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Sarcopenia Screening by Registered Dietitian Nutritionists (RDNs) in the United States (U.S.)

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Sarcopenia Screening by Registered Dietitian Nutritionists (RDNs) in the United States (U.S.)

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by

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ABSTRACT

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Sarcopenia is a disease of muscle wasting primarily seen in older adults. Although this term was first coined over three decades ago, there is a lack of consensus on a definition, screening criteria, and treatment protocol for sarcopenia. The primary purpose of this study is to determine whether registered dietitian nutritionists (RDNs) in the United States (U.S.) screen for sarcopenia. Study participants were recruited through a randomized email list and included RDNs throughout the U.S. Respondents completed a survey questioning knowledge of sarcopenia, screening tools and company protocols in place, and the need and desire for sarcopenia education. Data revealed a lack of pre-existing protocols in place, a dissonance of validated and unvalidated screening tools used in practice, and substantial need for sarcopenia education.

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Chapter 1. Introduction

Sarcopenia was first defined in 1989 by Irwin Rosenberg as the age-related loss of muscle mass and function from the Greek roots “sarx” for flesh and “penia” for loss (Rosenberg, 1989). Several updated definitions have been proposed since the introduction of the term, but there has yet to be an established global or even national definition. Without specific guidelines for diagnosis and treatment of sarcopenia, statistics have been estimated but not verified.

In 2014, the European Working Group on Sarcopenia in Older People (EWGSOP) and the International Working Group on Sarcopenia (IWGS) conducted a systematic review that found the prevalence of sarcopenia to be between 1-29% for older, free-living people, 14-33% for those in long-term care institutions, and 10% for those in acute care settings (A. Cruz-Jentoft et al., 2014). These wide ranges are just one example of the variation in definitions, diagnoses, and treatment of sarcopenia. More recently, a systematic review conducted in 2017 found that 10% of men and 10% of women amongst over 58,000 individuals over the age of 60 had sarcopenia (Shafiee et al., 2017). This study included several established definitions including those set by the EWGSOP, the IWGS and the AWGS (Asian Working Group on Sarcopenia). Similarly, Bonetto and Bonewald (2019) estimated that the prevalence of sarcopenia would be 20% of the world’s population by the year 2050 and one-third of the population by 2150. However, a second review published in 2019 found that 43% of men and 46% of women had sarcopenia (Shen et al., 2019). The criteria included 16 studies, over 3,500 participants, and included only nursing home residents. With only the EWGSOP definition as the determinant for this review, there is a higher level of incidence when compared to the previous systematic review. Additionally, there was a statistically significant difference between the prevalence of malnutrition independent of sarcopenia prevalence found in this review.

A study published in 2019 found that the annual cost of sarcopenia-related hospitalizations in the U.S. is estimated to be $40.4 billion U.S. dollars each year (Goates et al., 2019). In comparison, several of the same authors of this 2019 study previously investigated the healthcare costs related to disease-related malnutrition. Although this study published in 2016 looked at only eight diseases (stroke, COPD, CHF, breast cancer, dementia, musculoskeletal disorders, depression, and colorectal cancer) that were associated with malnutrition and did not include acute disease-related or environmental malnutrition, the findings were still conclusive. It was estimated that this set of disease-associated malnutrition prevalence costs approximately $15.5 billion U.S. dollars (Goates et al., 2016). It is understood that these estimates cannot be directly compared. However, the research and understanding of malnutrition has a further reach than that of sarcopenia now. By extension of this logic, it is possible that the annual healthcare cost of sarcopenia could potentially be decreased by further research, understanding, and defined criteria of sarcopenia.

Similar to related diseases and terms including malnutrition, cachexia, and frailty, there exists a need for universally agreed upon screening, assessment, and treatment protocols for sarcopenia. The purpose of this study is trifold and includes determining whether or not registered dietitian nutritionists (RDNs) in the United States (U.S.) screen for sarcopenia; identifying which tools, if any, are used to screen and identify patients at risk for sarcopenia and any standard protocols in place; and identifying if there is a need and/or desire for education on sarcopenia screening.

Chapter 2. Review of the Literature

Sarcopenia Definition and Background

As stated above, sarcopenia was first defined in 1989 by Irwin Rosenberg as the age-related loss of muscle mass and function from the Greek roots "sarx" for flesh and "penia" for loss (Rosenberg, 1989). The European Working Group on Sarcopenia in Older People (EWGSOP2) convened in 2018—nearly a decade after the first meeting—to determine a new and improved definition for sarcopenia based on the evidence available. The EWGSOP2 determined that "sarcopenia is a muscle disease (muscle failure) rooted in adverse muscle changes that accrue across a lifetime"; however, it is more common in older adults but can occur earlier in life (Cruz-Jentoft et al., 2018). The EWGSOP2 also discussed inclusion criteria for sarcopenic diagnosis as shown in Table 1 below.

Table 1

Proposed Sarcopenia Diagnosis Criteria

Probable sarcopenia is identified by Criterion 1. **Diagnosis is confirmed by additional documentation of Criterion 2.** **If Criteria 1, 2 and 3 are all met, sarcopenia is considered severe.**
(1) Low muscle strength
(2) Low muscle quantity or quality
(3) Low physical performance

Note. Retrieved from "Sarcopenia: revised European consensus on definition and diagnosis" by A. J. Cruz-Jentoft, G. Bahat, J. Bauer, et al., 2018, *Age and Ageing*, *48*, p. 16-31. Copyright 2018 by the Authors.

Sarcopenia is now a billable diagnosis for reimbursement in some countries as of 2016 (Cao & Morley, 2016). Several updated definitions have been proposed, but there has yet to be a definitive and global definition established (Lee et al., 2013; Morley et al., 2001; Shen et al.,

2019). Aside from EWGSOP, other organizations throughout the world have proposed definitions of sarcopenia including the following:

- The International Working Group on Sarcopenia (IWGS) published in 2011 that:

  > Sarcopenia is the age-associated loss of skeletal muscle mass and function. Sarcopenia is a complex syndrome that is associated with muscle mass loss alone or in conjunction with increased fat mass. The causes of sarcopenia are multi-factorial and can include disuse, changing endocrine function, chronic diseases, inflammation, insulin resistance, and nutritional deficiencies. While cachexia may be a component of sarcopenia, the two conditions are not the same (Fielding et al., 2011).

- The Asian Working Group for Sarcopenia (AWGS) has agreed that sarcopenia should be described as low muscle mass, low muscle strength, and low physical performance; in comparison to EWGSOP, AWGS recommends measuring both muscle strength and physical performance as well as established lower cutoff measurements for the Asian populations compared to non-Asian populations (Chen et al., 2014).
- The European Society of Clinical Nutrition and Metabolism (ESCNM), the International Sarcopenia Initiative (ISI), and the Foundation for the National Institutes of Health (FNIH) have stated their affirmations in the original definition set forth by the EWGSOP (Cederholm et al., 2017; Cruz-Jentoft et al., 2014; S. A. Studenski et al., 2014).

Muscle Mass, Strength, and Loss

Many studies have shown that muscle mass and strength decline as an individual ages (Delmonico et al., 2009; Distefano & Goodpaster, 2018; Koster et al., 2011; Lexell et al., 1988).

Additionally, it is widely agreed upon that once individuals reach the age of fifty, muscle mass declines at a rate of 1-2% per year and muscle strength declines at a rate of 1.5-3% per year (Lang et al., 2010). It has also been found that muscle strength declines faster than muscle mass as a rate of two to five times (Koster et al., 2011). Although determinants for this age-induced loss of muscle mass and strength vary, there are several modifiable factors in which individuals can slow the rates of decline.

These modifiable factors include obesity, obesity-related conditions, and physical inactivity, among others (Distefano & Goodpaster, 2018). Obesity coupled with loss of muscle mass and function has been deemed sarcopenic obesity. This seemingly oxymoron has been proven in that increased adipose tissue negatively affects muscle function as well as decreases handgrip strength, to be discussed in following sections (Koster et al., 2011; Stenholm et al., 2008). As muscle protein synthesis declines with aging, resistance exercise has been shown to have similar effects in both older and younger cohorts (Schulte & Yarasheski, 2001). Furthermore, as oxidative stress increases in older adults, mitochondrial function decreases in part due to lack of physical activity (Safdar et al., 2010).

Sarcopenia Development

Development and progression of sarcopenia is largely associated with age and a decrease in skeletal muscle mass and strength if it is classified as primary sarcopenia. Secondary sarcopenia is considered when there are external factors aside from aging such as nutrition, activity, or disease that act as the cause (A. J. Cruz-Jentoft et al., 2018; Meron & Akuthota, 2018). In terms of primary sarcopenia, reduced physical activity and increased amount of time spent in bed can in part explain the increase in sarcopenia prevalence by way of decline in skeletal muscle mass (Bonetto & Bonewald, 2019). In addition, both acute and chronic

sarcopenia exist dependent on the length of time before sarcopenia is expressed which has been established by the EWGSOP2. Acute sarcopenia develops within 6 months and is often triggered by hospitalization or a high-level stressor event. On the other hand, chronic sarcopenia is that which has lasted longer than 6 months and is often related to aging, chronic disease, or progressive diseases (A. J. Cruz-Jentoft et al., 2018).

When reviewing sarcopenia, other related terms of interest include:

- *Sarcopenic obesity* was first loosely defined in 1996 as "reduced lean mass with excess fat as a percentage of body weight" (Heber et al., 1996). More recently and most notably, sarcopenic obesity is when "loss of muscle and gain in fat occur together… it may be that the gain in fat and the loss of muscle reinforce each other, and act synergistically" (Roubenoff, 2001). The latter has been noted and has been the basis in several more recent studies as well (Schrager et al., 2007; Scott et al., 2015; Stenholm et al., 2008).
- *Dynapenic obesity* is relative to muscle strength with excess body fat in comparison to sarcopenic obesity that is relative to muscle mass with excess body fat (Scott et al., 2015). Dynapenic obesity has gained popularity due to its increased association in functional decline compared to sarcopenic obesity (Scott et al., 2014).
- *Frailty* was originally defined in 2001 in a study looking at community-dwelling adults as "a clinical syndrome in which three or more of the following criteria were present: unintentional weight loss (10 lbs. in past year), self-reported exhaustion, weakness (grip strength), slow walking speed, and low physical activity" (Fried et al., 2001). However, it has more recently been observed in

terms of cognitive impairment in addition to the traditional physical impairment. This newer definition states that cognitive frailty is a "heterogeneous clinical manifestation characterized by the simultaneous presence of both physical frailty and cognitive impairment," which also includes additional criteria (Kelaiditi et al., 2013).

- *Malnutrition* is overarchingly defined as "a state of nutrition in which a deficiency of energy, protein, and other nutrients causes adverse effects on the body's size, composition, and function resulting in poorer clinical outcomes" (Stratton et al., 2018).
- *Cachexia*, similar to those discussed above, does not have an explicit definition. In 2008, clinicians and scientists met at the cachexia consensus conference to establish a definition for cachexia. The agreed upon definition of cachexia established was "a complex metabolic syndrome associated with underlying illness and characterized by loss of muscle with or without loss of fat mass" (Evans et al., 2008).

Screening and Assessment of Sarcopenia

Based on the number of working groups and organizations both discussed and not throughout this research, it is no surprise that there is not a definitive definition and screening protocol in place for sarcopenia. As stated above, there is no universally agreed upon definition for sarcopenia. Considering the variance amongst definitions, the same progression has been set for assessing those at risk for sarcopenia; there is also a lack of consensus for the screening and assessment of sarcopenia. A variety of tools, both validated and not, have been introduced for identifying those at risk of sarcopenia. These tools can be found in research and/or clinical

settings, have benefits and drawbacks, and some have more realistic applications than others. Following are descriptions of validated tests used in screening and diagnosing sarcopenia.

SARC-F

The SARC-F (strength, assistance in walking, rise from a chair, climb stairs, and falls) tool is one of the most common tools used in both research and clinical settings due to its high level of specificity and short administration time. Each component includes a question that is self-reported by the participant and is given a score of 0, 1, or 2. A total score of 4 or higher is indicative of a sarcopenia diagnosis (Li et al., 2019). The strength component questions how much difficulty the individual has in lifting and carrying 10 pounds with the scoring ranging from 0 (no difficulty), 1 (some difficulty), or 2 (a lot of difficulty or unable). The assistance in walking component questions how much difficulty the individual has in walking across a room with the scoring ranging from 0 (no difficulty), 1 (some difficulty), or 2 (a lot of difficulty, use of aids or unable). The rise from a chair component questions how much difficulty the individual has in transferring from a chair or a bed with the scoring ranging from 0 (no difficulty), 1 (some difficulty), or 2 (a lot of difficulty or unable without assistance). The climbing stairs component questions how much difficulty the individual has in climbing a flight of 10 stairs with the scoring ranging from 0 (no difficulty), 1 (some difficulty), or 2 (a lot of difficulty or unable). Finally, the falls component questions how many times the individual has fallen in the past year with the scoring ranging from 0 (no falls), 1 (1-3 falls), or 2 (4 or more falls) (Malmstrom & Morley, 2013). The SARC-F has been validated since its development in 2013 and has been found suitable for use in community-dwelling older adults (Malmstrom & Morley, 2013). A visual representation of the SARC-F can be found in Appendix A.

Ishii's Score

Ishii's Score was developed by a group of health professionals in Japan in 2014 (Ishii et al., 2014). The score is calculated by acquiring age, grip strength, and calf circumference and inputting this data into a formula. For men, the formula [0.62 X (age – 64) – 3.09 X (HS – 50) – 4.64 X (CC – 42)] is used where CC is calf circumference and HS is handgrip strength with the cut-off point ≥105 (Ishii et al., 2014). For women, the formula [0.80 X (age – 64) – 5.09 X (HS – 34) – 3.28 X (CC – 42)] is used where CC is calf circumference and HS is handgrip strength with the cut-off point ≥120 (Ishii et al., 2014). Although Ishii's Score has been validated, it has only been done so with Japanese participants (Tang et al., 2018). More recently, a group of public health professionals based in Belgium recommended a cutoff range of 111.1 to 128.5 for both men and women to better decipher amongst individuals at risk for sarcopenia (Locquet et al., 2018). This group also found that Ishii's Score demonstrated the best sensitivity and negative predictive value (NPV) as well as the highest area under the curve (AUC) when compared to four other sarcopenia screening tools (Locquet et al., 2018). Although Ishii's Score has only been validated for Japanese older adults, it has been validated to determine the 3-year mortality rate in Chinese older adults (Tang et al., 2018). Similar to the SARC-F, Ishii's Score was tested and validated for use in community-dwelling older adults regardless of ethnicity and demographics (Morandi et al., 2015). See Appendix B for the published version of Ishii's Score.

MSRA Questionnaire

The MSRA (Mini Sarcopenia Risk Assessment) questionnaire was developed in 2017 in Italy to serve as a prescreening tool for sarcopenia in community-dwelling older adults (Rossi et al., 2017). The MSRA-7 includes 7 questions comprising of age, hospitalizations, physical activity level, weight loss, number of meals consumed per day, dairy consumption, and protein

consumption with scores of 0, 5, or 10 (Rossi et al., 2017). The MSRA-5 is comprised of the same questions omitting the dairy and protein consumption questions with scores of 0, 5, 10, or 15. The cutoff score for both versions of the MSRA is 30 points with individuals having a score below 30 points being four times more likely to develop sarcopenia than those with a score above 30 points (Rossi et al., 2017). High sensitivity of the MSRA questionnaire lends it to be a good choice for a first-line of defense while the higher specificity of the SARC-F tool makes it out to be a better choice for a second-line defense (Yang et al., 2019). Similar to Ishii's Score, MSRA needs to be tested amongst populations other than Asian or Italian descent, respectively, to determine a higher accuracy (Yang et al., 2019). Similar to SARC-F and Ishii's Score, MSRA determines sarcopenia screening based on the EWGSOP definition (A. J. Cruz-Jentoft et al., 2018; Ishii et al., 2014; Malmstrom & Morley, 2013; Rossi et al., 2017). See Appendix C for the published versions of the MSRA questionnaire.

SarQoL Questionnaire

The SarQoL (Sarcopenia Quality of Life) was established in 2015 (Beaudart et al., 2015) and validated in English in 2017 (Beaudart, Biver, et al., 2017) as a disease-specific quality of life assessment for persons with sarcopenia. Experts in the field at the time believed that an assessment on quality of life specific to sarcopenia was necessary for patient safety and treatment. The questionnaire was originally written in French but is now available in 31 other languages, including English, with another six translations in progress. However, only five of the translated versions have been validated. After determining the domains and questions to be answered on behalf of individuals with sarcopenia, the original team decided upon 55 items that were addressed in 22 questions. Although it was originally designed for individuals 65 years of age and older in community-dwelling settings, it is widely used for a variety of ages and living

situations. The questionnaire takes about 10 minutes to complete for a total possible score of 100 points (Beaudart, Reginster, et al., 2017). See Appendix D for the published version of the SarQoL.

Bioelectrical Impedance Analysis

Bioelectrical impedance analysis (BIA) indirectly measures the skeletal muscle mass by way of low-grade electrical impulses sent through the body (A. J. Cruz-Jentoft et al., 2018). Although dual-energy x-ray absorptiometry (DXA) imaging is more accurate and deemed an appropriate tool for determining skeletal muscle mass, it is more costly and harder to gain access to than BIA (Dent et al., 2018; Gonzalez & Heymsfield, 2017). BIA is also endorsed as a secondary means of obtaining skeletal muscle mass by the EWGSOP, AWGS, and the International Consensus for Cancer Cachexia (ICCC), but current literature does not support the use of BIA for the diagnosis of sarcopenia (Dent et al., 2018; Gonzalez & Heymsfield, 2017). However, the use of non-imaging techniques leave room for greater variety of error and lack of accuracy (Boutin et al., 2015).

Other Screening Tools

Convened in 2016, the Global Leadership Initiative on Malnutrition (GLIM) received feedback from members of several of the world's prominent clinical nutrition organizations and societies in order to define a global diagnostic criterion for malnutrition (Cederholm et al., 2019). Leaders of GLIM consist of members from American Society for Parenteral and Enteral Nutrition (ASPEN), European Society for Clinical Nutrition and Metabolism (ESPEN), Latin American Federation of Nutritional Therapy, Clinical Nutrition and Metabolism (FELANPE), Parenteral and Enteral Society of Asia (PENSA), as well as additional representation from other organizations to gain insight from all around the world. The prominence of this research and

proposed diagnostic criteria for malnutrition is essential for the progression of global diagnostic benchmarks for sarcopenia. Also discussed throughout the GLIM committee meetings were the relationships between malnutrition, cachexia, sarcopenia, and frailty. The GLIM consensus reported that the proposed diagnostic criteria be used in conjunction with preexisting criteria for sarcopenia, frailty, and cachexia (Cederholm et al., 2019). Based on the GLIM proposed global malnutrition diagnosis criteria, previously studied correlations between frailty with gait speed, cachexia with handgrip strength, and sarcopenia with assessment of food intake can each be found to coexist with one or more of the described counterparts. This stated, an assessment of gait speed, handgrip strength, and assessment of food intake is integral in understanding sarcopenia screening, diagnostics, and treatments.

Gait Speed

Gait speed, often referred to as the "6th vital sign", has been utilized by physical therapists, occupational therapists, and neurologists alike (Middleton et al., 2015). Gait speed, or walking speed, requires energy, control of basic movements, support, and involves multiple organ systems in the body (Studenski et al., 2011). It has been concluded that a decline in gait speed has a correlation with disabilities, cognitive impairment, fall risk, and mortality (Van Kan et al., 2009). With specificity to this research, it has been established by the International Academy on Nutrition and Aging (IANA) that there is sufficient evidence available to determine that gait speed is a strong predictive indicator of undesirable outcomes in community-dwelling older adults (Van Kan et al., 2009).

Handgrip Strength

Skeletal muscle mass and muscle strength, while related, are independent of one another. It has been shown that muscle strength declines at a much higher rate (2-4 times) than muscle

mass and can be indicative of adverse outcomes (Wall et al., 2013). The relationship between handgrip strength and these adverse health effects is not considered new information. A study conducted in 1984 found that patients with lower handgrip strength scores had an increased occurrence of postoperative complications (Davies et al., 1984). Handgrip strength has also been shown to be connected to mortality, morbidity, and frailty (Cooper et al., 2011; Syddall et al., 2003). In terms of screening for sarcopenia, handgrip strength (grip strength) was not included in the position of the International Clinical Practice Guidelines for Sarcopenia (ICFSR) for valid reasons as discussed in those guidelines (Dent et al., 2018). However, the ICFSR recommends the use of grip strength—as well as gait speed—as diagnostic criteria for sarcopenia (Dent et al., 2018).

Assessment of Food Intake

Unintentional weight loss can be an indicator for loss of muscle mass and, ultimately, both malnutrition and sarcopenia. In terms of malnutrition, conducting a 24-hour food recall or short diet history is cumbersome and tedious for both the interviewer and interviewee. Food frequency questionnaires (FFQ), however, are less invasive on time, skills, and the respondents' responsibility overall (Steinemann et al., 2017). Understanding the relationships that exist between malnutrition and sarcopenia—as well as cachexia—and the tools used to screen for and diagnose them, is critical for identifying future treatment options. Although many tools are available, there is no single, validated tool available to screen for more than one of these conditions concurrently (Miller et al., 2018). With each condition being a possible outcome to nutritional inadequacies or imbalances, it is vital to identify or develop tools that can overlap, as well. The Academy of Nutrition and Dietetics (AND) published an updated position paper in

2019 stating that the malnutrition screening tool (MST) should be used to screen for malnutrition, or undernutrition, in adults (Skipper et al., 2019).

Sarcopenia Treatment

Although treatment options for sarcopenia are not established, there are various treatments that have been studied including physical activity, dietary modifications, supplement use, and even hormone replacement therapies.

Physical Activity

A prominent randomized controlled trial conducted in 2014, the LIFE (Lifestyle Interventions and Independence for Elders) study followed over 1,600 individuals over the span of two and a half years (Pahor et al., 2014). This pioneer study observed the effects of either a structured physical activity program or health education program on mobility disability. The physical activity group members were instructed to participate in various individualized exercises including walking, resistance exercises, and strength training while members of the health education group were instructed to attend workshops focused on "successful ageing" and also included minor stretching exercises (Pahor et al., 2014). The LIFE study found that compared to baseline 400 meter walking distances and times, participants in the physical exercise cohort experienced lower major and persistent mobility deficits with 30.1% (n=246 of 818) and 14.7% (n=120 of 818) when compared to the health education cohort's major and persistent mobility deficits with 35.5% (n=290 of 817) and 19.8% (n=162 of 817), respectively (Pahor et al., 2014).

Changes to Diet and Supplements

Although the evidence is not as strong for nutritional interventions without exercise as for physical exercise alone, there remains a strong interest in research related to nutrition

interventions to treat sarcopenia. Of note, one review published in 2018 discussed the mounting evidence of the importance of adequate protein, vitamin D, antioxidant and long-chain polyunsaturated fatty acids (LCPUFA) in healthy ageing (Robinson et al., 2018). The Working Group, comprised of members of ESCEO (European Society for Clinical and Economic Aspects of Osteoporosis, Osteoarthritis, and Musculoskeletal Diseases), discussed the importance of these nutrients, the research strengths and limitations, and further research needs in order to determine specific nutrition interventions for the treatment of sarcopenia.

Sarcopenia in Practice Settings

With the lack of global consensus on the screening, assessment, treatment, and even explicit definition of sarcopenia, there is no one healthcare profession that has been shown to explicitly inquire about sarcopenia in practice today. Based on the primary sarcopenia aspects including muscle mass and strength, nutrition intake, and related diseases such as malnutrition, cachexia and frailty, there are several professions that would be most abreast of sarcopenia diagnosis and treatment. Regarding muscle mass and strength with and without relation to frailty, physical therapists and/or occupational therapists seem to coincide best with this aspect. Nutrition corresponds best with registered dietitian nutritionists who work closely with physical therapists and occupational therapists regarding patient status and outcomes. With a lack of separate or shared responsibilities defined for each of these professions—as well as other healthcare professionals—it begs the question of who currently screens, assesses, treats, and monitors those with sarcopenia? In addition, what profession more closely coincides with these stated responsibilities and should conduct proper sarcopenia treatment? The aim of the proposed research questions focuses on the registered dietitian nutritionists' current role and future of sarcopenia screening, assessment, and treatment.

The following three research questions were investigated regarding the responses obtained from the formulated survey:

RQ1: Do registered dietitian nutritionists routinely screen and identify patients at risk for sarcopenia?

RQ2: Are there any screening tools which are commonly used to screen and identify patients at risk for sarcopenia, and are there any protocols in place?

RQ3: Is there a need and/or a desire for education for registered dietitian nutritionists on what sarcopenia is and how to conduct screening?

Chapter 3. Methods

Survey Design

Data was collected using a 29-question survey comprised of 9 demographic questions and 20 sarcopenia-related questions. Throughout the survey, the option was given not to answer specific questions should the participant so choose. In addition, not all 29 questions were answered by all participants dependent on answers selected for previous questions. The survey was developed by the primary investigator and feedback was received by the thesis committee comprised of two registered dietitian nutritionists (RDN) and one physical therapist (PT). The survey took approximately 5 minutes to complete. See Appendix E for the complete survey.

Study Population

The study population included 210 RDNs in the U.S. Study participants met the following inclusion criteria: (1) over the age of 18 years of age, (2) registered dietitian nutritionist in the United States. Exclusion criteria included: (1) under the age of 18 years of age, (2) not a registered dietitian nutritionist in the United States.

Survey Implementation

The Commission on Dietetic Registration (CDR) is the credentialing agency for the Academy of Nutrition and Dietetics (AND) for RDNs in the U.S. After filing an application, CDR provided a random list of 5,000 email addresses of RDNs throughout the U.S. In November 2020, the survey was distributed to all 5,000 RDNs via an email with a Qualtrics survey link. Respondents were notified of potential risks and benefits of the study. This study was initially approved by the East Tennessee State University (ETSU) Institutional Review Board (IRB) on September 14, 2020. Minor revisions were made to the survey and revised approval by ETSU

IRB was received on October 29, 2020. The survey was closed for participation on December 5, 2020.

Data Collection, Coding, and Cleaning

After the closure of the survey, data were downloaded from Qualtrics as an Excel file, then coded and imported into IBM Statistical Package for Social Sciences (SPSS), version 27. Variables for testing were based upon the study's questions and interest in further discoveries of these groupings. The chosen variables for analysis are provided in Appendix F. Surveys from participants that were incomplete were coded but were disregarded in the data analysis process.

Data Analysis

Data analysis was completed using SPSS, version 27. Descriptive statistics were reported for demographic information and frequencies for all Sarcopenia-related questions. A series of one-way Analysis of Variance (ANOVA) tests were conducted to examine the influence of demographic variables on screening for sarcopenia at p-value ≤ 0.05.

Chapter 4. Results

Demographics

Of the 210 survey participants, 27.6% (n=58) identified between 21-30 years of age, 27.1% (n=57) were 31-40, 16.7% (n=35) were 41-50, 13.3% (n=28) were 51-60 and 15.2% (32) were 60 years or older. Most of the participants (53.8%) hold a master's degree (n=113) followed by 39.5% with a bachelor's degree (n=83), 5.7% with a doctorate degree (n=12), and 1.0% (n=2) indicating highest level of education as other. Of all respondents, 90.5% (n=190) were currently practicing RDNs, 5.7% (n=12) were not currently practicing, 3.3% (n=7) were retired, and 0.5% (n=1) declined to answer. Of the states represented in this survey, states not explicitly accounted for include Alaska, Delaware, Montana, Oregon, Vermont, Wisconsin, and Wyoming although 1.9% (n=4) identified practicing in more than one state. Of the 210 survey participants, 38.6% (n=81) are members of Dietetic Practice Groups (DPGs) while 58.6% (n=123) are not. Out of the 81 participants who are members of DPGs, 40.7% (n=33) are members of more than one DPG. In terms of practice settings for survey participants, 22.4% (n=47) work in more than one setting, 20.5% (n=43) work in inpatient acute care, 11.0% (n=23) work in ambulatory or outpatient facilities, 10.5% (n=22) work in settings not listed, while the remaining 35.6% (n=75) work in one of the other fourteen settings listed. Survey participants demographics can be found in Table 2.

Table 2

Participant Demographics (n=210)

Demographic		Participants (n)	Participants (%)
Age	21-30	58	27.6
	31-40	57	27.1
	41-50	35	16.7
	51-60	28	13.3
	60+	32	15.2
Highest earned degree	Bachelor's	83	39.5
	Master's	113	53.8
	Doctorate	12	5.7
	Other	2	1.0
Currently practicing	Yes	190	90.5
	No	12	5.7
	Retired	7	3.3
	Prefer not to answer	1	0.5
Member of DPG	Yes	81	38.6
	No	123	58.6
	Retired	5	2.4
	Prefer not to answer	1	0.5
Practice setting	Acute care – inpatient	43	20.5
	Acute care – outpatient	13	6.2
	Ambulatory/outpatient care facility	23	11.0
	College, university or academic medical center	9	4.3
	Food or equipment manufacturer, distributor, or retailer	2	1.0
	Health/fitness facility	2	1.0
	Home health	1	0.5
	Long-term care	17	8.1
	Pharmaceutical or nutrition products manufacturer, distributor, or retailer	3	1.4
	Private practice	9	4.3
	Retail	1	0.5
	School nutrition	1	0.5
	Social services organization	5	2.4
	Not currently practicing	7	3.3
	Retired	4	1.9
	Other	22	10.5
	Prefer not to answer	1	0.5
	More than one setting	47	22.4

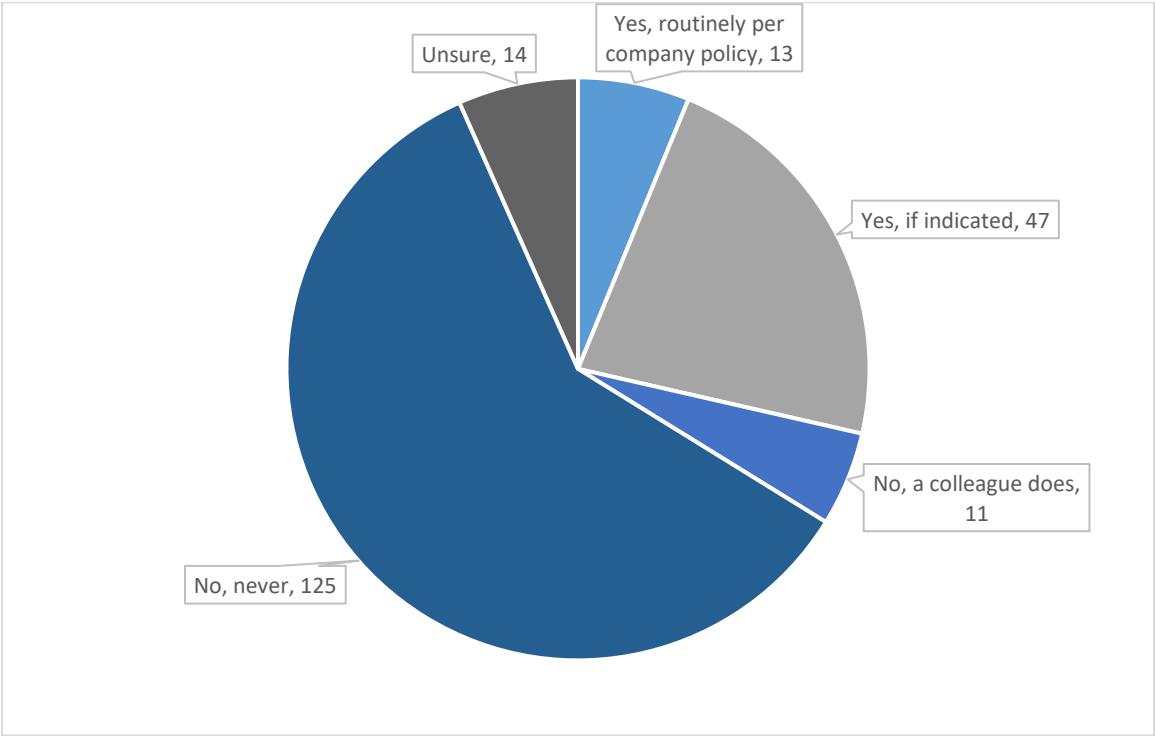
Research Questions

RQ1: Do registered dietitian nutritionists routinely screen and identify patients at risk for sarcopenia?

Survey question 2.3 corresponded to this research question and read “Do you screen for sarcopenia?”. There were five possible responses for this question. Of the 210 survey participants, 6.2% (n=13) and 22.4% (n=47) do screen for sarcopenia either per company policy or if indicated, respectively. Of those who do not screen for sarcopenia, 5.2% (n=11) do not screen for sarcopenia and stated that a colleague screens while 59.5% (n=125) never screen. In addition, 6.7% (n=14) were unsure if they screen for sarcopenia (Figure 1).

Figure 1

Survey Question 2.3 "Do You Screen for Sarcopenia?"



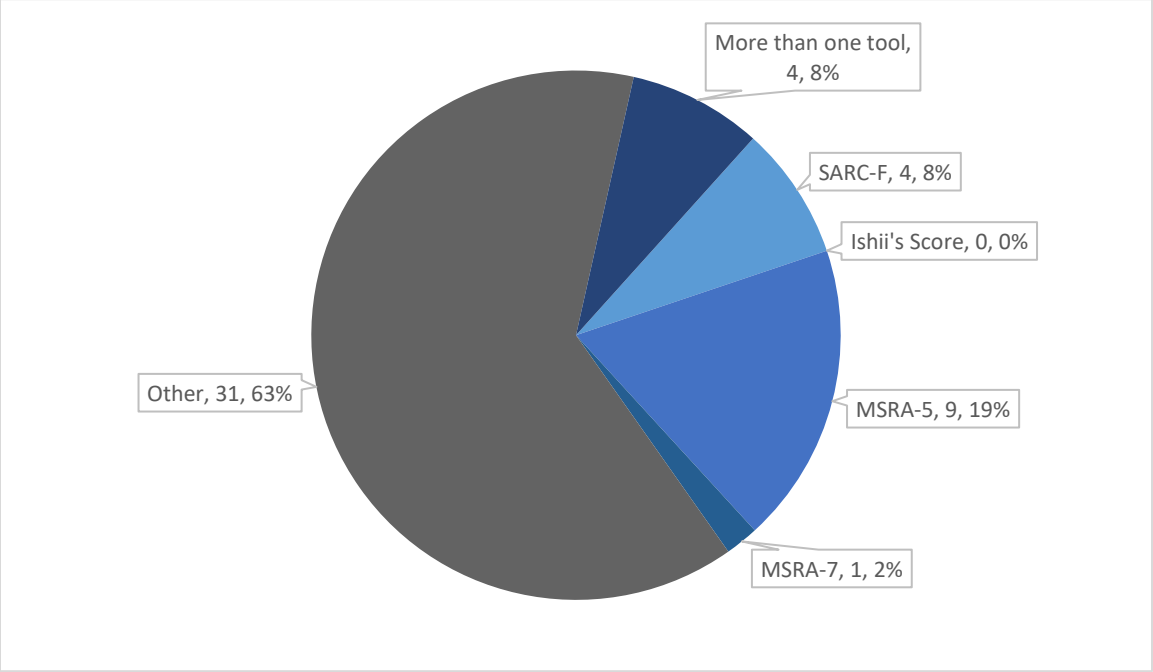
Based on these responses, 28.6% (n=60) of RDNs who participated in this study do screen for sarcopenia while 64.7% (n=136) do not screen for sarcopenia. These results agree with the hypothesis that RDNs do not routinely screen and identify patients at risk for sarcopenia. Of note, survey question 2.2 asked “Are you familiar with sarcopenia?”. Respondents could select among yes, no, and somewhat. Of the 14 respondents who selected unsure to question 2.3, 71.4% (n=10) selected yes, 7.2% (n=1) selected no, and 21.4% (n=3) selected somewhat to question 2.2. This is indicative of some level of knowledge of what sarcopenia is, but these RDNs are not sure what the screening or identification processes of sarcopenia entails.

RQ2: Are there any screening tools which are commonly used to screen and identify patients at risk for sarcopenia, and are there any protocols in place?

The first segment of this research question is addressed by survey question 2.5 and the latter segment by survey question 2.7. Survey question 2.5 stated “What tool(s) do you use to screen for sarcopenia?” and gave the option to select multiple responses as well as an open text for additional screening tools not listed. Survey question 2.5 was only visible to those participants who selected either of the yes answer choices in question 2.3. Of the 49 participants who answered, 8.2% (n=4) selected SARC-F, 18.4% (n=9) selected the MSRA-5 questionnaire, 2.0% (n=1) selected the MSRA-7 questionnaire, 63.3% (n=31) selected the use of a tool not listed and 8.2% (n=4) selected the use of more than one tool (Figure 2). There were no selections for using Ishii’s Score to screen for sarcopenia.

Figure 2

Survey Question 2.5 "What Tool(s) do You Use to Screen for Sarcopenia?"

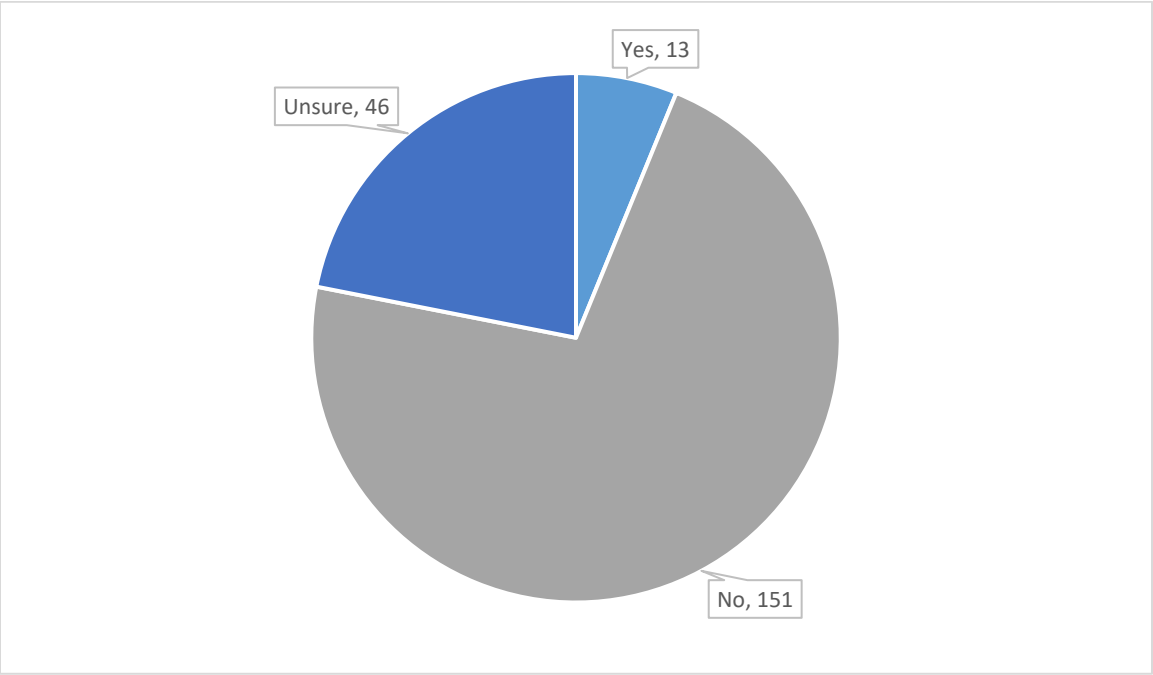


Of the 31 RDNs who used a tool other than the options listed, 51.6% (n=16) used nutrition focused physical exam (NFPE), 9.7% (n=3) used an unvalidated personal tool and 38.7% (n=12) used ASPEN (American Society of Parenteral and Enteral Nutrition) guidelines or other validated malnutrition screening tool.

Addressing the latter segment of this research question, survey question 2.7 stated "Does your facility/practice have any sarcopenia screening protocols in place?". Responses regarding sarcopenia screening protocols included 6.2% (n=13) selecting yes, 71.9% (n=151) selecting no, and 21.9% (n=46) selecting unsure of any protocols (Figure 3).

Figure 3

Survey Question 2.7 "Does Your Facility/Practice Have any Sarcopenia Screening Protocols in Place?"



Based on the data gathered from the survey results, the hypothesis that screening tools and protocols used to screen and identify patients at risk for sarcopenia are not commonly seen in practice is supported.

RQ3: Is there a need and/or a desire for education for registered dietitian nutritionists on what sarcopenia is and how to conduct screening?

Survey questions 3.9 and 3.10 addressed this research question. Survey question 3.9 polled RDNs by asking "Would you be interested in sarcopenia education?". The majority of participants responded that they would be interested with 68.1% (n=143), 21.4% (n=45) would not be interested, and 10.5% (n=22) were unsure (Figure 4). Of the 143 participants who would be interested in sarcopenia education, survey question 3.10 became viewable and asked, "What

format of sarcopenia education would you be interested in?". Participants were given the options of webinars, virtual training, online modules, and CPE (Continuing Professional Education), as well as the options to select more than one and other. Of the 143 responses, 30.8% (n=44) selected all four options, 15.4% (n=22) selected three options except virtual training, 14.0% (n=20) selected webinars and CPE (Table 3).

Figure 4

Survey Question 3.9 "Would You be Interested in Sarcopenia Education?"

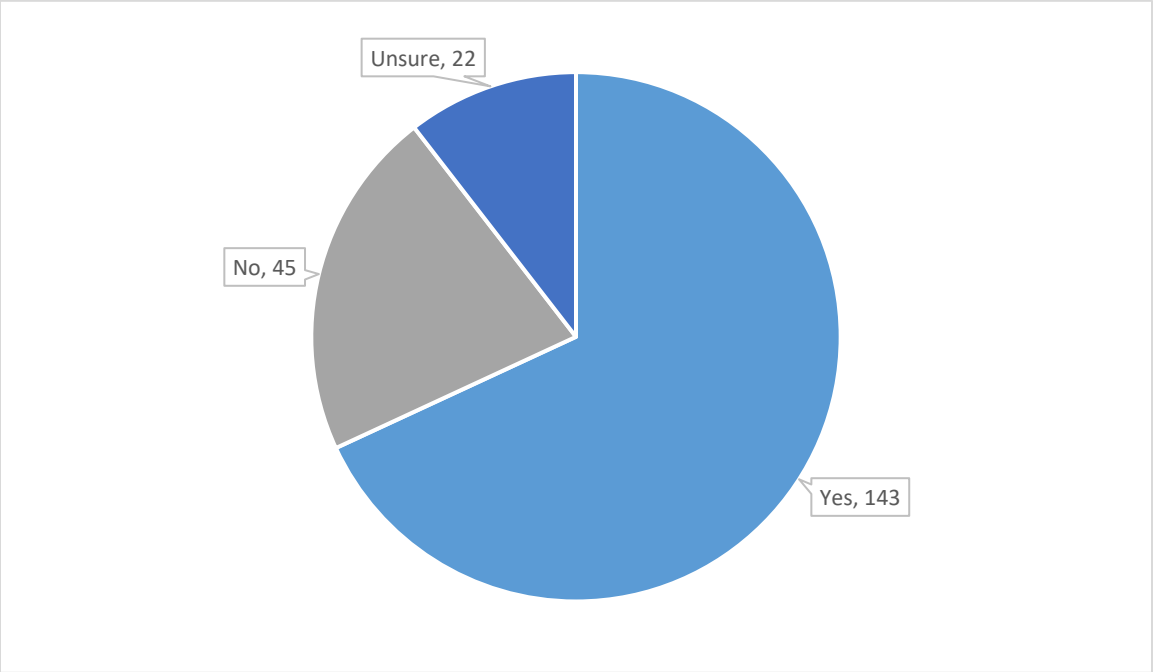


Table 3

Survey Question 3.10 "What Format of Sarcopenia Education Would You be Interested in?"

Education	Participants (n)	Participants (%)
Webinars	12	8.4
Virtual training	3	2.1
Online modules	2	1.4
CPE	12	9.1
Other	0	0.0
All four options	44	30.8
Webinars, online modules, CPE	22	15.4
Virtual training, online modules, CPE	6	4.2
Webinars, CPE	20	14.0
Webinars, virtual training, CPE	8	5.6
Virtual training, CPE	2	1.4
Webinar, virtual training, online modules	3	2.1
Online modules, CPE	3	2.1
Webinars, virtual training	2	1.4
Webinars, online modules	3	2.1

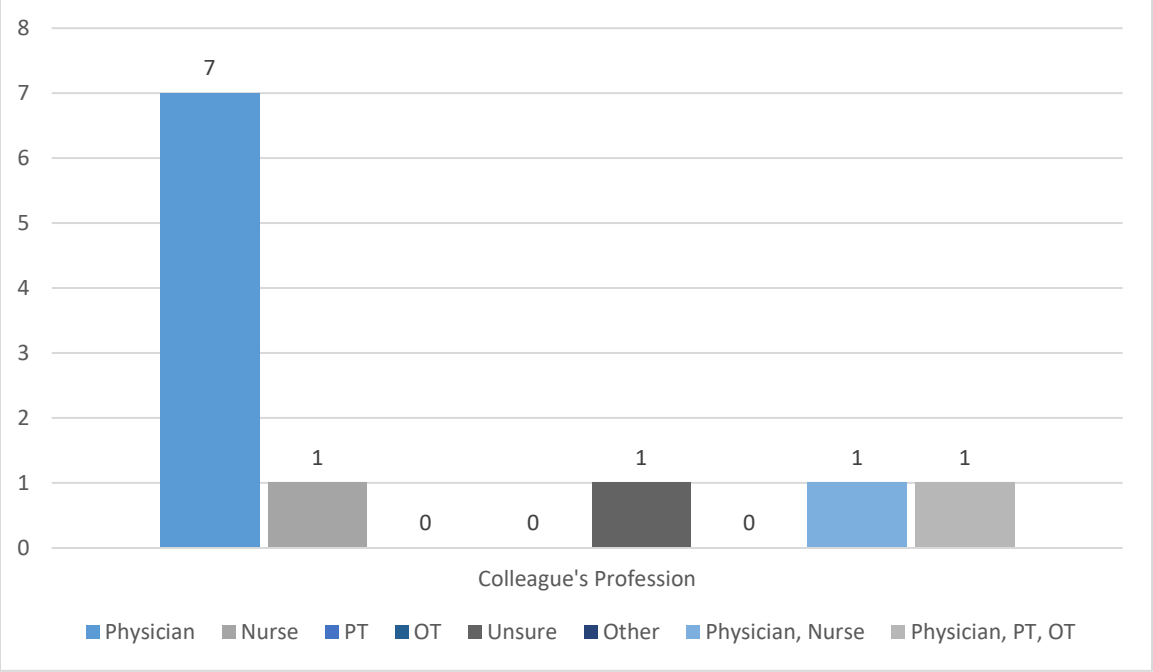
In terms of the universal need for sarcopenia education, survey questions 2.2 and 2.3 that were discussed above under "Research Question 1" also contribute to this research question. Responses for survey questions 2.2 and 2.3 that questioned, "Are you familiar with sarcopenia?" and "Do you screen for sarcopenia?" respectively, indicate the need for sarcopenia education. Regarding survey question 2.2, 27.1% (n=57) of participants responded no or somewhat while 72.9% (n=153) responded yes. Although this is not strictly indicative of the lack of sarcopenia knowledge, the 153 respondents' level of knowledge from seeing the term in an article to actively practicing and researching sarcopenia can be highly variable. In contrast, need for sarcopenia education is supported by survey question 2.3 in which only 28.6% (n=60) do screen for sarcopenia while 64.7% (n=136) do not screen for sarcopenia, and 6.7% (n=14) were unsure if they screen for sarcopenia. Based on the responses to survey questions 3.9, 3.10, 2.2, and 2.3, the hypothesis that there is a need for education for RDNs on what sarcopenia is and how to conduct screening is supported.

Other Findings

Survey question 2.3, which stated “Do you screen for sarcopenia?” led to a follow up question for participants who selected the option of “No, a colleague does”. Of the 5.2% (n=11) that selected this answer choice, follow up question 33 was then posed “What is the colleague's profession that screens for sarcopenia?”. Several healthcare professions were listed, but respondents were given the option to select multiple professions, select unsure, and write in a response. Of the 11 respondents to this question, seven selected only physician, one selected nurse, one selected unsure, one selected both physician and nurse, and one selected physician, physical therapist, and occupational therapist (Figure 5).

Figure 5

Survey Question 33 “What is the Colleague's Profession that Screens for Sarcopenia?”



Survey question 2.4 questioned “If sarcopenia screening is indicated, what triggers determine this?” and gave participants the option to select multiple responses and write in a response. This survey question only became visible if a participant selected the option “Yes, if indicated” to survey question 2.3. Of the 48 responses to this question, 4.2% (n=2) selected malnutrition, 2.1% (n=1) selected physical activity, 2.1% (n=1) selected nutrition focused physical exam (NFPE), 2.1% (n=1) selected other, 18.8% (n=9) selected 2 triggers, 22.9% (n=11) selected 3 triggers, 27.1% (n=13) selected 4 triggers, 8.3% (n=4) selected 5 triggers, 10.4% (n=5) selected 6 triggers and 2.1% (n=1) selected 7 triggers. Exact count of each trigger selected can be found in Table 4 and Figure 6.

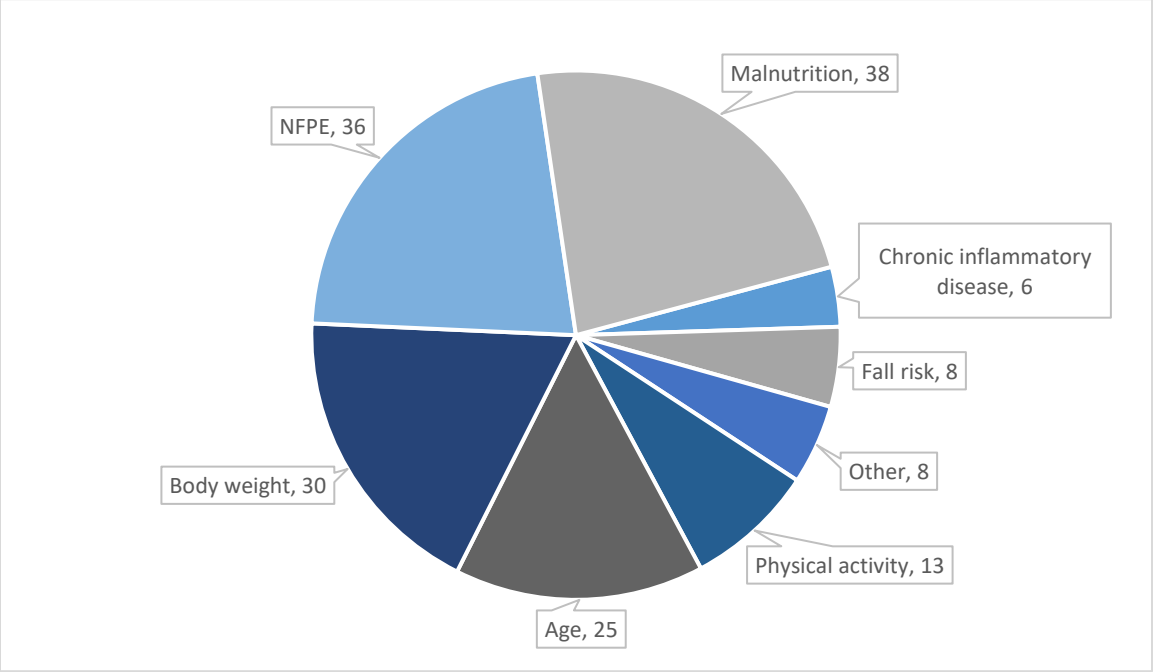
Table 4

Survey Question 2.4 “If Sarcopenia Screening is Indicated, What Triggers Determine This?”

Trigger		**Participants (n)**	**% Total Responses (164)**
Age		25	15.2
Fall risk		8	4.9
Malnutrition		38	23.2
Body weight		30	18.3
Physical activity		13	7.9
NFPE		36	22.0
Chronic inflammatory disease		6	3.7
Other			
	Lean mass, fat free mass, strength	1	0.6
	Reason for referral (malnutrition, request for supplements, weight loss, skin breakdown)	1	0.6
	Pediatrics	1	0.6
	NFEP	1	0.6
	Referral from provider	1	0.6
	Psych medications	1	0.6
	Nutrition lab values	1	0.6
	MST	1	0.6

Figure 6

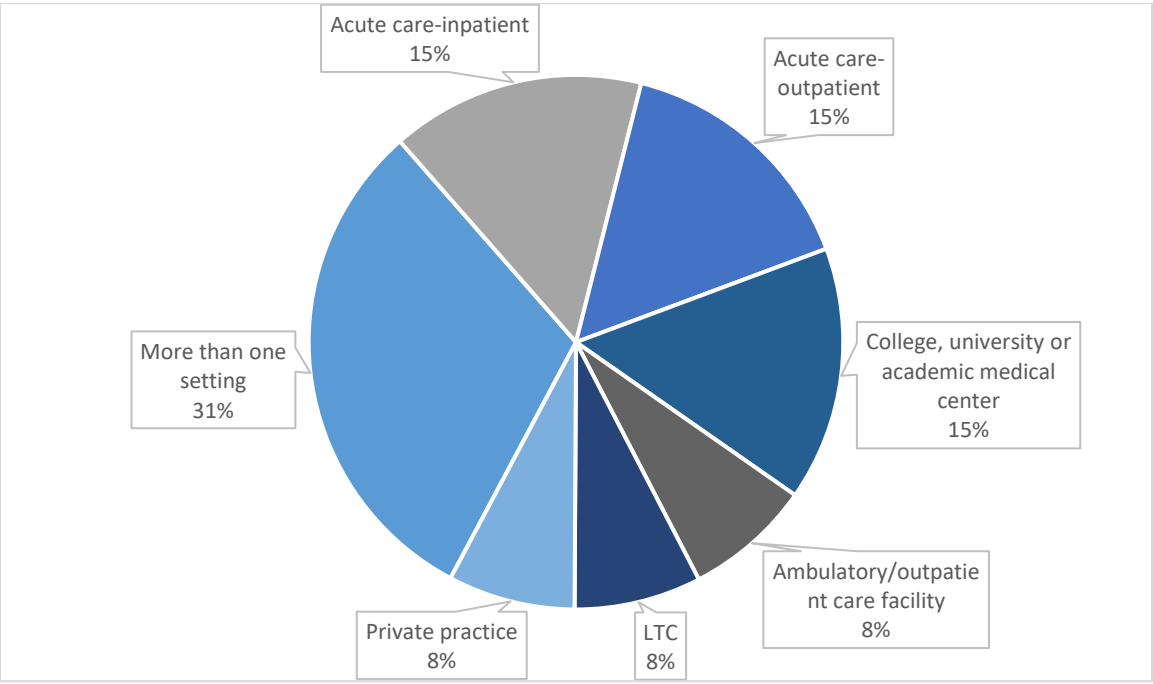
Survey Question 2.4 "If Sarcopenia Screening is Indicated, What Triggers Determine This?"



In response to RQ2, survey question 2.7 defined above found that 6.2% (n=13) respondents' workplace has sarcopenia screening protocols in place. Although not statistically significant, survey question 2.7 was correlated with survey question 1.10 which questioned "In what setting(s) do you commonly practice?". Of the 13 participants who selected yes to question 2.7, 30.7% (n=4) practice in more than one setting, 15.4% (n=2) practice in the acute care inpatient setting, 15.4% (n=2) practice in the acute care outpatient setting, 15.4% (n=2) work in a college, university or academic medical center, 7.7% (n=1) work in an ambulatory/outpatient care facility, 7.7% (n=1) practice in a long-term care facility, and 7.7% (n=1) work in private practice (Figure 7).

Figure 7

Survey Question 1.10 "In What Setting(s) Do You Commonly Practice?"



Chapter 5. Conclusion

As expected, all hypotheses of the three proposed research questions were proven and null hypotheses were voided. This research in whole and in parts have both reiterated and shed light on other aspects regarding sarcopenia knowledge, protocols, and education needs by a sample of RDNs in the U.S. The lack of standardized screening, assessment and treatment protocols in place are apparent. Subsequently, there is an overlook for a population of individuals who could potentially benefit greatly from sarcopenia treatment interventions.

Limitations

This study had several limitations. First, the study sample of 210 RDNs cannot be generalized to the RDN population as a whole. Secondly, this research extended only to registered dietitian nutritionists and does not include the plethora of other healthcare professionals. By extension, the study sample size cannot be generalized to all healthcare professionals as whole.

Future Research

Initial study methods were to include physical assessments of community-dwelling older adults. However, due to COVID-19 protocols, it was not possible to visit this population. Future research possibilities could include collecting data regarding physical and nutrition assessments of community-dwelling older adults. Through this research, more information could be gathered regarding screening and assessment protocols already in place as well as shortcomings in this area.

In addition, further investigations into organizations throughout the U.S. and the world to define protocols that are both in place and lacking regarding sarcopenia could be of value.

Findings of this research could assist in detecting larger-spectrum shortcomings rather than just individuals in practice.

Once a definition and screening criteria has been globally agreed upon, next steps into treatment of sarcopenia would be necessary. Similar to the processes of how screening and diagnostic tools have been studied, more extensive research would be essential in order to properly treat this debilitating disease.

Next steps regarding this sarcopenia research would initially include education to RDNs and other healthcare professionals as well as voicing the importance of this disease and call for action to healthcare organizations for protocols to be set.

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APPENDICES

Appendix A. SARC-F Screen for Sarcopenia

SARC-F Screen for Sarcopenia

Component	Question	Scoring
Strength	How much difficulty do you have in lifting and carrying 10 pounds?	None = 0 Some = 1 A lot or unable = 2
Assistance in walking	How much difficulty do you have walking across a room?	None = 0 Some = 1 A lot, use aids, or unable = 2
Rise from a chair	How much difficulty do you have transferring from a chair or bed?	None = 0 Some = 1 A lot or unable without help = 2
Climb stairs	How much difficulty do you have climbing a flight of 10 stairs?	None = 0 Some = 1 A lot or unable = 2
Falls	How many times have you fallen in the past year?	None = 0 1-3 falls = 1 4 or more falls = 2

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Appendix B. Formula for Ishii's Score

Formula for Ishii's Score

The exact formula to calculate the scores are as follows:

Score in men, $0.62 \times (\text{age} - 64) - 3.09 \times (\text{grip strength} - 50) - 4.64 \times (\text{calf circumference} - 42)$

Score in women, $0.80 \times (\text{age} - 64) - 5.09 \times (\text{grip strength} - 34) - 3.28 \times (\text{calf circumference} - 42)$.

The corresponding probabilities of sarcopenia are calculated with the following formulae:

Probability in men, $1 / [1 + e^{-(\text{sum score} / 10 - 11.9)}]$

Probability in women, $1 / [1 + e^{-(\text{sum score} / 10 - 12.5)}]$

Appendix C. The Mini Sarcopenia Risk Assessment (MSRA) 7 and 5 items Questionnaire

The Mini Sarcopenia Risk Assessment (MSRA) 7 and 5 items Questionnaire

	7 items	**5 items**
1-How old are you?	Score	Score
≥70 years	0	0
<70 years	5	5
2-Were you hospitalized in the last year?		
Yes, and more than one hospitalization	0	0
Yes, one hospitalization	5	10
No	10	15
3-What is your activity level?		
I'm able to walk less than 1000 meters	0	0
I'm able to walk more than 1000 meters	5	15
4-Do you eat 3 meals per day regularly?		
No, up to twice per week I skip a meal (for example I skip breakfast or I have only milky coffee or soup for dinner)	0	0
Yes	5	15
5-Do you consume any of the following?		
Milk or dairy products (yogurt, cheese), but not every day	0	-
Milk or dairy products (yogurt, cheese) at least once per day	5	-
6-Do you consume any of the following?		
Poultry, meat, fish, eggs, legumes, ragout or ham, but not every day	0	-
Poultry, meat, fish, eggs, legumes, ragout or ham at least once per day	5	-
7-Did you lose weight in the last year?		
≥2 kg	0	0
<2 kg	5	10

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Appendix D. Sarcopenia Quality of Life (SarQoL) Survey – Validated English Translation

Sarcopenia Quality of Life (SarQoL) Survey – Validated English Translation

Questionnaire I Time : ±10 min

SarQoL
Sarcopenia and Quality of Life

Quality of life in sarcopenia

This questionnaire asks about sarcopenia, which is a muscle weakness that comes about with ageing. Sarcopenia can affect your daily life. This survey will enable us to find out if the state of your muscles currently affects your quality of life.

Please choose the most appropriate response for each question. The questionnaire should take you approximately 10 minutes to complete.

1. Do you currently feel you have a reduction in:

	A lot	Some	A little	None
The strength in your arms?	☐	☐	☐	☐
The strength in your legs?	☐	☐	☐	☐
Your muscle mass?	☐	☐	☐	☐
Your energy?	☐	☐	☐	☐
Your physical capabilities?	☐	☐	☐	☐
Your general flexibility?	☐	☐	☐	☐

2. Do you have pain in your muscles?

- ☐ Often
- ☐ Sometimes
- ☐ Rarely
- ☐ Never

SarQoL
Sarcopenia and Quality of Life

3. When undertaking light physical activities (walking slowly, doing the ironing, dusting, washing-up, DIY, watering the garden, etc.), do you:

	Often	Occasionally	Rarely	Never	I do not undertake these types of physical activities
Have difficulty?	☐	☐	☐	☐	☐
Get tired?	☐	☐	☐	☐	☐
Experience pain?	☐	☐	☐	☐	☐

4. When undertaking moderate physical activities (fast walking, cleaning windows, hoovering, washing the car, pulling up weeds in the garden, etc.), do you:

	Often	Occasionally	Rarely	Never	I do not undertake these types of physical activities
Have difficulty?	☐	☐	☐	☐	☐
Get tired?	☐	☐	☐	☐	☐
Experience pain?	☐	☐	☐	☐	☐

5. When undertaking intense physical activities (running, hiking, lifting heavy objects, moving furniture, digging the garden, etc.), do you:

	Often	Occasionally	Rarely	Never	I do not undertake these types of physical activities
Have difficulty?	☐	☐	☐	☐	☐
Get tired?	☐	☐	☐	☐	☐
Experience pain?	☐	☐	☐	☐	☐

6. Do you currently feel old?

- ☐ Yes, very
- ☐ Yes, somewhat
- ☐ Yes, a little
- ☐ No, not at all

SarQoL
Sarcopenia and Quality of Life

7. If yes to question 6, what gives you that impression?
(Choose as many answers as you like)

- ☐ I become unwell easily
- ☐ I take many medications
- ☐ I feel a weakness in my muscles
- ☐ I have problems with my memory
- ☐ I've had to face the death of several people close to me
- ☐ I do not have much energy, I am often tired
- ☐ My eyesight is poor
- ☐ Other:

8. Do you feel physically weak?

- ☐ Yes, completely
- ☐ Yes, somewhat
- ☐ Yes, a little
- ☐ No, not at all

9. Do you feel you are limited in:

	A lot	Some	A little	None
The length of time you can walk for?	☐	☐	☐	☐
How often you go out walking?	☐	☐	☐	☐
The distance you can walk?	☐	☐	☐	☐
The speed at which you can walk?	☐	☐	☐	☐
The length of your steps?	☐	☐	☐	☐

10. When you are walking:

	Often	Occasionally	Rarely	Never	I am unable to walk
Do you feel very tired?	☐	☐	☐	☐	☐
Do you need to sit down regularly to recover?	☐	☐	☐	☐	☐
Do you have difficulty crossing roads quickly enough?	☐	☐	☐	☐	☐
Do you have difficulties with uneven surfaces?	☐	☐	☐	☐	☐

SarQoL
Sarcopenia and Quality of Life

11. Do you have problems with your balance?

- ☐ Often
- ☐ Occasionally
- ☐ Rarely
- ☐ Never

12. How often do you fall?

- ☐ Very often
- ☐ Occasionally
- ☐ Rarely
- ☐ Never

13. Do you think that your physical appearance has changed?

- ☐ Yes, very
- ☐ Yes, somewhat
- ☐ Yes, a little
- ☐ No, not at all

14. If yes to question 13, in what way? (Choose as many answers as you like)

- ☐ Change in your weight (you've put on weight or you've lost weight)
- ☐ Appearance of wrinkles
- ☐ Loss of height
- ☐ Loss of muscle mass
- ☐ Hair loss
- ☐ Getting white or grey hair
- ☐ Other:

15. If yes to question 13, are you upset by this change?

- ☐ Yes, very
- ☐ Yes, somewhat
- ☐ Yes, a little
- ☐ No, not at all

SarQoL
Sarcopenia and Quality of Life

16. Do you feel frail?

- ☐ Very much so
- ☐ A little
- ☐ Not at all

17. Do you currently have difficulty in undertaking any of the following daily activities:

	Unable to do	Great difficulty	A little difficulty	No difficulty	Not applicable
Climbing a flight of stairs?	☐	☐	☐	☐	☐
Climbing several flights of stairs?	☐	☐	☐	☐	☐
Going up one or several steps without holding on to the banister?	☐	☐	☐	☐	☐
Squatting of kneeling?	☐	☐	☐	☐	☐
Stooping or leaning down to pick up an object off the floor?	☐	☐	☐	☐	☐
Getting up from the floor without holding on to anything?	☐	☐	☐	☐	☐
Getting out of a low chair without armrests?	☐	☐	☐	☐	☐
Moving, generally, from a sitting position to a standing position?	☐	☐	☐	☐	☐
Carrying heavy objects (large bags full of shopping, saucepan filled with water, etc.)?	☐	☐	☐	☐	☐
Opening a bottle or a jar?	☐	☐	☐	☐	☐
Using public transport?	☐	☐	☐	☐	☐
Getting in or out of a car?	☐	☐	☐	☐	☐
Doing your shopping?	☐	☐	☐	☐	☐
Doing the housework (making the bed, hoovering, doing the ironing, washing the dishes, etc.)?	☐	☐	☐	☐	☐

SarQoL
Sarcopenia and Quality of Life

18. Does your muscle weakness limit your movement?

- ☐ Yes, a lot
- ☐ Yes, somewhat
- ☐ Yes, a little
- ☐ No, not at all

19. If yes to question 18, for what reasons? (Choose as many answers as you like)

- ☐ Fear of pain
- ☐ Fear that you might not be able to
- ☐ Fear of feeling tired after these activities
- ☐ Fear of falling
- ☐ Other:

20. Does your muscle weakness limit your sex life?

- ☐ I am not sexually active
- ☐ Yes, completely
- ☐ Yes, somewhat
- ☐ Yes, a little
- ☐ No, not at all

21. How has your participation in physical activities/sport changed?

- ☐ Increased
- ☐ Decreased
- ☐ Unchanged
- ☐ I have never participated in physical activities or sports

22. How has your participation in leisure activities (going out to eat, gardening, doing DIY, shooting/fishing, senior citizens clubs, playing bridge, going for a walk, etc.) changed?

- ☐ Increased
- ☐ Decreased
- ☐ Unchanged
- ☐ I have never participated in leisure activities

Note: Reused with written permission from Olivier Bruyere, creator of the original SarQoL in French. All published translations can also be found at www.sarqol.org.

Appendix E. Sarcopenia Survey

Sarcopenia Survey

Start of Block: Demographics

Q1.1 **Demographics Questions**

Q1.2 Age:

- ○ 21-30
- ○ 31-40
- ○ 41-50
- ○ 51-60
- ○ 60+
- ○ Prefer not to answer

Q1.3 Years in practice:

- ○ Less than 1
- ○ 1-5
- ○ 6-10
- ○ 11-15
- ○ 16-20
- ○ 20+
- ○ Prefer not to answer

Q1.4 What is your highest level of education?

- ○ Bachelor's Degree
- ○ Master's Degree
- ○ Doctorate Degree
- ○ Other
- ○ Prefer not to answer

Q1.5 What is your field of study for your highest earned degree? (i.e. PhD in Nutrition)

_____

Q1.6 Are you currently practicing?

- ○ Yes
- ○ No
- ○ Retired
- ○ Prefer not to answer

Display This Question:

If Q1.6 = Yes

Q1.7 If yes, in what state(s) do you currently practice?

- [ ] AK
- [ ] AL
- [ ] AR
- [ ] AZ
- [ ] CA
- [ ] CO
- [ ] CT
- [ ] DE
- [ ] FL
- [ ] GA
- [ ] HI
- [ ] IA
- [ ] ID
- [ ] IL
- [ ] IN
- [ ] KS
- [ ] KY

- [ ] LA
- [ ] MA
- [ ] MD
- [ ] ME
- [ ] MI
- [ ] MN
- [ ] MO
- [ ] MS
- [ ] MT
- [ ] NC
- [ ] ND
- [ ] NE
- [ ] NH
- [ ] NJ
- [ ] NM
- [ ] NV
- [ ] NY

- [ ] OH
- [ ] OK
- [ ] OR
- [ ] PA
- [ ] RI
- [ ] SC
- [ ] SD
- [ ] TN
- [ ] TX
- [ ] UT
- [ ] VA
- [ ] VT
- [ ] WA
- [ ] WI
- [ ] WV
- [ ] WY
- [ ] Prefer not to answer

Q1.8 Are you a member of any Dietetic Practice Groups (DPGs)?

- ○ Yes
- ○ No
- ○ Retired
- ○ Prefer not to answer

Display This Question:

If Q1.8 = Yes

Q1.9 Which DPGs are you a member of? Please select all that apply.

- [ ] Behavioral Health Nutrition
- [ ] Clinical Nutrition Management
- [ ] Diabetes
- [ ] Dietetics in Health Care Communities
- [ ] Dietitians in Business and Communications
- [ ] Dietitians in Integrative and Functional Medicine
- [ ] Dietitians in Nutrition Support
- [ ] Food and Culinary Professionals
- [ ] Healthy Aging
- [ ] Hunger and Environmental Nutrition
- [ ] Management in Food and Nutrition Systems
- [ ] Medical Nutrition Practice Group
- [ ] Nutrition Education for the Public
- [ ] Nutrition Educators of Health Professionals
- [ ] Nutrition Entrepreneurs

- [ ] Nutrition Informatics
- [ ] Oncology Nutrition
- [ ] Pediatric Nutrition
- [ ] Public Health/Community Nutrition
- [ ] Renal Dietitians
- [ ] Research
- [ ] School Nutrition Services
- [ ] Sports Cardiovascular and Wellness Nutrition
- [ ] Vegetarian Nutrition
- [ ] Weight Management
- [ ] Women's Health
- [ ] Prefer not to answer

Q1.10 In what setting(s) do you commonly practice?

- ☐ Acute Care - Inpatient
- ☐ Acute Care - Outpatient
- ☐ Ambulatory/Outpatient Care Facility
- ☐ College, University or Academic Medical Center
- ☐ Food or Equipment Manufacturer, Distributor, or Retailer
- ☐ Health/Fitness Facility
- ☐ Home Health
- ☐ Long-Term Care
- ☐ Pharmaceutical or Nutrition Products Manufacturer, Distributor, or Retailer
- ☐ Private Practice
- ☐ Retail
- ☐ School Nutrition
- ☐ Social Services Organization
- ☐ Not Currently Practicing
- ☐ Retired
- ☐ Other, please specify: _____
- ☐ Prefer not to answer

End of Block: Demographics

Start of Block: Part 1

Q2.1 **Part 1**
Sarcopenia is historically defined as "the age-related loss of skeletal muscle mass and/or muscle function".

Q2.2 Are you familiar with sarcopenia?

- ○ Yes
- ○ No
- ○ Somewhat

Q2.3 Do you screen for sarcopenia?

- ☐ Yes, routinely per company policy
- ☐ Yes, if indicated
- ☐ No, a colleague does
- ☐ No, never
- ☐ Unsure

Display This Question:

If Q2.3 = No, a colleague does

Q33 What is the colleague's profession that screen for sarcopenia? Please select all that apply.

- ☐ Physician
- ☐ Nurse
- ☐ Physical Therapist
- ☐ Occupational Therapist
- ☐ Unsure
- ☐ Other, please specify: _____

Display This Question:

If Q2.3 = Yes, if indicated

Q2.4 If sarcopenia screening is indicated, what triggers determine this? Please select all that apply.

- ☐ Age
- ☐ Fall Risk
- ☐ Malnutrition
- ☐ Body Weight
- ☐ Physical Activity
- ☐ Nutrition Focused Physical Exam
- ☐ Chronic Inflammatory Disease
- ☐ Other, please specify: _____

Display This Question:

If Q2.3 = Yes, routinely per company policy

Or Q2.3 = Yes, if indicated

Q2.5 What tool(s) do you use to screen for sarcopenia? Please select all that apply.

- ☐ SARC-F (Strength, Assistance in walking, Rise from a chair, Climb stairs, Falls)
- ☐ Ishii's Score
- ☐ MSRA-5 (Mini Sarcopenia Risk Assessment 5-question)
- ☐ MSRA-7 (Mini Sarcopenia Risk Assessment 7-question)
- ☐ Other, please specify: _____

Q2.6 Are you familiar with any of the sarcopenia screening tools listed below? Please select all that apply.

- ○ SARC-F (Strength, Assistance in walking, Rise from a chair, Climb stairs, Falls)
- ○ Ishii's Score
- ○ MSRA-5 (Mini Sarcopenia Risk Assessment 5-question)
- ○ MSRA-7 (Mini Sarcopenia Risk Assessment 7-question)
- ○ Other, please specify: _____
- ○ None

Q2.7 Does your facility/practice have any sarcopenia screening protocols in place?

- ○ Yes
- ○ No
- ○ Unsure

Q2.8 Does your facility/practice have follow-up protocols for those diagnosed with sarcopenia?

- ○ Yes
- ○ No
- ○ Unsure

Q2.9 Do you utilize handgrip strength measurements?

- ○ Yes
- ○ No

Display This Question:

If Q2.9 = Yes

Q2.10 In what ways do you utilize handgrip strength? Please select all that apply.

- ☐ Muscle Strength
- ☐ Malnutrition
- ☐ Frailty
- ☐ Other, please specify: _____

Q2.11 Do you refer to other healthcare professions for sarcopenia screening/diagnosis/treatment, or do other professions refer to RDNs in your facility? Please select all that apply.

- ☐ Yes, I refer to colleague(s)
- ☐ Yes, colleague(s) refer to me
- ☐ No, I do not refer out or receive referrals regarding sarcopenia
- ☐ Unsure

Display This Question:

If Q2.11 = Yes, I refer to colleague(s)

Or Q2.11 = Yes, colleague(s) refer to me

Q34 What is the profession of the colleague(s) which you refer to or who refer to you? Please select all that apply.

- ☐ Physician
- ☐ Nurse
- ☐ Physical Therapist
- ☐ Occupational Therapist
- ☐ Unsure
- ☐ Other, please specify: _____

End of Block: Part 1

Start of Block: Part 2

Q3.1 **Part 2** *Sarcopenia was defined in 2018 by the European Working Group on Sarcopenia in Older People (EWGSOP2) as "a muscle disease (muscle failure) rooted in adverse muscle changes that accrue across a lifetime; sarcopenia is common among adults of older age but can*

also occur earlier in life". This proposes that sarcopenia is not only age-related but can be a pathology as well. Inclusion criteria set forth by EWGSOP2 are comprised of low muscle strength, low muscle quality or quantity, low physical performance.

Q3.2 Were you previously aware of this proposed definition?

- ○ Yes
- ○ No

Q3.3 Does this proposed definition affect the way you see sarcopenia?

- ○ Yes
- ○ No
- ○ Unsure

Display This Question:

If Q3.3 = Yes

Q3.4 In what ways does this proposed definition affect the way you see sarcopenia? Please select all that apply.

- ☐ In practice
- ☐ In research
- ☐ Other, please specify: _____

Q3.5 Do you feel this proposed definition requires any modification?

- ○ Yes
- ○ No
- ○ Unsure

Display This Question:

If Q3.5 = Yes

Q3.6 In what ways do you feel this proposed definition needs modification?

- ☐ "Muscle disease" should be omitted
- ☐ Inclusion criteria
- ☐ Younger age inclusion
- ☐ Other, please specify: _____

Q3.7 Does this proposed definition affect the way we will respond to sarcopenia as RDNs?

- ○ Yes
- ○ No
- ○ Unsure

Q3.9 Would you be interested in sarcopenia education?

- ○ Yes
- ○ No
- ○ Unsure

Display This Question:

If Q3.9 = Yes

Q3.10 What format of sarcopenia education would you be interested in? Please select all that apply.

- ☐ Webinars
- ☐ Virtual Training
- ☐ Online Modules
- ☐ Continuing Professional Education (CPE)
- ☐ Other, please specify: _____

Q32 Please include any additional comments or suggestions below:

_____

End of Block: Part 2

Appendix F. Variable Selections

Variable Selections

Variable	Descriptor/Category
Screen for Sarcopenia	5 levels (Yes, routinely; Yes, if indicated; No, colleague does; No, never; Unsure)
Sarcopenia Screening Tools	6 levels (SARC-F (Strength, Assistance in walking, Rise from a chair, Climb stairs, Falls); Ishii's Score; MSRA-5 (Mini Sarcopenia Risk Assessment 5-question); MSRA-7 (Mini Sarcopenia Risk Assessment 7-question); Other; None)
Sarcopenia Screening Protocols	3 levels (Yes; No; Unsure)
Sarcopenia Education Interest	3 levels (Yes; No; Unsure)
Type of Sarcopenia Education	15 levels (Webinars; Virtual Training; Online Modules; Continuing Professional Education (CPE); Other; All 4 options; Webinars, Online Modules, CPE; Virtual Training, Online Modules, CPE; Webinars, CPE; Webinars, Virtual Training, CPE; Virtual Training, CPE; Webinar, Virtual Training, Online Modules; Online Modules, CPE; Webinars, Virtual Training; Webinars, Online Modules)
Age	6 levels (21-30; 31-40; 41-50; 51-60; 60+; Prefer not to answer)
Years in Practice	7 levels (Less than 1; 1-5; 6-10; 11-15; 16-20; 20+; Prefer not to answer)
States of Practice	54 levels (50 U.S states individually; Prefer not to answer; Other; More than one state; Retired/not currently practicing)
Highest Level of Education	5 levels (Bachelor's degree; Master's degree; Doctorate degree; Other; Prefer not to answer)
Currently Practicing RDN	4 levels (Yes; No; Retired; Prefer not to answer)
Practice Settings	18 levels (Acute Care – Inpatient; Acute Care – Outpatient; Ambulatory/Outpatient Care Facility; College, University or Academic Medical Center; Food or Equipment Manufacturer, Distributor, or Retailer; Health/Fitness Facility; Home Health; Long-Term Care; Pharmaceutical or Nutrition Products, Manufacturer, Distributor, or Retailer; Private Practice; Retail; School Nutrition; Social Services Organization; Not Currently Practicing; Retired; Other; Prefer not to answer; More than one setting)
Familiar with Sarcopenia	3 levels (Yes; No; Unsure)
Colleague's Profession that screen for Sarcopenia	8 levels (Physician; Nurse; Physical Therapist; Occupational Therapist; Unsure; Other; More than one profession; Unsure)

Triggers for Sarcopenia Screening	14 levels (Age; Fall risk; Malnutrition; Body weight; Physical activity; Nutrition Focused Physical Exam; Chronic inflammatory disease; Other; 2 triggers selected; 3 triggers selected; 4 triggers selected; 5 triggers selected; 6 triggers selected; 7 triggers selected)
RDNs Refer for Sarcopenia Screening	4 levels (Yes, I refer to colleague(s); Yes, colleague(s) refer to me; No, I do not refer out or receive referrals regarding sarcopenia; Unsure)
Awareness of new proposed Sarcopenia definition	2 levels (Yes; No)
Member of DPG group(s)	28 levels (Behavioral Health Nutrition; Clinical Nutrition Management; Diabetes; Dietetics in Health Care Communities; Dietitians in Business and Communications; Dietitians in Integrative and Functional Medicine; Dietitians in Nutrition Support; Food and Culinary Professionals; Healthy Aging; Hunger and Environmental Nutrition; Management in Food and Nutrition Systems; Medical Nutrition Practice Group; Nutrition Education for the Public; Nutrition Educators of Health Professionals; Nutrition Entrepreneurs; Nutrition Informatics; Oncology Nutrition; Pediatric Nutrition; Public Health/Community Nutrition; Renal Dietitians; Research; School Nutrition Services; Sports Cardiovascular and Wellness Nutrition; Vegetarian Nutrition; Weight Management; Women's Health; Prefer not to answer; More than one DPG)

VITA

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	B.S. Nutrition and Dietetics, Texas Woman's University, Denton, Texas, 2019
	M.S. Clinical Nutrition, East Tennessee State University, Johnson City, Tennessee, 2021
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