Whole Body Dual X-Ray Absorptiometry (DXA) and Bioelectrical Impedance Analysis (BIA) to Determine Body Composition

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DESCRIPTION

There has been an interest in using whole body dual x-ray absorptiometry (DXA) and bioelectrical impedance analysis (BIA) in the clinical care setting rather than a research setting.

Body composition measurements can be used to quantify and assess the relative proportions of specific body compartments such as fat and lean mass (e.g., bones, tissues, organs, muscles). These measurements may be more useful in informing diagnosis, prognosis, or therapy than standard assessments (e.g., body weight, body mass index) that do not identify the contributions of individual body compartments or their particular relationships with health and disease. While these body composition measurements have been most frequently utilized for research purposes, they may be useful in clinical settings to:

- Evaluate the health status of undernourished individuals, those impacted by certain disease states (e.g., anorexia nervosa, cachexia), or those undergoing certain treatments (e.g., antiretroviral therapy, bariatric surgery).
- Evaluate the risk of heart disease or diabetes by measuring visceral fat versus total body fat.
- Assess body composition changes related to growth and development (e.g., infancy, childhood), aging (e.g., sarcopenia), and in certain disease states (e.g., HIV, diabetes).
- Evaluate individuals in situations where body mass index is suspected to be discordant with total fat mass (e.g., body building, edema).

A variety of techniques has been researched, including most commonly, anthropomorphic measures, bioelectrical impedance analysis (BIA), and dual-energy x-ray absorptiometry (DXA). All of these techniques are based in part on assumptions about the distribution of different body compartments and their density, and all rely on formulas to convert the measured parameter into an estimate of body composition. Therefore, all techniques will introduce variation based on how the underlying assumptions and formulas apply to different populations of subjects (i.e., different age groups, ethnicities, or underlying conditions).

Body Composition Measurement Methods

Clinical Practice

Anthropomorphic Techniques
Routinely, anthropomorphic measures are sufficient to estimate adiposity in a clinical setting. Anthropometric measurements include the following:

- **Height and Weight**: Height and weight are the most commonly measured and can be determined with great accuracy. They are important in making clinical decisions regarding treatment of obesity. Weight can be related to height by several methods, but the most widely used is the BMI (body mass index), which is weight in kilograms divided by the height in meters squared. Height and weight should be measured by a provider in the office. BMI is used routinely in the clinical setting to diagnose obesity. Although it correlates with body fat, it does not directly measure body fat.
- **Waist Circumference**: Waist circumference is another essential anthropometric measurement. It is measured with flexible tape placed on horizontal plane at the level of iliac crest. Increasing central adiposity, as measured by waist circumference, is associated with an increased risk of morbidity and mortality.
- **Multisite Testing of Skinfold Thickness**: Multisite testing of skinfold thickness is one of the oldest and still most common methods of determining a person's body composition and body fat percentage. This test estimates the percentage of body fat by measuring skinfold thickness at specific locations on the body. The

thickness of these folds is a measure of fat under the skin, also called subcutaneous adipose tissue. Skinfold thickness results rely on formulas that convert these numbers into an estimate of a person's percentage of body fat according to a person's age and gender. Skinfold measurements are generally taken at specific sites on the right side of the body. The tester pinches the skin at the location site and pulls the fold of skin away from the underlying muscle so only the skin and fat tissue are held. Special skinfold calipers are then used to measure the skinfold thickness in millimeters.

The measurement sites vary depending on the specific skinfold testing protocol being used, but typically include the following seven locations on the body:

- Abdomen – next to the belly button
- Mid-axilla – midline of the side of the torso
- Pectoral – the mid-chest just forward of the armpit
- Subscapular – beneath the edge of the shoulder blade
- Suprailiac – just above the iliac crest of the hip bone
- Triceps – the back of the upper arm
- Quadriceps – middle of the upper thigh

According to the American College of Sports Medicine, when performed by a trained, skilled tester, skinfold measurements of body fat are up to 98% accurate. However, due to new technologies available such as electrical impedance methods and scales that measure body composition instead of directly measuring skinfolds, skinfold testing may not be utilized like it once was in clinical practice setting.

Research Methods

Underwater Weighing

Underwater weighing requires the use of a specially constructed tank in which the subject is seated on a suspended chair. The subject is then submerged in the water while exhaling. While valued as a research tool, weighing people underwater is obviously not suitable for routine clinical use. This technique is based on the assumption that the body can be divided into 2 compartments with constant densities: adipose tissue, with a density of 0.9 g/cm3, and lean body mass (i.e., muscle and bone), with a density of 1.1 g/cm3. One limitation of the underlying assumption is the variability in density between muscle and bone; for example, bone has a higher density than muscle, and bone mineral density varies with age and other conditions. In addition, the density of body fat may vary, depending on the relative components of its constituents (e.g., glycerides, sterols, glycolipids).

Imaging

Magnetic resonance imaging (MRI) or computed tomography (CT) can be used to measure visceral adipose tissue. The technique usually quantifies adipose tissue in a single slice cross section at the level of the L4/L5 lumbar disc. The subcutaneous fat (outside the abdominal musculature) may be measured in the same image. These measures of visceral adiposity correlate with insulin resistance, triglycerides, hepatic steatosis, and other components of the metabolic syndrome. This technique is used for research in obesity and metabolic disease and does not contribute to clinical care.

Bioelectrical Impedance Analysis (BIA)
Bioelectrical impedance is based on the relationship between the volume of the conductor (i.e., human body), the conductor's length (i.e., height), the components of the conductor (i.e., fat and fat-free mass), and its impedance. Estimates of body composition are based on the assumption that the overall conductivity of the human body is closely related to lean tissue. The impedance value is then combined with anthropomorphic data to give body compartment measures. The technique involves attaching surface electrodes to various locations on the arm and foot. Alternatively, the individual can stand on pad electrodes.

Whole Body Dual X-Ray Absorptiometry (DXA)
Using low dose x-rays different energy levels, whole body dual x-ray absorptiometry (DXA) measure lean tissue mass, total and regional body fat, as well as bone density. DXA scans have become a tool for research body composition, but there has been an interest in using DXA in the clinical care setting rather than a research setting.

While the cited techniques above assume 2 body compartments, DXA can estimate 3 body compartments consisting of fat mass, lean body mass, and bone mass. DXA systems use a source that generates x-rays at 2 energies. The differential attenuation of the 2 energies is used to estimate bone mineral content and the soft tissue composition. When 2 x-ray energies are used, only 2 tissue compartments can be measured; therefore, soft tissue measurements (i.e., fat and lean body mass) can only be measured in areas in which no bone is present. DXA also has the ability to determine body composition in defined regions (i.e., the arms, legs, and trunk). DXA measurements are based in part on the assumption that the hydration of fat-free mass remains constant at 73%. Hydration, however, can vary from 67% to 85% and can be variable in certain disease states. Other assumptions used to derive body composition estimates are considered proprietary by DXA manufacturers.

Dual X-RAY Absorptiometry as a Test to Detect Abnormal Body Composition

Clinical Context and Test Purpose
The purpose of whole-body dual x-ray absorptiometry (DXA) body composition studies is to improve the diagnosis and management of individuals who have clinical condition associated with abnormal body composition.

Patients
The relevant population of interest are individuals with clinical conditions associated with abnormal body composition.

Interventions
The test being considered is DXA body composition studies administered in an outpatient setting.

Comparators
The following practices are currently being used to make decisions in this individual group: standard of care without DXA or an alternative method of body composition analysis.

Outcomes
The general outcomes of interest include symptom management and change in disease status. For individuals at risk of osteoporosis outcomes of interest would include fracture incidence. For individuals with HIV who are treated with antiretroviral therapy, outcomes of interest would include lipodystrophy.

(2019) Bundred et al. completed a systematic review evaluated body composition assessment and sarcopenia in patients with pancreatic ductal adenocarcinoma. Meta-analyses revealed that sarcopenia was associated with lower overall survival in both operable (harms ratio, 1.95; 95% confidence interval [CI], 1.35 to 2.81; p<.001) and unresectable patients (harms ratio, 2.49; 95% CI, 1.38 to 4.48; p=.002). However, of the 42 included studies, only one utilized measurement obtained by DXA, limiting the relevance of the overall findings to this technology and preventing extraction of pertinent clinical validity data. Furthermore, the authors caution that many studies failed to account for variation introduced by gender, race, tumor stage, and other factors. Additionally, clear criteria for the diagnosis of sarcopenia or cachexia via body composition assessments with DXA are lacking.

(2019) Calella et al. performed a systematic review exploring various methods for body composition analysis in patients with cystic fibrosis (CF). A previous systematic review by Calella et al. (2018) presented on differences in body composition between patients with CF and healthy controls evaluated by DXA and other methods. DXA was most frequently used to measure lean body or fat-free mass which was significantly reduced in CF patients. While several included studies showed a correlation between lower fat-free mass and impaired pulmonary function, application, and use of this measure in patient management and its impact on health outcomes was not explored and requires further clarification. Since these reviews featured qualitative analyses, data on clinical validity could not be extracted.

(2019) Murphy et al. completed a meta-analysis aimed to assess the agreement between intra-abdominal adipose tissue (IAAT) quantified by alternative methods and the reference standards, computed tomography (CT) and magnetic resonance imaging (MRI). MEDLINE and EMBASE electronic databases were systematically searched to identify studies that quantified IAAT thickness, area, or volume by a comparator method and CT or MRI. Using an inverse variance weighted approach (random-effects model), the mean differences and 95% limits of agreement (LoA) were pooled between methods. The meta-analysis included 24 studies using four comparator methods. The pooled mean differences were -0.3 cm (95% LoA: -3.4 to 3.2 cm; P = 0.400) for ultrasound and -11.6 cm^2 (95% LoA: -43.1 to 19.9 cm^2; P = 0.004) for bioelectrical impedance analysis. Dual-energy x-ray absorptiometry (DXA) quantified both IAAT area and volume with mean differences of 8.1 cm^2 (95% LoA: -98.9 to 115.1 cm^2; P = 0.061) and 10 cm^3 (95% LoA: -280 to 300 cm^3 ; P = 0.808), respectively. While this analysis was primarily focused on the utilization of the different body composition methods for the management of obesity, direct effects on key health outcomes were not explored and patient populations included for analysis displayed extensive heterogeneity and largely featured healthy populations. Measurements of IAAT volume were deemed comparable to the reference methods, however, 95% limits of agreement (LoA) were wide, and these results were not seen until the removal of an outlying study. Rationale for identifying the study as an outlier and removing it from the meta-analysis was limited. Prior to the removal of the outlier, the pooled mean difference was significant compared to the reference methods at -124 cm^3 (95% LoA, -479 to 230; p=.013; I2=99% [p <.001]; Q (7) =773). Performance of DXA for the measurement of IAAT volume also varied significantly between male and female subgroups. Furthermore, included studies did not pre-determine clinically meaningful LoA. The authors' further caution that DXA measurement of IAAT volume has the capacity to differ from reference methods by more than 100%, however, the clinical significance of these margins of error are uncertain in individuals with obesity. While IAAT area cutoff points have been described for the determination of metabolic risk and visceral obesity based on single-slice CT, the authors do not recommend utilization of DXA IAAT area measurements for this purpose due to wide LoA. The clinical utility of existing IAAT area cut points is also uncertain as these parameters were found to have applicability for women and cannot necessarily be extrapolated to mixed populations.

ASPEN recommends the use of DXA for the assessment of FM in patients with a specific disease or clinical outcome with a strong recommendation rating based on their analysis. Due to the lack of studies reporting on the validity of DXA for lean mass measurements, no recommendations could be made for assessments of this body compartment. The systematic review acknowledges that while the quality of the included evidence was low, the strong recommendation rating was applied with the rationale that the net benefits of FM assessment via DXA outweigh potential harms. However, the use of DXA findings to make patient management decisions and reporting of adverse events was not featured in the included studies.

(2019) Reina et al. conducted a case-control study to assess the correlation of BMI or serum albumin levels to DXA-derived parameters of nutritional status and sarcopenia in women (N=89) with rheumatoid arthritis. While 44% of cases met diagnostic criteria for sarcopenia based on quantification of the skeletal muscle index, a reference technique was not clearly identified in this study. Skeletal muscle index is calculated by dividing appendicular skeletal muscle mass by the square of the patient's height. A previously identified threshold of $\leq 5.75\ kg/m^2$ in women was applied, however, this metric was established through the use of BIA in a slightly older patient population. Given that DXA provides measures of lean mass which may be influenced by body compartments other than skeletal muscle, the relevance of this diagnostic cutoff point is uncertain. Furthermore, the study utilized a control group composed of patients affected by non-inflammatory rheumatic disorders as opposed to healthy controls, further limiting the relevance of applied cutoff points. In addition to the uncertainties of establishing and applying normal values for components of body composition, it also is unclear how a single measure of body composition would be used in patient management. Studies discussing appropriate use and determination of DXA-derived lean mass cutoffs for sarcopenia in various populations of patients and underlying disorders continue to be featured in the literature.

As a single diagnostic measure, it is important to establish diagnostic cutoff points for normal and abnormal values. This is problematic because normal values will require the development of normative databases for the different components of body composition (i.e., bone, fat, lean mass) for different populations of patients at different ages. Regarding measuring bone mineral density (BMD), normative databases have largely focused on postmenopausal white women, and these values cannot necessarily be extrapolated to men or to different races. DXA determinations of BMD are primarily used for fracture risk assessment in postmenopausal women and to select candidates for various pharmacologic therapies to reduce fracture risk. In an example regarding lean mass.

Summary of Evidence
For individuals who have a clinical condition associated with abnormal body composition who receive whole body dual x-ray absorptiometry (DXA) body composition studies, the evidence includes systematic reviews and several cross-sectional studies comparing DXA with other techniques. The available studies were primarily conducted in research settings and often used DXA body composition studies as a reference standard; these studies do not permit conclusions about the accuracy of DXA for measuring body composition. A systematic review exploring the clinical validity of DXA measurements against reference methods for the quantification of intra-abdominal adipose tissue raised concerns for precision and reliability. More importantly, no studies were identified in which DXA body composition measurements were actively used in an individual's management. The evidence is insufficient to determine the effects of the technology on net health outcomes.

Dual X-RAY Absorptiometry as a Test to Monitor Changes in Body Composition

Clinical Context and Test Purpose
The purpose of the serial whole body dual x-ray absorptiometry (DXA) body composition studies in patients who have a clinical condition managed by monitoring body composition changes over time is to improve disease management.

Patients
The relevant individual population of interest are individuals with clinical conditions managed by monitoring body composition changes over time.

Interventions
The test being considered is serial DXA body composition studies.

Comparators
The following practices are currently being used to make decisions in this individual group: standard of care without DXA or an alternative method of body composition analysis.

Outcomes
The general outcomes of interest include symptom management and change in disease status. For individuals with anorexia nervosa, outcomes of interest would include disease -related mortality and rate of remission.

(2020) Arthur et al published additional results from the Women's Health Initiative cohort of postmenopausal women (N=10,931), reporting additional associations between DXA-derived measures of body fat and breast cancer risk. The multivariable-adjusted HR for risk of invasive breast cancer per SD increase in trunk fat mass was 1.21 (95% CI, 1.12 to 1.31) and whole-body fat mass was 1.21 (95% CI, 1.12 to 1.30). The multivariable-adjusted HR for risk of ER+ breast cancer per SD increase in trunk fat mass was 1.21 (95% CI, 1.11 to 1.31) and whole-body fat mass was 1.22 (95% CI, 1.11 to 1.33). Multivariable-adjusted HR for invasive breast cancer per SD increase in BMI was also significant, with an HR of 1.19 (95% CI, 1.10 to 1.28). Trends of time-dependent analyses of anthropometric measures and overall and ER + incident breast cancer cases was significant for BMI ($p <.001$) and waist circumference ($p<.001$). The following limitations were identified: the study population was unclear, version used unclear regarding both DXA and patient participation in RCT treatment or observational groups. Not comparted to other tests used for the same purpose and key clinical validity outcomes are not reported, adverse event of the tests is also not described. Therefore, the added clinical utility of DXA-derived fat measures is unclear for this population.

(2019) Iyengar et al. reported his ad hoc secondary analysis of the Women's Health Initiative (WHI) clinical trial and observational study cohorts was restricted to postmenopausal participants with a BMI ranging from 18.5 to 24.9. Women aged 50 to 79 years were enrolled from October 1, 1993, through December 31, 1998. Of these, 3460 participants underwent body fat measurement with dual-energy x-ray absorptiometry (DXA) at 3 US designated centers with follow-up. At a median follow-up of 16 years (range, 9-20 years), 182 incident breast cancers had been ascertained, and 146 were ER positive. Follow-up was complete on September 30, 2016, and data from October 1, 1993, through September 30, 2016, was analyzed August 2, 2017, through August 21, 2018. The main outcomes and measures included: Body fat levels were measured at baseline and years 1, 3, 6, and 9 using DXA. Information on demographic data, medical history, and lifestyle factors was collected at baseline. Invasive breast cancers were confirmed via central review of medical records by physician adjudicators. Blood analyte levels were measured in subsets of participants. The author's reported the following results: among the 3460 women included in the analysis (mean [SD] age, 63.6

[7.6] years), multivariable-adjusted hazard ratios for the risk of invasive breast cancer were 1.89 (95% CI, 1.21-2.95) for the highest quartile of whole-body fat and 1.88 (95% CI, 1.18-2.98) for the highest quartile of trunk fat mass. The corresponding adjusted hazard ratios for ER-positive breast cancer were 2.21 (95% CI, 1.23-3.67) and 1.98 (95% CI, 1.18-3.31), respectively. Similar positive associations were observed for serial DXA measurements in time-dependent covariate analyses. Circulating levels of insulin, C-reactive protein, interleukin 6, leptin, and triglycerides were higher, whereas levels of high-density lipoprotein cholesterol and sex hormone-binding globulin were lower in those in the uppermost vs lowest quartiles of trunk fat mass. In conclusion, postmenopausal women with normal BMI, relatively high body fat levels were associated with an elevated risk of invasive breast cancer and altered levels of circulating metabolic and inflammatory factors. Normal BMI categorization may be an inadequate proxy for the risk of breast cancer in postmenopausal women. The authors identified limitations as follows: limitations include the nongeneralizability of the findings beyond postmenopausal women, the relatively small number of incident invasive breast cancers, and the small sample size for some blood factors, which limited the number of covariates that could be adjusted for in the multivariate model. Despite the small number of events, we were able to detect an association between body fat levels and breast cancer risk. Furthermore, the effect sizes were of similar magnitude to those reported in previous studies that examined associations between body fat and risk of breast cancer across the full range of BMI

(2018) Dordevic et al. reported the aim of this study was to explore the reliability and precision of body compartment measures, in particular visceral adipose tissue, in weight stable adults over a range of BMIs using GE-Lunar iDXA. Weight-stable participants aged 18¯65 years had a total body composition scan on GE-Lunar iDXA either on three separate occasions over a three-month period (n = 51), or on a single occasion for duplicate scans with repositioning (n = 30). The coefficient of variation (CV%) and least significant change (LSC) of body compartments were calculated. The CV was higher for all measures over three months (range 0.8¯5.9%) compared with same-day precision-scans (all < 2%). The CV for visceral adipose tissue (VAT) was considerably higher than all other body compartments (42.2% three months, 16.2% same day scanning). To accurately measure VAT mass using the GE iDXA it is recommended that participants have a BMI ≥ 25 kg/m², or VAT mass > 500 g. Changes observed in VAT mass levels below 500 g should be interpreted with caution due to lack of precision and reliability. All other compartmental measures demonstrated good reliability, with less than 6% variation over three months. One of the limitations of the present study of was a higher number of participants within the 'healthy BMI range' who demonstrated significantly increased variation in repeated VAT measures compared with participants with BMI ≥ $25 kg/m^2$. In future studies that aim to investigate VAT changes in adults with overweight and obesity as defined by a BMI ≥ 25 kg/m^2 and ≥ 30 kg/m^2, respectively, the LSC may be lower. Nonetheless, based on the present study, a change >260 g or more is recommended to be confident of a significant change in VAT mass. The author's concluded, despite the CV for total body mass remaining below 1% for both study arms, the variability of measures collected over three months for all body segments was increased compared with repeated same-day scanning. In the case of the variability in VAT, this will make it difficult to assess true loss or gain of VAT during weight loss interventions, particularly in individuals with VAT mass <500 g.

For future studies that aim to assess changes in VAT mass using the GE iDXA it is recommended that to increase likelihood of accurate interpretation, participants should have a BMI at least 25 kg/m^2, or VAT greater than 500 g. Data obtained from participants with VAT mass levels below 500g should be interpreted with caution. Furthermore, we suggest that VAT changes in people with BMI lower than 25 kg/m^2 would be better to be reported as absolute value rather than percentage changes.

Summary of Evidence
For individuals who have a clinical condition managed by monitoring changes in body composition over time who receive whole body dual x-ray absorptiometry (DXA) composition studies, the evidence includes several prospective studies monitoring individuals over time. The studies used DXA as a tool to measure body composition and were not designed to assess the accuracy of DXA. None of the studies used DXA findings to make individual management decisions or addressed how serial body composition assessment might improve health outcomes. The evidence is insufficient to determine the effects of the technology on net health outcomes.

Bioelectrical Impedance Analysis (BIA) to Detect Whole Body Composition
During bioelectrical impedance analysis (BIA) electrodes are attached to the hands and feet of the individual being evaluated. Certain electrodes apply the electrical current while other select and measure the output without the current being felt by the individual. Muscle, having higher water content than adipose tissue (fat), should have lower impedance. BIA has been proposed as a method for whole body composition or body fat composition assessment in conjunction with annual wellness examinations or weight management evaluations with an individual's health care provider. Variables such as testing methods, types of equipment as well has health factors of the individual being tested are known to affect results.

Clinical Context and Test Purpose
The purpose of serial bioelectrical impedance analysis (BIA) studies in individuals who have a clinical condition managed by monitoring body composition changes over time is to improve disease management.

Patients
The relevant individual population of interest are individuals with clinical conditions managed by monitoring body composition changes over time.

Interventions
The test being considered is serial bioelectrical impedance analysis (BIA) studies.

Comparators
The following practices are currently being used to make decisions in this individual group: standard of care without bioelectrical impedance analysis (BIA) or an alternative method of body composition analysis.

Outcomes
The general outcomes of interest include symptom management and change in disease status.

Summary of Evidence
Based on review of the peer reviewed medical literature, there is currently no established role for whole body bioelectrical impedance analysis (BIA) for individuals who have a clinical condition associated with abnormal body composition or who have a clinical condition managed by monitoring changes in body composition over time. Currently no studies have been identified in the literature in which BIA measurements were actively used in an individual's management, and studies have not reported data demonstrating the impact of body composition assessment on net health outcomes. Further studies are needed to assess the clinical value of this testing. The evidence is insufficient to determine the effects of the technology on net health outcomes.

Practice Guideline and Position Statements

International Society for Clinical Densitometry (ISCD)
(2019) The International Society for Clinical Densitometry (ISCD) updated their adult position statement which included a statement on the use of DXA body composition. The statement included the following ISCD position regarding the use of DXA total body composition with regional analysis in the following conditions:

- To assess fat distribution in patients with human immunodeficiency virus (HIV) who are using antiretroviral agents known to increase the risk of lipoatrophy.
- To assess fat and lean mass changes in obese patients undergoing bariatric surgery (or medical, diet, or weight loss regimens with anticipated large weight loss) when weight loss exceeds approximately 10%. The statement noted that the impact of DXA studies on clinical outcomes in these patients is uncertain.
- To assess fat and lean mass in patients with muscle weakness and poor physical functioning. The impact on clinical outcomes is uncertain.

Of note, pregnancy is a contraindication to use of DXA to measure body composition. The statement also adds that the clinical utility of DXA measurements of adiposity and lean mass (e.g., visceral adipose tissue, lean mass index, fat mass index) is uncertain. Furthermore, while the use of DXA adiposity measures such as fat mass index may be useful in risk-stratifying patients for cardio-metabolic outcomes, specific thresholds to define obesity have not been established. (*Accessed April 2022*)

International Conference on Sarcopenia and Frailty Research Task Force
(2018) Evidence-based clinical practice guidelines for the screening, diagnosis, and management of sarcopenia were developed by the International Conference on Sarcopenia and Frailty Research task force. The following recommendations were made:

- Screening for sarcopenia can be performed using gait speed analysis or SARC-F questionnaire.
- Individuals screened as positive for sarcopenia should be referred for further assessment to confirm the presence of the disease.
- DXA imaging should be used to determine low levels of lean body mass when diagnosing sarcopenia.

The recommendation regarding the diagnostic use of DXA received a conditional (weak) recommendation. The certainty of the evidence for DXA assessment was ranked low due to the following:

- DXA studies featuring populations from low-middle income countries are lacking.
- DXA measurement of lean body mass rather than muscle mass may potentially misclassify body composition in certain individuals.
- Incorporation of DXA measurements of lean body mass may have limited additional benefit for the prediction of relevant health outcomes (eg, falls, fractures, lowered physical performance, mobility).

(*Accessed April 2022*)

National Institute for Health and Clinical Excellence (NICE)
(2014) National Institute for Health and Clinical Excellence (NICE) issued a guideline on obesity: identification, assessment and management. This guideline covers identifying, assessing and managing obesity in children (aged 2 years and over), young people and adults. It aims to improve the use of bariatric surgery and very-low-calorie diets to help people who are obese to reduce their weight and notes the following information:

- Use BMI as a practical estimate of adiposity in adults. Think about using waist circumference in addition to BMI in people with a BMI less than 35 kg/m^2.
- Use BMI (adjusted for age and gender) as a practical estimate of adiposity in children and young people. Waist circumference is not recommended as a routine measure.
- Do not use bioimpedance as a substitute for BMI as a measure of general adiposity in adults and children.
  (*Accessed April 2022*)

U.S. Preventative Services Task Force Recommendations (USPSTF)

- **Obesity in Children and Adolescents: Screening**
  (2017) The USPSTF recommends that clinicians screen for obesity in children and adolescents 6 years and older and offer or refer them to comprehensive, intensive behavioral interventions to promote improvements in weight status.
    - Body mass index measurement is the recommended screening test for obesity. Body mass index percentile is plotted on growth charts, such as

those developed by the CDC, which are based on US-specific, population-based norms for children 2 years and older. Obesity is defined as an age- and sex-specific BMI in the 95th percentile or greater. (*Accessed April 2022*)

- **Weight Loss to Prevent Obesity-Related Morbidity and Mortality in Adults: Behavioral Interventions**
  (2018) The USPSTF updated their 2012 recommendation for screening all adults for obesity to the following. Clinicians should offer or refer adults with body mass index (BMI) of 30 kg/m^2 or higher to intensive, multicomponent behavioral interventions.
  - Waist circumference may be an acceptable alternative to BMI measurement in some patient subpopulations.
  - The USPSTF commissioned a systematic evidence review to update its 2012 recommendation on screening for obesity in adults. Because screening for obesity is now part of routine clinical practice, it was not a focus of this review. (*Accessed April 2022*)

Joint Guidelines

American College of Cardiology (ACC)/American Heart Association (AHA)/The Obesity Society (TOS)
(2013) The ACC/AHA/TOS issued a guideline for the management of overweight and obesity in adults and the summary of recommendations for obesity state, "identifying patients who need to lose weight (BMI and waist circumference), measure height and weight and calculate BMI at annual visits or more frequently. Measure weight circumference at annual visits or more frequently in overweight and obese adults."
(E-Expert Opinion)

This guideline does not mention the use of whole-body dual x-ray absorptiometry (DXA) or bioelectrical impedance analysis (BIA) in the assessment and management of overweight and obese adults.
(*Accessed April 2022*)

Regulatory Status
Body composition software for several bone densitometer systems has been approved by the U.S. Food and Drug Administration through the premarket approval process. They include but are not limited to the following:

- Hologic DXA systems (Hologic)
- Lunar iDXA systems (GE Healthcare)
- Norland DXA systems (Swissray)

PRIOR APPROVAL

Not applicable.

POLICY

The use of whole-body dual x-ray absorptiometry (DXA) and bioelectrical impedance analysis (BIA) for body composition studies are considered **investigational** for all indications. There is insufficient evidence to support conclusions concerning the net health outcomes or benefits associated with this testing.

PROCEDURE CODES AND BILLING GUIDELINES

To report provider services, use appropriate CPT* codes, Alpha Numeric (HCPCS level 2) codes, Revenue codes, and/or ICD diagnosis codes.

- 76499 Unlisted diagnostic radiographic procedure
- 0358T Bioelectrical impedance analysis whole body composition assessment, with interpretation and report

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POLICY HISTORY

Date	Reason	Action
April 2022	Annual Review	Policy Renewed
April 2021	Annual Review	Policy Renewed
April 2020	Annual Review	Policy Revised
April 2019	Annual Review	Policy Renewed
April 2018	Annual Review	Policy Renewed
April 2017	Annual Review	Policy Renewed
April 2016	Annual Review	Policy Revised
July 2015	Annual Review	Policy Revised
August 2014	Annual Review	Policy Renewed
September 2013		New Policy

New information or technology that would be relevant for Wellmark to consider when this policy is next reviewed may be submitted to:

Wellmark Blue Cross and Blue Shield
Medical Policy Analyst
PO Box 9232
Des Moines, IA 50306-9232