on these findings to ascertain if shortened telomeres and the corresponding increase in cellular senescence are contributing factors in sarcopenia.

Building on these efforts, the renewal project will focus on **two objectives**: (1) to conduct multidimensional assessment of diet, physical activity and related factors affecting aging adults and (2) to develop, implement and evaluate interventions that improve health and well-being in aging adults in urban and rural environments. Given the diversity of the current team, which includes experts from metabolic nutrition to Extension and Outreach researchers, our team is well positioned to address the health and well-being of community-residing older adults from the laboratory to community. This provides a unique opportunity to work from the metabolic level to translational science.

We will also expand our reach to include those age 40 years and older. This expansion of age inclusion is based on our present work that has illustrated the need to start interventions earlier than age 60 when applicable^{17,45,53}.

The technical feasibility of the research.

Our team has a long-standing interest and strong research record in the areas of aging, nutrition, exercise/physical activity, physiology and health promotion. Each has extensive experience in one of the five areas: metabolic nutrition, nutrition and/or physical activity interventions, qualitative research, nutritional science, and cell physiology. The proposed research is strengthened by our interdisciplinary approach that embodies translational research taking it from the lab to the community. The project team has a successful work history, including project development, data collection, evaluation, and dissemination.

The advantages for doing the work as a multistate effort.

This multistate aspect will provide the opportunity for team members to reach a diverse group of aging adults from around the United States. The multistate and institutional aspect allows us to collect data in a range of socioeconomic and ethnically diverse populations and across rural, suburban and urban geographical areas. This multistate group currently covers the northeast, mid-Atlantic, Southern, and upper Midwest regions of the country. Second, the multistate nature of the project, which entails the utilization of standardized assessment tools used by all researchers, lends itself to the establishment of a large data set from which additional analyses can be conducted. Additionally, the collaborative nature of the proposed work will allow a better utilization of research funding on larger-scale, multi-purpose, comprehensive projects that embodies translational research (lab to community).

Anticipated Impacts

The proposed multistate research team will train undergraduate and graduate students in qualitative research (e.g., conducting focus groups, analyzing focus group transcripts), quantitative research (e.g., data collection, data analysis), professional and scientific writing, laboratory skills,

anthropometric measures, nutritional status assessment, dietary intake assessment, and physical function. The team will submit collaborative grant applications to external funding organizations and publish research findings in joint publications. The work conducted through our independent and collaborative efforts will (1) provide a better understanding of nutrition and physical activity needs of at-risk aging adults, (2) develop and implement effective strategies to address these needs, and (3) identify biomarkers related to the health of aging adults. Overall, these combined efforts will improve understanding of the dietary intakes, physical function, QOL and food security, lower sarcopenia risk, and reduce age-related diseases such as type 2 diabetes.

RELATED CURRENT AND RELEVANT WORK

Related multistate projects. A recent Current Research Information System (CRIS) search of multistate research projects was conducted using the key words: human, aging, nutrition, exercise, physical activity, obesity, and sarcopenia. This search revealed this proposed renewal project is unique. Other multistate initiatives address in some aspect nutrition, physical activity, exercise, obesity and sarcopenia, but the focus on aging and older adults is not replicated with other multistate projects. Furthermore, there are no known groups working at the intersection of these important topics whose members represent such a diverse range of disciplines and skills and continued support of these efforts is perhaps more important than ever before as the population of the US is continuing to age.

Accomplishments under current project. A strength of the NE-1439: Changing the Health Trajectory for Older Adults through Effective Diet and Activity Modifications multistate project is that the current team is comprised of molecular biologists, nutritional scientists, sociologists, anthropologists, registered dietitian nutritionists, exercise physiologists, and Extension researchers. Having a broad interdisciplinary team provides an opportunity for innovative collaborative translational work. Translational research is key to fundable, comprehensive nutritional research.

Our work since October 2014 has focused on three research areas including molecular and mechanistic understanding of age-related diseases, environmental assessment, and lifestyle needs assessments and interventions. Collectively, we have secured more than \$750,000 in funding, published 39 peer-reviewed manuscripts (4 joint publications), trained 66 undergraduate students, 50 graduate students, and 2 post-doctoral research associates, and developed various Extension resources, including a four-module Extension healthy aging curriculum (For more information, <https://www.nimss.org/meetings/project/15898>).

Given the diversity of the work being completed, the resulting projects have been a blend of individual state projects and collaborative multistate efforts. For example, Dr. Belden adapted a PCR-based telomere length assay (a marker for cellular aging) similar to the one used in the NHANES national survey¹¹. This initial project involved only Rutgers University (Rutgers) students and faculty. Following this assay adaption, Dr. Ventura-Marra (West Virginia University [WVU]) collaborated with Dr. Belden to perform a telomere assessment as a biological marker of cellular aging as part of a diet and cardiovascular risk assessment study. This collaborative effort provided Dr. Ventura-Marra with the opportunity to report include objective data on cellular aging to support the efficacy of a lifestyle intervention and allowed Dr. Belden to use the developed assay in a real-world application⁴⁰. The proposed renewal project is anticipated to expand on this type of collaboration. In addition to their individual foundation experiments, the molecular biologists and nutritional scientists will be involved with select intervention studies to help assess programming impacts by performing comprehensive dietary analyses.

Another example of a project that started as a one-state effort but expanded to include three other states is our produce consumption environmental assessment study. Dr. Cohen (University of Massachusetts at Amherst [UMass]) began work on creating a theory-based produce access questionnaire. In order to ensure the applicability of the tool to different populations, Dr. Cohen worked with NE-1439 team members (Iowa State University [ISU], New York University [NYU], and WVU) to complete formative online focus groups as well as pilot-test the resulting environmental assessment tool (ISU and University of Illinois-Urbana Champaign [UIUC]). These multistate collaborations resulted in

ascertaining the priorities for health eating in older adults in diverse communities³³ and used the resulting survey tool to determine the perceived environmental supports for produce consumption among older adults³⁴. As a result, our team has a better understanding of the produce access issues facing older adults. We learned how to use technology to conduct qualitative research across state lines, and now have a tool that can be used by other team members. Further, the inclusion of sociologists and anthropologists on our team in recent years has enabled our environmental and intervention work to look more holistically at the health and well-being of older adults. We anticipate expanding on this work by including more quality of life assessment tools during our studies.

Multistate research projects offer many benefits including working across state lines to evaluate the efficacy and impact of lifestyle interventions among diverse audiences. However, a challenge is that in order for an intervention to be effective it must be focused on the needs and preferences of the target audience. This means the approach utilized by each state may need to differ. In order to be more collaborative while respecting the unique needs of residents from each state, we began using common assessment tools across studies. This has allowed for the merging of data to perform cross-sectional studies. For example, many states were implementing various community-based nutrition education programs designed to meet the needs of our stakeholders. Although we were not evaluating the same intervention across states, each state had asked the same sociodemographic questions and used the same nutritional risk assessment tool. Team members from three states, New Hampshire (no longer with the project), Rhode Island and Iowa, created a multistate database with sociodemographic data and the nutritional risk assessment data to identify the nutritional risk factors of community-residing older adults. This study revealed most community-residing older adults were at nutritional risk and that their intake frequencies of protein-rich foods was low (MacNab et al., 2018). Given the success of this project, this approach will be expanded for this proposed renewal project with all states choosing from the same assessment measures as appropriate for their studies.

Furthermore, three current team members are Extension state specialists (ISU, Mississippi State University [MSU], and UICU). Having Extension Specialists on the NE-1439 team, has allowed for the development of community-based materials and interventions based on the formative work completed through the NE-1439 project. For example, the Stay Independent—a healthy aging series (<https://www.extension.iastate.edu/humansciences/stay-independent>) was developed based on the nutritional risk assessments by MacNab and others³⁹. It is now a statewide program in Iowa. For the proposed renewal project, we aim to pilot test community-based interventions through Extension as well as develop Extension publications and products that are informed through our collaborative research efforts. Doing so, increases the likelihood of this multistate project having national implications, as Extension is available in all states.

The work accomplished over the past few years through the NE-1439 multistate project has identified sarcopenia as a focus of our future interdisciplinary work. Helping adults age in place is a critical public health issue as the number of adults turning age 65+ grows rapidly. Long-term care spending reached \$210.9 billion in 2011 in the United States (US)²⁰ and can comprise a major expense for older adults. A major threat to adults being able to age in place is sarcopenia. Sarcopenia is an often undiagnosed, chronic disease affecting older adults that has dire consequences both financially and physically³². The renewal project provides the opportunity for team members to focus on sarcopenia prevention applying a translational approach that is inclusive of molecular, community and environmental areas. This is innovative in the area of sarcopenia research. While sarcopenia will be a disease endpoint of focus, we will also continue to emphasize ways that the work we do has applications for the general aging process and for other health conditions.

OBJECTIVES

The long-term goal of the proposed renewal project is to promote the independence and well-being of community-residing aging adults (ages 40 years and older). We aim to achieve this long-term goal by achieving the following research objectives:

- **Objective 1:** To conduct multidimensional assessments of diet, physical activity and related factors affecting aging adults.
- **Objective 2:** To develop, implement and evaluate interventions that preserve or improve health in aging adults living in rural and urban environments.

Completing research studies under these objectives over the proposed five-year period (2019 through 2024) is expected to provide us with a more thorough understanding of: (1) the issues impacting the health and well-being of adults age 40 years and older; (2) how diet and exercise/physical activity factors influence the body at the molecular and cellular level; and (3) intervention strategies resulting in behavior changes as well as the development of interventions that are deliverable at the community-level nationally.

METHODS

Team members are expected to participate in at least one of the two overarching research objectives. The interdisciplinary composition of our team necessitates individual-level research as well as integrative, collaborative projects. The proposed activities will contribute toward the long-term goal of promoting the independence and well-being of community-residing aging adults (ages 40 years and older) while enabling researchers to maintain autonomy over their research experiments. For example, many of the laboratory-based projects will take place at the one of three universities (MSU, Ohio State University [OSU], and Rutgers); however, the formative work being completed in the areas of lipidomics (OSU), selenium (MSU) and telomere length (Rutgers, MSU) will inform our intervention strategies. It is also anticipated that some of our lifestyle intervention researchers will work with our molecular biologists and nutritional scientists to conduct specialized laboratory tests in addition to the traditional blood tests when examining the impact of dietary and physical activity programming. Finally, establishing one standardized set of inclusion criteria for human subjects conducted as part of this project is not feasible given the anticipated blend of individual-level and collaborative research as well as target behaviors. Therefore, the recruitment strategies utilized may vary by study (Appendix A).

Objective 1: To conduct multidimensional assessments of diet, physical activity and related factors affecting aging adults. These multidimensional assessments will explore molecular, community, and individual factors thus providing a comprehensive assessment. This approach will entail three overarching areas.

- AREA 1 involves performing molecular assessments on aging adults as a means to better inform participants' activities and diet choices. Diet and exercise ultimately affect physiology on the molecular and cellular level and specific biomarkers are often the best predictors of whether certain diet and exercise modifications are beneficial. To accomplish Area 1, routine assessments of telomere length (Leukocyte Telomere Length [LTL] assay) will be coupled with assays that monitor markers of inflammation (CRP, Fibrinogen, IL-6, and TNF γ). The purpose of these assays will help predict the best diet and activity interventions for the participants and educate them on best practices to increase health span and independent living. In particular, Wu and others⁶⁷, have reported dietary selenium deficiency shortens telomere length in the highly proliferative colonocytes and accelerates incidence of such age-related symptoms of telomere-humanized mice. This provides an opportunity to assess whether telomere length is associated with blood selenium status in aging adults. Muscle mass will be estimated using bioelectrical impedance or skin fold and circumference measurements. Muscle function will be measured using grip strength, a criterion of the FNIH definition of sarcopenia⁵⁷ will be used to assess muscle function^{9,66}. Peripheral blood lymphocytes collected at the same time as plasma for markers of inflammation and telomere length (above) will be analyzed for mitochondrial enzyme activity (e.g., citrate synthase activity⁵⁴). Targeted lipidomics of mitochondrial fractions from

peripheral blood lymphocytes will identify mitochondrial phospholipids that are modified by dietary lipids³⁵.

- **AREA 2** includes conducting needs and preference assessments to determine aging adults' perceptions and recommendations for community environmental supports for a food secure, culturally appropriate and healthy eating environments. Improving the general health, functionality and the quality of life (QOL) of aging adults is a Healthy People 2020 goal^{19,64}. In order to achieve this, social determinants of health (circumstances in the environment in which people are born, live, learn, work, worship and age) must be considered. The purpose of these studies is to identify the most important and modifiable enablers and behavioral of healthy eating among aging adults. To accomplish this, mixed methodology approaches will be used, including both qualitative and quantitative methods such as focus groups and consumer surveys. Qualitative methodology is an effective way to engage groups of people in a conversation about topics in which there are gaps in the literature and results can be useful as formative data to create surveys. We anticipate that focus groups would include six to eight people and do as many as needed to reach a saturation point in the data. Saturation occurs when further data collection does not provide new knowledge. Open-ended questions will be used and questions will be developed to answer gaps in the literature review. All focus group discussions will be transcribed verbatim and will be analyzed using standard focus group protocols. Themes will then be identified from the most prevalent codes found amongst the transcriptions. Expanding on the NE-1439 produce access questionnaire project additional consumer surveys will be developed using literature reviews, formative data from focus group discussions, or from community service providers or community members in the rural and urban regions of the participating states. These surveys will highlight the most important and modifiable community settings to improve food access and dietary behaviors in older adults. Surveys will be pretested for clarity and reliability and then administered to consumers receiving services through home-delivered meal programs (e.g., Meals on Wheels), congregate meal sites, food pantries, senior centers, and other community centers serving older adults in participating states. Surveys will identify older adults' use of community supports for healthy eating, identify the types of supports used, identify where seniors access their foods and if they are food secure, and provide recommendations for improvement to foster healthy eating in older adults.
- **AREA 3** entails determining, examining and understanding cultural, personal and accessibility barriers to dietary intakes and physical activity by aging adults. The purpose of these studies is to identify the geographic locations, cultural, and personal characteristics, and attitudes and beliefs that influence dietary behaviors (e.g., the purchase, preparation, and consumption of various foods) and physical activity patterns. Based on these findings, we will propose and implement sustainable methods to eliminate identified barriers, including nutrition education and physical activity interventions. Quantitative and qualitative data will be collected on aging adults. Quantitative data such as demographics, dietary intake, physical activity, food security and food access will be collected using standardized, validated assessment tools across states (See "Survey Tools Description" section). The methods for qualitative data collection will be focus groups and personal interviews as described above in Area 2. The information obtained through these studies will be shared with team members during the team's general meetings and the annual meetings. The findings will be used to inform the studies being conducted under Objective 2.

Objective 2: To develop, implement, and evaluate interventions that improve health in aging adults living in rural and urban environments. The growth of the current team (13 states) has resulted in a more diverse make-up of states. This diversity includes population density (urban versus rural). Of the 11 states focused on community-based research, four (36.4%) have rural state populations of 20% and higher⁶³. Rural-residing older adults have worse physical health, decreased socialization, and a lower health-related quality of life than their urban-residing counterparts do^{4,31}. The proposed renewal project will begin to examine programs relevance toward both rural and urban environments.

- Area 1 necessitates conducting qualitative and quantitative research examining nutrition- and physical activity related patterns and predictors of healthy aging. The purpose is to identify individual, family, clinical, community and health services nutrition- and physical activity-related factors for successful aging. All states implementing human studies will use the same assessment tools as applicable to the respective studies. These common assessment tools reflect the core variables being addressed across all human studies in this multistate project. These survey tools will collect the same: sociodemographic information, examine nutritional risk and dietary composition, food security, QOL, physical function, and physical activity. A common data set will be created to store data from all needs assessment and intervention studies conducted as part of this project. This large data set will be used to conduct modeling studies examining predictors of successful aging as well as cross-sectional data analyses to explore risk factors across states.
- Area 2 will involve developing theory-based nutrition and physical activity interventions based on identified needs and preferences. These interventions may focus on a variety of issues affecting aging adults such as weight loss, arthritis reduction, general health, and food security. Expanding on the work completed as part of the NE-1439 project we will further develop a sarcopenia prevention program. A variety of methods will be utilized depending on the type of study being implemented. These methods may include community-based assessments and/or interventions (e.g., Extension-delivered), clinical trials, and epidemiological studies. The key predictors and outcome measures include anthropometric, biochemical, clinical, dietary, physical activity, socioeconomic, and environmental factors according to the study design. For example, the loss of muscle in sarcopenia driven by cellular senescence and the major driver of cellular senescence is telomere shortening. When telomeres become too short, cells enter a state where they are incapable of dividing and enter a dormant state. In addition, chronic inflammation has been proposed to be a major contributor to sarcopenia so following markers of inflammation will serve as a predictor of muscle loss. To address this, key markers of inflammation such as IL-6, and TNF γ and DNA repair such as OGG1 will be assessed in blood serum. Results from these biochemical analyses will complement and strengthen this area of research. Elevated inflammation, as indicated by plasma levels of TNF γ and IL-6, are highly associated with muscle loss. The Belury research group (OSU) will assess the association of dietary intake of fatty acids with inflammation and muscle function, mass and mitochondrial capacity, in collaboration with Drs. Belden (Rutgers) and Cheng (MSU).
- Area 3 is the development and testing of a theory-based, community-implemented, exercise and nutrition program (lifeSPAN [Sarcopenia Prevention through Activity and Nutrition] Program) capable of reducing the risk of and/or severity of sarcopenia among women ages 40-75 years. The long-term goal of the lifeSPAN Program is to promote the independence and well-being of community-residing aging and older women through an integrative, community-based exercise and nutrition intervention. The lifeSPAN program utilizes an interdisciplinary approach, applies sustainable lifestyle intervention approaches, and is designed for community-delivery through Extension. The lifeSPAN Program will include creating an exercise DVD that emphasizes resistance training (based on work completed by URI as part of the NE-1439 project) and a nutrition curriculum that promotes protein intake through whole foods (based on MacNab study³⁹). The key indicators may include physical function (grip strength, four-meter gait speed test, chair stand tests, isometric leg extensor strength), body composition (multi-frequency bioelectrical impedance analysis (MFBI), height and weight), nutrition and food measures (multiple 24-hour recalls, nutritional risk and dietary intake frequencies, complete blood counts, serum selenium levels), and markers of inflammation. The intervention will be pilot-tested in a variety of community settings. Data analysis will be undertaken using general linear models methods, focused on testing for differences between Control and Treatment groups and controlling for relevant demographic and structural covariates. The lifeSPAN program will be implemented in both urban and rural areas.

Survey Tool Descriptions

Sociodemographic Attributes

We will use the demographic questions collected as part of the Performance Outcome Measurement Project (POMP)². The demographics module includes 10 questions related to gender, race, age, marital status, and include. These questions utilize standard wording used with national surveys, which will allow for better comparison to national findings.

Nutritional Risk and Dietary Intake Frequency Assessment:

The Dietary Screening Tool (DST) is a validated tool to assess nutritional risk in middle-aged and older adults based on frequency of intakes of fruits, vegetables, dietary fiber, lean protein, added fat, sugars and sweets, dairy, and processed meats. The DST has 25 food and behavior specific questions, which can be completed by individuals in less than 10 minutes and scored by clinicians in less than 5 minutes^{5,6}. The maximum score of 100 points is divided into 7 diet component categories (added fats, sugar, and sweets; whole fruit and juice; vegetables; total and whole grains; lean protein; dairy; and processed meat). A higher score is desirable as it indicates lower nutritional risk ("nutritional risk" [<60 points], "possible nutritional risk" [60-75 points], and "not at risk" [>75 points]) (Bailey, 2009). As part of the NE-1439 project, Dr. Ventura-Marra validated the DST for use among middle-adults adults (45 to 64 year olds)⁴¹; thus expanding its use among all aging adults.

Food Security

Food insecurity is associated with poverty, lower nutrient intakes, increased likelihood of poor or fair health, being a person of color, activities of daily living (ADLs) limitations, and poor chronic disease management^{3, 26, 37, 38, 56, 58, 72}. Per the USDA Economic Research Service, nearly all the states in the renewal project where community-based research will occur (10 out of 11) has a food insecurity rate of 10 % and higher⁶³. The renewal project will collect food security data. To lower participant burden, researchers will be encouraged to use either the "Six-Item Short Form"⁶² or the two-question option²⁵. The "Six-Item Short Form" quickly assesses food insecurity among older adults⁶². A two-question subset from this short form has a sensitivity of 96% and higher and a specificity of 79% and higher²⁵.

Quality of Life (QOL)

We will assess QOL using one of the following tools: Satisfaction with Life Scale (SWLS)¹⁵, food satisfaction will be measured using the Satisfaction With Food-Related Life (SWFL) scale²⁴, or the deJong Gieveland 6-item loneliness scale¹³. The validated SWLS is a measure of subjective well-being. It is a 5-item 7-point Likert scale questionnaire used as measure of global cognitive judgments of satisfaction with one's life¹⁵. The SWFL scale is comprised of five questions on a 6-point Likert scale centered on food and meals²⁴. The loneliness scale is comprised of six questions and assesses emotional loneliness and social loneliness¹³.

Physical Activity

The validated Yale Physical Activity Survey (YPAS) estimates caloric expenditure of habitual physical activity, including exercise activities, chores, and leisure activities in older adults^{16,68}. It is valid and reliable when used with adults aged 60-86 years. Since there are no questions regarding specific exercises such as resistance training, we will ask a few additional questions regarding whether they have recently engaged in resistance training or other exercises including recent frequency, duration, and intensity.

Physical Function

Physical function will be assessed using at least one of the following tests: static handgrip strength^{36,42,48,52}, the Short Physical Performance Battery Protocol (SPPB)^{27,28}, and a 400-meter walk test^{51,65}.

Static handgrip strength is a simple, safe, reliable and valid predictor of total body strength, physical functioning, and future disability and will be done using a hand-grip dynamometer (Jaymar Hydraulic Dynamometer, J.A. Preston, Corp., Jackson, MS)^{36,42,48,52}. Participants will perform the grip strength test in a seated position using their dominant arm with the elbow flexed at a 90-degree angle. They will be instructed using standardized oral encouragement to squeeze the dynamometer with as much force as possible and highest force attained will be recorded. Three trials separated by a 1-minute rest period will be done and the highest force will be used.

The SPPB includes three balance tests, a gait speed test and a chair stand test^{27,28}. Walking speed will be measured by requesting the participant to walk at their normal pace over a 4m distance. Time in seconds to complete the full course will be recorded. Two attempts will be done, and the faster of the two times will be used. A 46-cm high straight-back chair will be used to complete the repeated chair stand test, and participants will be instructed to stand up from the chair once without using their arms for assistance. If a participant is able to complete one chair stand, he/she will be asked to stand up and sit back down five times as quickly as possible, and the time to complete one series of five chair stands will be recorded. Participants will be instructed to sustain balance in three different positions distinguished by sequential narrowing of the base of support. Position one will begin with feet together (i.e. side by side); position two will consist of the heel of one foot next to the big toe of the other foot (i.e. semi-tandem); the last position will have the heel of one foot in front of and touching the toes of the other foot (i.e. tandem). For all three positions, participants will be timed for a maximum of 10 seconds, and scores will be summed for the measure of balance for a range of 0 to 30 seconds. Scores from 0 (inability to complete the test) to 4 (highest possible score) will be assigned to each of the three performance measures based on standard cut-points. A summary score ranging from 0 (lowest) to 12 (highest) will be calculated by adding walking speed, chair stands, and balance scores.

We will also use the 400-m walk test^{51,65}. This test is a predictor of subsequent mortality in older adults. On a track (or measured corridor) each participant will be instructed to walk the track in a continuous loop as quickly as possible at a pace that can be maintained. Standardized oral encouragement will be given, as well as feedback regarding the number of laps remaining.

MEASUREMENT OF PROGRESS AND RESULTS

Outputs

- Development of Manual of Operations that includes all common validated tools that will be used for multistate research efforts. This manual will help ensure common research protocols are followed by all states.
- A comprehensive database of needs assessment and intervention data will be developed to allow for multistate cross-sectional data analysis and comprehensive assessment of lifestyle interventions for community-residing aging adults.
- Results from these studies will be used to provide recommendations to appropriate agencies regarding implementation of methods to improve availability and accessibility of healthful foods and physical activity for older adults.
- Continued statistical exploration of the associations among the following age-related health factors: dietary and physical activity behaviors, quality of life, socioeconomic status, race, etc.
- Molecular data of telomere length and markers of inflammation correlated with specific dietary and activity interventions.

- Using cross-sectional and longitudinal approaches, we will measure the association of dietary fat quality with changes of muscle function, mass and mitochondrial capacity. Results will be used to design intervention studies to test dietary oils (doses and types) to attend the loss of muscle mass and function in older people.

Outcomes or Projected Impacts

- Improved understanding of the nutrition and physical activity practices of community-residing adults ages 40 years and older influencing their chronic disease status.
- Reduced chronic disease incidence and/or severity as indicated through self-report, validated survey outcomes related to identified chronic disease and/or blood values.
- Reduced nutritional risk and improved dietary intake frequencies as measured by the DST among those participating in nutrition-focused interventions
- Increased physical activity participation among aging adults and increased physical function among those attending exercise, physical activity and/or sarcopenia interventions.
- Reduced food insecurity among those with limited incomes
- Enhanced healthspan as assessed by reduced chronic disease risk factors, increased QOL, and/or physical function.
- Study participants will gain knowledge regarding recommended nutrition and physical activity behaviors.
- Optimized healthspan through nutrition and physical activities that are cost-effective and achievable for aging or older adults.
- Implement dietary and other lifestyle goals that will attenuate muscle loss.

Milestones

- Year 1:
 - Develop operations manual for common survey tools.
 - Develop SPSS-base codebooks for each of the common research tools.
 - Prepare manuscripts and grant submissions for studies.
- Years 1-2:
 - Create lifeSPAN curriculum and prepare related grant applications.
 - Optimize laboratory procedures for blood collection and preparation of peripheral blood lymphocytes at multiple sites.
 - Prepare manuscripts and grant submissions for studies.
- Years 2-3:
 - Pilot-test lifeSPAN program.
 - Collect survey data from across states.
 - Examine telomere length and markers of inflammation for selected studies.
 - Quantify association of dietary fat intake with mitochondrial capacity and muscle health.
 - Prepare manuscripts and grant submissions for studies.
- Years 4-5:
 - Conduct cross-sectional data analysis using multistate dataset.
 - Examine telomere length and markers of inflammation for selected studies.
 - Prepare manuscripts and grant submissions for studies.

OUTREACH PLAN

We plan to disseminate the work accomplished through this multistate project at multiple levels. We will create and distribute education materials and programs for community-level implementation, ideally through Extension but may also include Area Agencies on Aging and public health departments. Joint publications related to our research findings will be prepared and submitted to peer-reviewed journals. We will continue to do oral and poster presentations at local, regional and national professional meetings such as Experimental Biology, American College of Sports Medicine, the American Society for Nutrition annual meeting, Food and Nutrition Conference and Expo, the Society of Nutrition Education and Behavior annual meeting, and the annual National Health Outreach Conference (Extension).

ORGANIZATION AND GOVERNANCE

Currently an Executive Committee (chair, chair-elect, past-chair, secretary, and member-at-large) and a Regional Administrative Advisor has the administrative oversight and organization for the multistate group. All positions are elected to three-year terms by team members during the annual meeting. The term begins October 1 of each respective year. The Chair is responsible for setting the meetings, developing and posting agendas, and facilitating the meetings. The Chair also oversees the completion of the annual reports and project-related revisions. The chair-elect completes the duties in the absence of the chair. The secretary maintains the minutes and sends to the Chair to post on the multistate website. The member-at-large attends the executive committee meetings and performs other duties as assigned by the Chair. The multi-state members meet on a regular basis (every other month) via online meetings and annually face-to-face at a date and place that is selected by the entire group.

The NE-1439 Multistate group is in the process of developing and adopting a policy and procedures manual that will guide the functioning of the group. The maximum size of the multistate group will be 25 members. Members will be expected to actively participate in, collaborate, and contribute to the multistate research and administrative activities. Members who choose not to actively participate will be asked to resign from the group. Active participation is defined as participating in at least 50% of online meetings and contributing to the collaborative research and administrative activities. Consideration for termination of group membership due to inactive status will be presented on agenda and discussed by full group membership followed by a vote by the full membership at the next group meeting (face-to-face or online). A protocol will be established for accepting new members. It is anticipated that new members will be voted upon by the current members and should have applicable expertise that strengthens the group research, at least one chapter of dissertation published, and able to obtain independent funding for participation. The best time to join the group will be during the renewal process. Candidates must submit CV and documentation of how their skills meet the group research needs to the Chair. The group will review and vote upon the respective candidates.

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Appendix A: Human Studies Sampling Methods

Convenience sampling will be the primary recruitment strategy applied for human studies. This is in part due to the community-based nature of our human studies. The inclusion and exclusion criteria will be determined based on the primary purpose of the study. For example, if we are evaluating the impact of a sarcopenia prevention program, the presence of sarcopenia and/or sarcopenia risk will be used as an inclusion criterion. Below are some examples of recruitment strategies that may be utilized as part of this proposed multistate project. Sample sizes will be determined for individual studies via a power calculation or an effect size calculation by the research team implementing the study.

Aging adult: For this multistate project, an aging adult is anyone age 40 years and older. This age range was selected as sarcopenia, diabetes, cardiovascular disease begins to present prior to age 60. Age 60 is the minimum age required to participate in the Older Americans Act food and nutrition programs and is used by this team to define older adult. The target age group recruited will be dependent on the human study being conducted.

Community-residing or community-dwelling: Those age 40 and older who own a home, live with adult children, reside in a senior apartment, or a retirement community. For some studies, an adult who lives in an assisted living facility may be included. It excludes those who reside in nursing care facilities.

Rural-residing: Those age 40 and older who live in a county with a rural-urban continuum code of four or higher and defined as “non-metro.”⁽¹⁾

Urban-residing: Those age 40 and older who live in a county with a rural-urban continuum code of one to three and defined as “metro.”⁽¹⁾

Food Insecure/Lower Income: When pilot testing a program designed for those who are food insecure and/or of limited income, researchers will recruit at locations serving this population. These locations may include congregate meal programs, Section 8 Senior housing (must meet income guidelines), those attending food assistance programs (e.g., commodity and supplemental food programs, food pantries, food banks), or SNAP-Ed programs for older adults.

Adults with Sarcopenia: For the sarcopenia related projects, the inclusion criteria to be applied will include being age 50 to 75 years; literate; community-residing; being able/willing to consume higher levels of protein-rich foods; being able/willing to be physically active; and being able to make their own meal choices. Preliminary screening will occur via telephone. All interested participants will answer questions regarding age, disease states contraindicated for high-protein consumption (e.g., kidney disease, chronic obstructive pulmonary disease, etc.), living arrangement, special dietary practices limiting protein options (e.g., vegan, nut allergy, etc.), and will complete the physical activity readiness questionnaire (PAR-Q)⁽²⁾. Anyone who falls outside of these inclusion criteria will not be invited to participate.

Adults with a chronic disease: For interventions aimed toward treating and/or preventing the progression of a chronic disease, various recruitment measures may be employed. These may include self-report by the participants, partnership with clinics and/or practitioners working with aging adults with the identified chronic disease, or assessment of these conditions through a physical examine conducted at the time of enrollment (e.g., blood pressure, height/weight, blood glucose, etc). Trained study staff may use Cholestech LDX table-top analyzers to assess blood values. The Cholestech LDX has been shown to be a valid and accurate measure in comparison to traditional venipuncture⁽³⁾ and is much more convenient for community settings.

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