

PROMOTING POSTMENOPAUSAL LEAN BODY MASS THROUGH BODY
COMPOSITION MEASUREMENT: A QUALITY IMPROVEMENT INITIATIVE

by

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of

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in

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DEDICATION

To my parents, thank you for your undying belief in me, both as a provider and as your daughter. You taught me the importance of advocacy for those around me and instilled in me the values that will continue to guide my practice. I owe my success to you, and the example you put forth.

To my husband, thank you for your steadfast support throughout this journey. I am deeply grateful for your partnership, love, and the encouragement you have given me to pursue my dreams.

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Grammarly, a GenAI platform, was utilized throughout this manuscript for the editing of grammar and sentence structure.

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ABSTRACT

Background: Menopause causes declining sex hormones, destabilizing metabolic pathways and resulting in fat redistribution, muscle loss, insulin resistance, inflammation, and altered lipoproteins. These changes increase metabolic syndrome, atherogenic plaque, and sarcopenia, raising disease risk and mortality. However, body composition testing and education on lean body mass are rarely routine in women's healthcare.

Local Problem: A Montana clinic specializing in weight loss and HRT lacked a standardized protocol to screen and educate about menopause-related body composition changes and disease risk.

Methods: Over six weeks, Plan-Do-Study-Act (PDSA) cycles integrated body composition screening and education for perimenopausal/menopausal patients receiving weight loss or HRT care. Outcomes were screening rates, education, satisfaction, and retention.

Intervention: Providers were trained on menopause-related metabolic changes and disease risk, then applied a protocol including baseline body composition analysis (InBody 380) and personalized education to preserve lean mass.

Results: 138 eligible patients were seen. Of these, 47.8% (n=66) completed a baseline body composition screening and 65.2% (n=90) received targeted education. Screening refusal occurred in fewer than 8% of patients (n=10). Patient satisfaction averaged 100%, and follow-up retention reached 97.8% (n=135).

Conclusion: Standardized body composition screening and education is a feasible primary intervention for menopausal women, showing high acceptance, satisfaction, and retention. This approach promotes engagement, early intervention, and identification of metabolic risks.

Keywords: Menopause, Body composition, Lean body mass, Hormone replacement therapy, Sarcopenia, Weight loss, Quality improvement, PDSA cycle

CHAPTER ONE

REVIEW OF THE LITERATURE

Mapping Evidence for Routine Body Composition Screening in
Postmenopausal Women: A Scoping ReviewIntroduction

The menopausal transition marks a pivotal physiological shift, characterized by the definitive depletion of ovarian function and the subsequent decline of key reproductive hormones, including estrogen, progesterone and testosterone. Throughout a woman's lifetime, these hormones provide a fine balance of metabolic support, insulin sensitivity, fat distribution, cardiovascular and cognitive health, and protection against certain cancers (Bermingham et al., 2022). When these hormones diminish, postmenopausal women experience profound psychological, physical, and metabolic alterations that accelerate the onset of chronic disease processes (Bermingham et al., 2022). This hormonal decline and acceleration of disease contributes directly to increased morbidity and mortality from conditions such as heart disease, cancer, stroke, Alzheimer's, diabetes, and hypertension – the leading causes of death among women (Tejada-Vera et al., 2025). Recognizing and addressing these changes is therefore critical to improving long-term health outcomes for women, and reducing the burden of preventable disease in the healthcare system.

To effectively address these healthcare risks with early prevention, it is essential to examine the underlying hormone and metabolic shifts driving disease in menopause, as they reveal critical opportunities for monitoring and identifying emerging changes in health. Many of these measurable shifts are identifiable in body composition. Body composition encompasses the

proportions of muscle, bone, organ tissue, water, minerals, and essential fats – those vital for the nervous system function, hormone regulation, and energy storage. Two key indicators of metabolic health and optimized body composition are lean body mass (LBM), also known as fat-free mass, and percent body fat (PBF), which together reflect the balance of muscle and adipose tissue. Visceral fat mass (VFM) – the accumulation of fat surrounding abdominal organs – is also of clinical significance as it is strongly associated with insulin resistance, systemic inflammation, dyslipidemia and increased cardiovascular and metabolic disease risk (Bermingham et al., 2022). Assessment of these parameters provides valuable insight for practitioners assessing physiological optimization and early detection of disease in postmenopausal women (Heymsfield et al., 2024).

Imbalances in body composition may occur as either excess non-essential fat or loss of muscle mass, known as sarcopenia. Elevated non-essential fat is positively correlated with increased rates of metabolic disease, cardiovascular risk, increased risk of cancers, dementia and Alzheimer's, as well as increased mortality (Bermingham et al., 2022, Chiu et al., 2020, Cui & Zhao, 2023). In postmenopausal women, declining estrogen levels contribute to body composition imbalances through adipose hypertrophy of both the subcutaneous and VFM, leading to inflammation, tissue hypoxia, fibrosis, and insulin resistance (IR) (Abildgaard et al., 2021, Bermingham et al., 2022). The resulting inflammation and IR initiate a detrimental cascade that disrupts glucose and insulin metabolism, enhances oxidative stress, and promotes metabolic disease and lipoprotein remodeling (Bermingham et al., 2022). These adipose-related changes also foster an atherogenic environment conducive to plaque formation, thereby increasing cardiovascular disease and related mortality (Zhu et al., 2020).

Conversely, the decline in estrogen and testosterone contribute to skeletal muscle atrophy, characterized by myofiber loss, mitochondrial dysfunction, reduced blood flow, impaired cellular regeneration, and a heightened inflammatory state (Buckinx & Aubertin-Leheudre, 2022). Mitochondrial dysfunction increases intramyocellular fatty acid metabolites, reducing cellular energy, and promoting IR within the muscle tissue (DeFronzo & Tripathy, 2009). Because skeletal muscle accounts for up to 80% of glucose uptake, muscle wasting is strongly associated with impaired glucose regulation, increased insulin variability, elevated fasting glucose and HbA1c levels, and increased rates of metabolic disease with aging (Thornton et al., 2024, Lin et al., 2025, DeFronzo & Tripathy, 2009).

Overall, sarcopenic obesity – the coexistence of low muscle mass and high adipose tissue – significantly increases the risk of metabolic and cardiovascular disease, as well as all-cause mortality (Bermingham et al., 2022, Buckinx & Aubertin-Leheudre, 2022). During the postmenopausal transition, rates of sarcopenic obesity increase substantially, with muscle mass declining by approximately 0.5% annually while fat mass increases nearly 1.7% per year (Buckinx & Aubertin-Leheudre, 2022). This is particularly concerning given that women spend roughly one third of their lifetime in menopause, meaning one third of their lifetime manifesting a state of sarcopenic obesity (Bermingham et al., 2022). The implications deepen further, as the global population of peri- and postmenopausal women is projected to exceed 1.2 billion within the next five years (Bermingham et al., 2022). Additionally, there is a projected increase of 0.4 billion adults 60 years and older by 2030 and a near doubling to 2.1 billion by 2050 (World Health Organization [WHO], 2025). The American healthcare system will only continue to face a rapidly expanding population of postmenopausal women with heightened risk of comorbidities,

chronic disease, hospitalization, and increased demand for medical resources (World Health Organization [WHO], 2025).

From a healthcare costs perspective, the financial burden of these conditions is already increasing substantially. In 2020, the direct cost of cardiovascular disease in the United States amounted to approximately \$393 billion (Kazi et al., 2024). This cost is projected to rise to \$1.4 trillion by 2050, with total costs – including lost productivity and premature mortality of patients – expected to reach \$1.8 trillion (Kazi et al., 2024). Similarly, the annual cost of diabetes management in 2022 totaled \$412.9 billion, an \$80 billion increase from the past decade (American Diabetes Association, 2022). Adults 65 and older spend over double on per capita healthcare costs compared to any other age group, and the indirect costs – lost productivity at work, absenteeism, disability and premature mortality – accounts for an additional \$106.3 billion in national economic burden (American Diabetes Association, 2022). Together, these trends underscore the urgent need for the U.S. healthcare system and clinicians to strengthen disease prevention, early detection, and management of disease – particularly among postmenopausal women, who face an unprecedented and growing burden of risk.

Although menopause is an inevitable life stage of the aging process, understanding of physiological shifts by medical providers increases awareness and may facilitate earlier identification of women at an elevated risk for disease and mortality. It is well established that only 48-60% of women will seek medical guidance, while more than 80% experience a negative impact on daily functioning (Bermingham et al., 2022, Vazirani & Ravichandiran, 2024). In order to intercede these women, primary care providers, the most common medical point of

contact, must be proficient in providing screening and education prior to the onset of the disease process.

Unfortunately, despite the well-documented physiological changes, current clinical practice remains focused primarily on symptom management, with no standardized guidelines for assessing body composition as a means of screening or prevention. While many providers rely on automatic BMI calculations or electronic medical record prompts, BMI alone is limited in its ability to detect sarcopenic obesity or accurately represent fat distribution (Busebee et al., 2023, Gažarová et al., 2022). Alternative anthropometric measures, such as waist circumference or waist-to-hip ratio, can better identify central adiposity and visceral fat accumulation; however these methods are rarely used consistently in routine visits and fail to fully account for variations in gender, age, height, and ethnicity (Gažarová et al., 2022). More comprehensive indices – such as Fat mass indices (FMI), or Fat-free mass indices (FFMI) – prove stronger correlations with metabolic risk by quantifying LBM, fat percentage, and fat deposition patterns (Gažarová et al., 2022).

Tools such as multi-frequency bioelectric impedance analysis (MF-BIA) provide accessible, cost-effective and reliable assessment of FMI and FFMI, including PBF and VFM. MF-BIA carries minimal risk to patients, as it requires no radiation exposure, and can easily be implemented in a clinical or community setting without adding excessive direct-patient care time or provider training, making it an ideal tool for routine screening and early identification of at-risk women (Gažarová et al., 2022). In contrast, more advanced modalities – computed tomography (CT), magnetic resonance imaging (MRI) and dual-energy X-ray absorptiometry (DXA) – offer precise body composition data but are costly, less accessible to patients, and in the

case of CT, exposes patients to radiation and increases health risks. Notably, while DXA is covered for osteoporosis screening in women 65 and older (or younger postmenopausal women at increased risk), the U.S. Preventative Services Task Force guidelines emphasize use for bone density only, not overall body composition (Nicholson et al., 2025).

These limitations in current practice highlight a critical need for accessible, low-risk, and standardized tools (such as MF-BIA) to evaluate body composition, providing an opportunity to identify at-risk postmenopausal women earlier, prevent disease and mortality, and reduce healthcare costs. Building on this need, the following project seeks to address the question: *How can the implementation of comprehensive body composition in postmenopausal women improve early detection and intervention for metabolic disease?* The specific objectives of this project are to examine current evidence linking body composition screening parameters to metabolic and cardiovascular disease risk, evaluate the role of body composition screenings as a preventative diagnostic tool within primary care and women's health settings, and identify how early intervention based on these screenings can optimize physiological function, improve longevity, reduce the financial burden of chronic disease, and enhance overall quality of life among postmenopausal women.

Methods

Databases used to conduct this search included but were not limited to Montana State University Library CatSearch, CINAHL, PubMed, National Library of Medicine, the Web of Science, Google Scholar, and the InBody Scholar Research Database. Medical subject heading (MeSH) terms used included: “body composition”, “lean body mass”, “skeletal muscle mass”, “fat free mass”, “sarcopenia”, “sarcopenic obesity”, “insulin resistance”, “postmenopaus*”,

“menopause”, “perimenopause”, “multi-frequency bioelectric impedance analysis”, “MF-BIA”, “bioelectric impedance analysis”, “women” and “women health”. Inclusion criteria included publications in English, publishment within the last five years, patients in peri- or post-menopause, body composition screening tools, peer-reviewed journal articles including qualitative, quantitative or mixed-studies. An initial review of article titles and abstracts assisted in determining suitability prior to assessment of full text to further identify relevant publications. Extraction of the studies was performed independently following JBI Evidence Synthesis and PRISMA guidelines.

Articles meeting the inclusion and exclusion criteria, as well as individual screening for suitability, were exported into a standardized Excel data-charting form for systematic categorization. Variables captured included participant characteristics: gender (male/female), age (years), ethnicity/race, BMI or baseline anthropometric data, and menopausal status (peri- or postmenopausal, or assumed postmenopausal for women over age 65 if not explicitly reported). Body composition measures recorded included lean body mass (percentage [%], pounds [lbs] or kilogram [kg]), percent body fat (PBF, %), and visceral fat mass (VFM, lb, kg, or %), along with measurement method (MF-BIA, BIA, DXA). Clinical and metabolic outcomes included comorbidities (cardiovascular disease, diabetes, hypertension), lipid profiles (total cholesterol, LDL, HDL, triglycerides), and serum metabolites (fasting insulin/glucose, HbA1c). Lifestyle variables included exercise type, frequency, or sedentary status. Study characteristics included study design (prospective cohort study, cross-sectional), and study strength, categorized using the hierarchy of evidence system (Melnik & Fineout-Overhold, 2022). These data items were

selected to ensure comprehensive, consistent extraction of variables relevant to body composition, metabolic risk, and postmenopausal status across studies.

Critical appraisal of individual sources of evidence was performed independently using a standardized evidence table to assess study design, data analysis, key findings and overall strength of evidence. The table was subsequently used to summarize study characteristics, participant demographics, measurement methods, and primary outcomes. Patterns and trends across studies were then identified and synthesized in a narrative format, highlighting consistent associations between body composition parameters (LBM, PBF, VFM) and metabolic or cardiovascular risk in postmenopausal women. Gaps in the literature were also noted, particularly regarding the routine use of MF-BIA for early detection and preventative screening, providing direction for future research and recommendations in the care of postmenopausal women.

Results

From the databases identified, a total of 240,574 records were retrieved through the initial MeSH terms search, applied in varied combinations across multiple databases. Following the removal of 167,268 ineligible studies that did not meet the inclusion criteria for human and female populations, 73,306 records remained for screening. Of these remaining studies, 71,973 were excluded due to publication dates falling outside the most recent five-year inclusion window, leaving 1,075 for potential retrieval. Subsequent refinement limited inclusion to studies utilizing BIA, MF-BIA, and DXA for body composition assessment, reducing the pool to 312 records for full-text eligibility assessment. After detailed abstract screening, additional exclusions were made based on incomplete fulfillment of inclusion criteria, inappropriate

demographic focus, professional or expert opinion formats, and studies presented as systematic reviews and meta-analysis. This process resulted in 17 studies meeting all eligibility criteria for inclusion in the final review. A PRISMA flow diagram was constructed to illustrate this selection process and justify exclusions at each stage (See Appendix A).

Characteristics of the 17 studies were systematically charted using a standardized data extraction in the form an evidence table. Data items included study objectives, designs and methodology, country and setting, sampling size and characteristics (age range, menopausal status), and key variables related to body composition, hormonal status, and cardiometabolic indicators. Measurement techniques were recorded, emphasizing use of BIA, MF-BIA, or DXA scan for quantifying LBM, PBF, and VFM. Additional outcomes – such as serum hormone concentrations, lipid profiles, fasting glucose and insulin, dietary intake, and physical activity – were extracted where applicable, along with the quality and techniques of data analysis. All data were organized in an evidence table to facilitate comparison across studies and to identify patterns related to body composition changes during the menopausal transition. Each source of evidence was appropriately cited to ensure transparency and traceability.

Critical appraisal of methodological quality was performed for all 17 studies using Melnyk & Fineout-Overholt (2022) Hierarchy of Evidence framework. This approach enabled classification of each study by research design and methodological rigor. Studies included ranged from Level II (randomized controlled trials) to Level IV (cross-sectional observational studies), with populations drawn from both clinical and community settings. All studies comprised of women along the menopausal transition (pre-, peri- or postmenopausal), across multiple regions (America, Finland, East Asia, South Korea, Brazil, etc.). This blend of data provided contextual

insight into the strength and reliability of the evidence supporting the relationship between menopausal transition and alterations in body composition, along with the possible future health implications. Strengths and weaknesses of individual studies were documented to highlight variability in design quality, measurement consistency, and population diversity. Collectively, this appraisal underscored areas of robust evidence – particularly utilizing body composition techniques – and identified ongoing gaps in standardized assessment methods for body composition screening in postmenopausal women.

The results of the 17 included studies were synthesized according to their primary focus, methodological design, and assessment tools utilized for measurement of body composition. Studies were categorized into the type of measurement modality – including BIA, MF-BIA, and DXA – to enable comparison of findings across technologies. Within these categories, results were further organized into menopausal stage (pre-, peri-, and postmenopausal), with consideration of geographical region, race/ethnicity, dietary and activity influences. Key outcomes extracted from individual studies included PBF, VF, and fat distribution, LBM and Appendicular Lean Mass (ALM, or the bone and muscle mass of the arms and legs), and hormonal correlations (i.e. follicle stimulating hormone [FSH], estradiol). This structured synthesis facilitated in identification of trends while highlighting areas of inconsistency warranting further investigation.

Discussion

In order to answer how the implementation of comprehensive body composition in postmenopausal women can improve early detection and intervention for metabolic disease, the following data was extracted from the literature.

Body Composition Measurements. Comprehensive body composition – using tools such as BIA, MF-BIA and DXA, which account for muscle mass, body fat and fat distribution – provide more meaningful insight into patient decline and possible cardiometabolic risks than traditional metrics currently in practice. Gordito Soler et al. (2025) demonstrated that BIA more accurately quantified BF and VF with more precision, enabling superior detection of metabolic IR compared to BMI and waist circumference, which remain standard clinical measures in primary care. Importantly, the predictive performance of BIA was higher in women than in men, with the area under the curve (AUC) values exceeding 0.97, indicating excellent discriminatory ability (Gordito Soler et al., 2025). This precision has significant clinical implications; Berg et al. (2024) reported that BIA-based body composition screening nearly doubled the diagnostic rate of obesity in women, particularly among those with a smaller frame but unfavorable body composition that would otherwise be overlooked by BMI alone. Given the variability in body frame size among postmenopausal women, BIA represents a reliable tool for identifying at-risk individuals who might be missed through conventional anthropometric screening with today's standard.

Detailed Body Composition Changes Across Menopause. Traditional anthropometric screenings often fail to detect the nuanced changes in muscle mass, fat mass, and fat distribution, which many of the studies using comprehensive assessment techniques have demonstrated the accelerated shifts during the menopausal transition. Common findings include increased overall FM, increased VF, decreased bone mineral density, reduced LBM, and decreased ALM, all of which strongly correlate with declining FSH and estradiol serum levels throughout menopause (Marlatt et al., 2022, Lee et al., 2024, Fighera et al., 2023). Notably, Park et al. (2020) and

Greendale et al. (2021) identified that the late perimenopause phase exhibits the most rapid loss of muscle mass and accumulation of visceral fat, coinciding with pronounced hormone shifts, including reduced estradiol and elevated FSH. Although the trajectory of these changes were not seen to be varied across race/ethnicity groups, Marlatt et al. (2020) reported higher baseline truncal fat and cardiometabolic risks in African Americans, with a similar reduction in LBM compared to Caucasians. Factors associated with higher sarcopenia risk include rural communities, lower income, inadequate dietary intake or skipped meals, and mild menopausal symptoms (Le et al., 2024). Conversely, protective factors include higher levels of physical activity – such as brisk walking or resistance training – greater protein intake, and support of a partner, which correlate with higher LBM and ALM (Son et al., 2023, Rehunen et al., 2021, Liao et al., 2024, Le et al., 2024, Juppi et al., 2020).

Implications for Cardiometabolic Risk. Failure to identify these compositional changes in postmenopausal women may have significant long-term health consequences. Increased FM and VF in postmenopausal women have been shown to elevated IR, fasting glucose, fasting insulin, triglycerides, and blood pressure, all well-established risk factors for cardiometabolic disease (Marlatt et al., 2022, Dehghan et al., 2021). Son et al. (2023) further identified specific elevations in vascular inflammatory markers – such as elevated CRP, TNF- α , and IL-6 – in women with higher BF and lower LBM who engaged in limited exercise. While higher LBM to VF ratios are protective against IR (Shao et al., 2023), Rehunen et al. (2021) clarifies that high LBM alone does not confer protection if VF remains elevated. Collectively, studies by Juppi et al. (2020), Dehghan et al. (2021), Park et al. (2020), and Son et al. (2023) underscore the importance of early interventions, such as resistance training and body composition monitoring, to maintain

favorable LBM-to-FM ratio to mitigate cardiometabolic risk during the early stages of perimenopause.

Efficacy of Body Composition Measurements. A range of tools – such as BIA, MF-BIA and DXA – are available to measure body composition, but tool validity and population-specific variations must be considered. Looney et. al (2024) compared the InBody 770 MF-BIA to DXA, assessing same-day and day-to-day measurements while controlling variables such as time of day, limited prior alcohol, exercise and caffeine intake. The study found high reproducibility, within 3% accuracy, for measuring TBF, intra- and extracellular water content, and LBM between the two measures. Similarly, Felipe et al. (2024), reported strong agreement between BIA and DXA predictive equations for assessing sarcopenia in postmenopausal women (ICC=0.89-0.92). By applying a 3% correction, MF-BIA provides reliable, cost-effective, and accessible screening for body composition and cardiometabolic risk, making it a practical option for early detection of at-risk postmenopausal women.

Limitations. Limitations of the scoping review include the restricted timeframe, variability in levels of evidence, differences in body composition measurement methods, heterogeneity in study populations, small sample sizes, and limited control over confounding factors such as diet and exercise. Limiting inclusion to studies published within the last five years excluded some potentially robust investigations, including randomized control trials and higher-level evidence. This may reflect the relatively recent need for assessment of postmenopausal women and the implications of changes in the muscle and fat mass. Additionally, the absence of standardized guidelines for body composition assessment – beyond DXA for osteoporosis – has led to inconsistencies in measurement tools, with studies employing

BIA, MF-BIA, or DXA in varying protocols. Consequently, optimal assessment standards for postmenopausal women remain undefined and will require ongoing research as trends in body composition and associated health outcomes continued to be examined. Population heterogeneity further complicates interpretation and generalization, highlighting the need for larger, more diverse sample sizes to capture nuanced trends across age, ethnicity and lifestyle factors. Finally, controlling variables such as dietary intake and physical activity presents a challenge, particularly in long-term studies where cultural and lifestyle differences can significantly influence outcomes.

Conclusion

This scoping review reinforces the critical importance of incorporating body composition screening into routine clinical care, particularly for women transitioning through menopause, who face heightened risk for cardiometabolic disease. Measures such as lean body mass, fat mass, visceral fat, and the ratio of these compositions consistently demonstrate strong associations with early metabolic changes, insulin resistance and long-term comorbidities, surpassing the predictive utility of conventional anthropometric measures. Current screening practices, including BMI and waist circumference, are insufficient to identify at-risk individuals, leaving many women vulnerable to preventable disease, decline in quality of life, and even death. These findings underscore the urgent need to implement routine, accessible and safe body composition assessments – such as BIA or MF-BIA – in primary care settings. By doing so, providers can proactively identify women at elevated risk, initiate early interventions, and ultimately reduce the burden of cardiometabolic disease. This will not only alleviate

healthcare costs systemically, but also improve health outcomes, enhance longevity, and improve quality of life in postmenopausal women.

CHAPTER TWO

QUALITY IMPROVEMENT PROPOSAL

Introduction and ProblemIntroduction

The proposed quality improvement project addresses a critical gap in women's healthcare by demonstrating how implementation of body composition screening among postmenopausal women can improve patient investment and overall outcomes. The menopausal transition is a universal biologic process affecting women globally, across cultural and ethnic groups, characterized by hormonal changes that accelerate fat redistribution, muscle mass loss, insulin resistance, and inflammatory markers (Bermingham et al., 2022). These shifts substantially elevate morbidity and mortality, while decreasing quality of life. As previously discussed, the global population of postmenopausal women, and those at risk of these menopause-driven changes, continues to grow, estimated to surpass 1.2 billion in the next decade (Bermingham et al., 2022). In the United States, cardiovascular disease remains a leading cause of death in women (Tejada-Vera et al., 2025), yet current menopause-specific care lacks standardized screening guidelines, attention to body composition, and focused preventative strategies (Busebee et al., 2023, Gažarová et al., 2022, Nicholson et al., 2025). The need for proactive intervention is particularly pronounced in Montana, where rurality compounds health disparities through reduced clinical access, provider shortages, financial constraints, and limited nutrition and exercise resources (Hauptert, 2023; Smith & Trevelyan, 2019). As a result, Montanans face an elevated risk of cardiometabolic disease. This disparity is especially apparent in Southwest

Montana, where cardiovascular-related mortality rates often exceed twice the national average, and adult obesity rates surpass 30% (Montana Department of Health and Human Services n.d., United Health Foundation, 2025). When these risks are considered alongside the compounded effects of estrogen deficiency, insulin resistance, and increased plaque deposition characteristic of the menopausal transition, a clear imperative emerges to implement targeted interventions that enhance patient outcomes. Evidence from the scoping review of the literature suggests that the use of comprehensive, noninvasive body composition tools – such as multifrequency bioelectrical impedance analysis (MF-BIA) – can detect early compositional changes preceding insulin resistance and cardiometabolic disease (Felipe et al., 2024). Integrating such accessible and safe screening practices into routine care has the potential to close a critical gap in the protection of a high-risk population and transform postmenopausal care by promoting early detection, targeted intervention, and long-term prevention of cardiometabolic disease.

Problem and Aim Statement

Despite well-documented cardiometabolic risks associated with menopause, their increased contribution to systemic financial burden, and the increased associated mortality, there remains a significant lack of standardized screening practices to assess compositional changes contributing to disease development. As traditional anthropometric measurements – such as BMI and waist circumference – fail to capture the nuances of lean body mass, fat mass, visceral fat and fat distribution throughout the menopausal transition, subsequent under-identification leads to delayed recognition and missed opportunity for prevention of cardiometabolic disease.

This project seeks to address the question: *How can the implementation of comprehensive body composition in postmenopausal women improve early detection and intervention for*

metabolic disease? Guided by findings from the scoping review, the aim of this quality improvement project is to integrate the routine use of MF-BIA into the clinical setting in a southwestern clinic in Montana for the screening of postmenopausal women. The project will evaluate how implementing this screening enhances early identification of unfavorable body composition changes – such as declining lean body mass and increasing visceral fat – and facilitates timely lifestyle or clinical interventions. By adopting this evidence-based, accessible, and safe method, the project aims to strengthen preventative care, reduce cardiometabolic disease burden, and improve overall health outcomes of women in Montana and beyond.

The clinic serves a large population of postmenopausal women seeking hormone replacement therapy (HRT) and weight loss counseling yet previously lacked a standardized method to assess detailed body composition changes associated with menopause. This quality improvement project aimed to implement multifrequency bioelectrical impedance analysis (MF-BIA) body composition screening to enhance early detection of metabolic risk and guide individualized care. The specific objectives were to complete the following across six week-long PDSA cycles: 1) educate 100% of clinic staff on the significance of body composition in postmenopausal health, 2) obtain a baseline MF-BIA scan on 100% of eligible patients, 3) provide each patient with a personalized plan to improve lean body mass, 4) achieve a patient satisfaction rate of $\geq 80\%$, and 5) ensure a 98% rebooking rate for follow-up visits.

Context

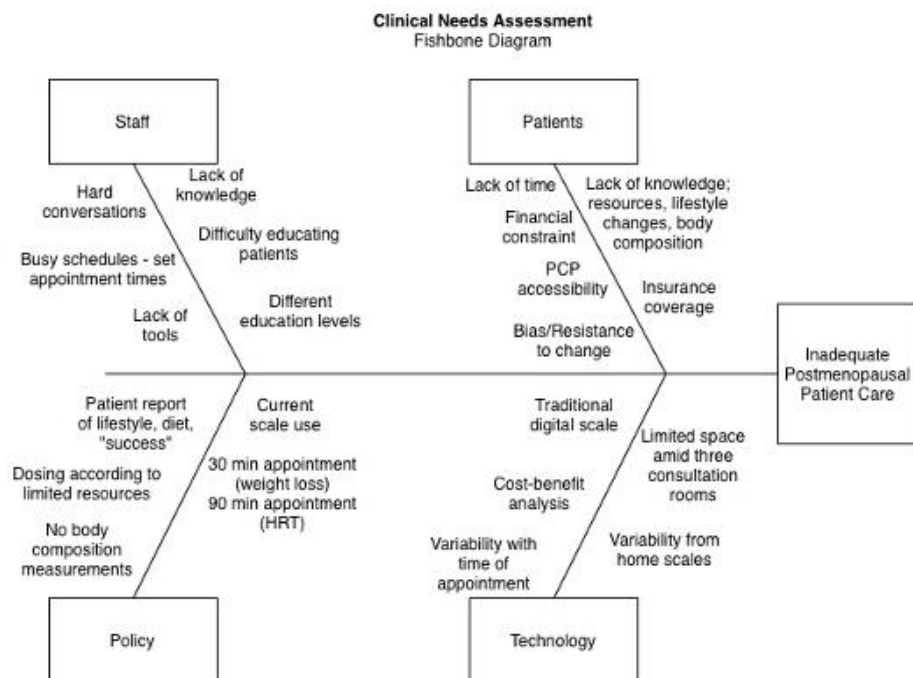
The clinical site for this project represents an optimal microsystem for implementing a quality improvement project focused on body composition screening among postmenopausal women. The clinic is in a rural setting of Southwest Montana and is comprised of three treatment

rooms and a close-knit interdisciplinary team consisting of a Physician Assistant (PA), an Advance Practice Registered Nurse (APRN), a Registered Nurse (RN), a medical assistant (MA), and a patient care coordinator. This structure supports efficient communication, shared decision-making, and strong continuity of care. The clinic's core services – HRT and weight loss counseling – are grounded in values of preventative and comprehensive health promotion, with a focus on optimizing longevity and quality of life. These already existing services naturally support the integration of MF-BIA as an evidence-based screening tool to assess muscle mass, fat mass, and visceral fat distribution. With more than 60% of the clinic's patient population in the peri- or postmenopausal stage, this site directly serves the population most at risk for cardiometabolic decline and unfavorable body composition. The incorporation of MF-BIA screening within this clinical setting therefore offers seamless and highly relevant opportunity to enhance early detection, guide personalized interventions, and advance preventative care outcomes for postmenopausal women.

Stakeholders are uniquely positioned to support and sustain this project. Co-owners of this clinic – the PA and MA – have both expressed strong buy in for the project in an effort to enhance profitability, quality of care, and patient satisfaction. Throughout the project they will provide administrative authority and clinical influence by ensuring policy integration, approval of workflow changes, and continued reassessment of financial strategy. The APRN provides evidence-based oversight, staff education and data collection, with a strong background in quality improvement initiatives. The RN and MA play vital roles in patient intake, MF-BIA operation, data collection, and patient education. The patient care coordinator also plays a vital role as the initial point of contact for patients in the program, providing vital education on clinic

resources, as well as supporting data tracking, scheduling, follow-up, and ensuring continuity of care. Patients also function as key stakeholders in this clinic and in the quality of their care, a role reflected in the clinic's historically high engagement, evidenced by an average rebooking rate of 92%. Collectively, the collaborative aspects of the stake holders and their backgrounds in this clinic create an ideal team for piloting, curating, and continuing the identified intervention.

Figure 1. Clinical Needs Assessment



Following identification of the clinical setting, a needs assessment was conducted to confirm the appropriateness of both the site and proposed intervention. As illustrated in the Clinical Needs Assessment Fishbone Diagram (Figure 1), the clinic currently lacks standardized body composition screening, contributing to suboptimal care for postmenopausal patients, as highlighted in Chapter One. From the staff perspective, barriers include limited education on body composition assessment, absence of a reliable screening tool, and time constraints within

tightly scheduled appointments. Discussions with stakeholders further revealed challenges surrounding the perceived difficult conversations and resistance to change. Patients similarly demonstrate limited understanding of body composition, its health implications, and available resources such as MF-BIA, while reporting financial and time constraints that limit access to higher-level assessments such as DXA scans. Clinic policies currently lack standardization, as HRT and weight loss counseling visits rely heavily on patient-reported data, which may be incomplete or biased in regard to lifestyle patterns. Traditional digital scales, which measure only weight, are insufficient for capturing meaningful changes in muscle mass, fat mass or fat distribution. Stakeholders note that previous delays in updating technology were influenced by limited space in the treatment rooms and insufficient understanding of the practice's clinical and economical benefits.

Quality Improvement Model

For this project, the IHI Quality Improvement Framework was selected to guide a series of six week-long Plan-Do-Study-Act (PDSA) cycle. This framework was chosen because it supports incremental testing of a new screening tool, encourages data-driven adjustments, and incorporates feedback from both patients and staff. In prior interviews, stakeholders emphasized the importance of continuous evaluation when investing in new technology to ensure quality improvement in screening practices and clinical flow. The PDSA framework provides structure where standardization was previously lacking and allows for measurable and adaptable implementation.

Prior to the PDSA cycle, the DNP candidate met with clinic stakeholders to define project interventions, metrics, and workflow for body composition screening. In the initial Plan phase

(January 9th-10th, 2026), all staff will receive education on the clinical implications of body composition, proper use of MF-BIA equipment, documentation procedures, patient education strategies, and follow-up protocols. The standardized screening protocol will then be implemented over six, week-long cycles for each eligible patient. The initial Do phase, or week of implementation, will begin January 12th, with collection of data for that week's cycle at the end of the business day on Friday, January 16th. The initial Study phase will be conducted that day, reviewing the data collected from patient charts (including completion of the body composition measurements, documentation of patient education, patient satisfaction rates, and rebooking metrics). Data review will then lead to the initial Act phase, where the DNP candidate will reconvene with stakeholders that day to review staff performance, workflow efficiency, patient satisfaction, rebooking rates, and cost-benefit outcomes. This will allow the DNP candidate, stakeholders and staff to identify opportunities for refinement of the following week's PDSA cycle. A subsequent Plan phase will delineate such adoptions to be implemented the following Monday, and the PDSA cycle will repeat itself until the six weeks are complete on February 20th, 2026. All data will then be evaluated collectively, and the PDSA cycles will be reviewed in total with stakeholders the week of March 2nd, 2026 to summarize findings and review for future opportunities.

Methods

Interventions and Implementation

Implementation Summary. This quality improvement initiative will be implemented in a rural clinic in Southwest Montana and will focus on improving the rates of comprehensive body composition screening in postmenopausal women who present for their weight loss consultations

or HRT appointments. The primary change will target implementation of MF-BIA screening during appointments of eligible patients (weight loss and HRT patients), providing interpretation of results, and suggested lifestyle modifications for targeted intervention of improving composition. Pre-implementation education will be provided to all staff members regarding the importance of body composition on postmenopausal health. The project will be measured over a six-week PDSA cycle, with the goal of 100% of clinic staff receiving education, 100% of eligible patients obtaining a baseline MF-BIA scan and a personalized plan to improve lean body mass, an $\geq 80\%$ patient satisfaction rate, and a 98% rebooking rate for follow-up visits. Patients consent for body metrics to be taken at the time of enrolling in the weight loss and HRT program, including the use of InBody technology for body composition screening.

Intervention and Implementation. The clinic's current workflow includes patient check-in with the patient care coordinator, a provider consultation focused on weight loss or HRT, measurement of body weight using a traditional scale (lbs), and reliance on patient-reported side effects, activity levels, and lifestyle habits to inform dosing and education. The proposed integration of comprehensive body composition screening would introduce objective metrics – such as lean body mass, body fat percent, and visceral fat – thereby enhancing the accuracy of health assessments and supporting more individualized dosing strategies and education. Initial implementation will begin January 9th with preliminary staff education involving the DNP candidate and all clinical personnel (Figure 2). Educational materials will summarize key evidence from Chapter One on the health and benefits of body composition screening, presented in a concise, bulleted data sheet for easy reference (See Appendix B). Staff will have until the

metrics (See Appendix D), along with personalized education on lifestyle recommendations customized to patient body composition, patient readiness, and immediate and long-term goals of care. The education provided is already supported by the clinic, such as:

- Increasing protein intake to 1g per ideal pound of body weight
- Increasing strength-training exercise to 3-5 times per week
- Increasing water intake to 100-120 oz per day
- Aiming for at least eight hours sleep per night

Following their visit, patients will follow current check-out procedures with the Patient Care Coordinator (PCC), who will verify their contact information, and schedule their next appointment. However unlike the previous workflow, the PCC will then activate an automated survey within the EMR to be sent within 72 hours via text or email depending on the patient's pre-selected preferences. Patients will be asked a single question, to rate on a Likert scale from 1 to 10, what is their satisfaction with the education received during their visit. This survey method is a free integration of the EMR system that is already implemented in clinic for other surveys, and familiar to staff.

At the end of each work week (Fridays), the PCC will compile data from patient charts, including the number of eligible patients seen, screened, rebooked, and the total scores of the satisfaction surveys completed. Concurrently, the RN will audit the same charts to verify screening completion, documentation of body metrics, and education delivery. All findings will be recorded on a standardized data collection form maintained in the clinic office, free of any possible patient identifiers, ensuring confidential, accurate, and efficient data retrieval for analysis following completion of each PDSA cycle (See Appendix E). This collected data will

then be reviewed by the DNP candidate, stakeholders and staff, assessing for possible areas of improvement for the following PDSA cycle. Upon completion of the project, the DNP candidate will compile the final data prior to meeting with practice owners during the first week of March to evaluate project outcomes, review the cost-benefit analysis, and determine recommendations for future implementation and sustainability based on PDSA cycle findings.

Anticipated barriers to the PDSA cycle were systematically evaluated during the planning phase to mitigate potential disruptions and ensure project continuity. In the event of staff illness or absence, the RN and MA (a co-owner), possess the appropriate scope of practice and availability to assume responsibilities typically handled by the PCC, including data collection, patient rescheduling, and follow-up. These team members are also prepared to complete body composition measurement if a provider is unable to do so due to time constraints or absence. For patients who decline the new screening technology, staff will first provide education on its purpose and benefits. If refusal persists, it will be appropriately documented in the patient's chart under "Patient Education" and "Other" (See Appendix C) to ensure transparency and accuracy in the project reporting.

Several key strengths are demonstrated in this PDSA cycle, including minimal education and time requirements for implementation, favorable cost-benefit considerations, sustainability, and objective metrics for improvements in quality of care. Staff education demands are minimal, requiring only a single 30-minute instructional session supplemented by ongoing team collaboration and support. Integration of the InBody380 MF-BIA device adds approximately two minutes to the standard intake process compared to a traditional scale, a negligible increase that does not extend total appointment duration. Stakeholders determined that this brief interval

allows providers time finalize charting or prepare for patient counseling, thereby maintaining workflow efficiency.

From a financial standpoint, the InBody380 MF-BIA device – purchased at an estimated cost of \$9,000 – was already under consideration by the clinic, allowing the project to align with existing operational goals. The DNP candidate's contribution of approximately 135 volunteer hours, valued at \$3,645 in equivalent staff wages, further offsets implementation costs. Additionally, improved patient satisfaction and engagement are expected to yield positive economic returns; each established weight loss counseling patient represents an annual value of \$4,200-\$6,600, with potential for further growth through conversion to other services, or patient referrals.

Beyond cost and efficiency, the project is likely to strengthen clinical excellence by integrating an evidence-based, noninvasive, and reproducible screening tool that enhances preventive care for postmenopausal women – whose longevity and quality of life is invaluable. The structured PDSA cycle allows for real-time feedback, adaptability, and sustainability of change, positioning the clinic to continue refining and scaling the intervention for broader practice integration and implications.

Evaluation and Analysis

Data from this six-week PDSA cycle will be compiled using the previously described data collection form and analyzed with both descriptive and inferential statistical methods to evaluate the effectiveness of implementing comprehensive body composition screening and to inform ongoing quality improvement efforts (See Appendix F). All data will be entered and analyzed using Intellectus Statistics software, a statistical software platform for quantitative

analysis. Descriptive statistics will be used to summarize key process and outcome measures, including percentage of eligible patients screened, proportion of visits with documented body composition data, rebooking rates, and mean patient satisfaction scores. Measures of central tendency (mean, median) and variability (standard deviation, range) will be calculated to provide a clear overview of performance patterns. Results will be presented in tabular form and visualized using bar charts for clarity and accessibility. Weekly run charts will be utilized for monitoring trends in patient screening and satisfaction rates throughout the six-week implementation period. This method will allow for real-time identification of changes in process consistency, variation, and overall progress toward project aims. Run charts are particularly well-suited for this small, clinical microsystems, offering a visual representation of improvement trajectories and supporting immediate team-based reflection. Inferential statistics, such as paired t-tests, will be utilized for comparing pre- and post-intervention outcomes, such as patient rebooking rates, to determine statistical significance. Qualitative feedback from patient satisfaction surveys, as well as final staff debriefings at the conclusion of the PDSA cycle, will undergo thematic analysis to identify common barriers, strengths, and improvement opportunities for further contextualized quantitative findings. Upon the completion of the PDSA cycle, all data will be reviewed with stakeholders to determine the level of the project's success in a data-driven approach.

Safety and Confidentiality

Patient confidentiality will remain prioritized throughout the PDSA cycles. Weekly data collection will be conducted by staff members with appropriate EMR access, and all data will be recorded without patient identifiers. Information stored on the InBody380 is passcode-protected

and does not include patient identifiers outside of the last four digits of their phone number. At no time will this be accessed by anyone other than the overseeing provider. Data imported into Intellectus Statistics will replicate the clinic data form, clear of patient identifiers, ensuring confidentiality during statistical analysis conducted by the DNP candidate outside of the clinic. The original data collection form will remain securely in the clinic office at all times, and at the conclusion of the project review with stakeholders, will be shredded unless stakeholders request otherwise for internal records. This process was specifically designed to safeguard patient privacy while allowing for accurate and efficient project evaluation.

Conclusions

This quality improvement project addresses the elevated risk of cardiometabolic disease among postmenopausal women living in rural Southwest Montana, where limited access to preventative health resources and clinical services contributes to higher rates of morbidity and mortality. Project implementation, through partnership with key stakeholders, will apply a multi-disciplinary approach that integrates provider and patient education, comprehensive patient assessment, collaborative teamwork, and continuous quality improvement. The introduction of body composition screening using the InBody380 multifrequency bioelectrical impedance analyzer (MF-BIA) device during all hormone replacement therapy (HRT) and weight loss counseling visits has the potential to standardize early detection and intervention for the adverse effects of the menopausal transition. A six-week Plan Do Study Act (PDSA) cycle will facilitate active implementation, ongoing assessment, and analysis of project outcomes. The primary objectives include enhancing consistency in staff education, achieving baseline screening for all eligible patients, personalized patient education to improve lean body mass, increasing patient

satisfaction, and ensuring consistent rebooking rates. Data gathered from this project will guide future quality improvement initiatives, advancing postmenopausal care through intentional, preventative, and standardized practice.

CHAPTER THREE

QUALITY IMPROVEMENT MANUSCRIPT

PROMOTING POSTMENOPAUSAL LEAN BODY MASS
THROUGH BODY COMPOSITION MEASUREMENT: A
QUALITY IMPROVEMENT INITIATIVE

Contribution of Authors and Co-Authors

Manuscript in Chapter 3

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Contributions: Problem identification and assessment, scoping review of current literature, intervention implementation, and systematic data collection and analysis.

Chair: Lindsey Davis, DNP, APRN, FNP-C

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Contributions: Secondary manuscript evaluation and guidance.

Manuscript Information

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Promoting Postmenopausal Lean Body Mass Through Body Composition Measurement: A

Quality Improvement Initiative

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Abstract

Background: Menopause causes declining sex hormones, destabilizing metabolic pathways and resulting in fat redistribution, muscle loss, insulin resistance, inflammation, and altered lipoproteins. These changes increase metabolic syndrome, atherogenic plaque, and sarcopenia, raising disease risk and mortality. However, body composition testing and education on lean body mass are rarely routine in women's healthcare.

Local Problem: A Montana clinic specializing in weight loss and HRT lacked a standardized protocol to screen and educate about menopause-related body composition changes and disease risk.

Methods: Over six weeks, Plan-Do-Study-Act (PDSA) cycles integrated body composition screening and education for perimenopausal/menopausal patients receiving weight loss or HRT care. Outcomes were screening rates, education, satisfaction, and retention.

Intervention: Providers were trained on menopause-related metabolic changes and disease risk, then applied a protocol including baseline body composition analysis (InBody 380) and personalized education to preserve lean mass.

Results: 138 eligible patients were seen. Of these, 47.8% (n=66) completed a baseline body composition screening and 65.2% (n=90) received targeted education. Screening refusal occurred in fewer than 8% of patients (n=10). Patient satisfaction averaged 100%, and follow-up retention reached 97.8% (n=135).

Conclusion: Standardized body composition screening and education is a feasible primary intervention for menopausal women, showing high acceptance, satisfaction, and retention. This approach promotes engagement, early intervention, and identification of metabolic risks.

Keywords: Menopause, Body composition, Lean body mass, Hormone replacement therapy, Sarcopenia, Weight loss, Quality improvement, PDSA cycle

Introduction

Menopause is the hormonal state each woman will come to at one point in their lives, marking the permanent ovarian decline or loss of estrogen, progesterone, and testosterone. These hormones are pivotal in regulating metabolic, cardiovascular, cognitive and endocrine health through the pathways of insulin sensitivity, fat distribution, muscle retention, metabolic stability, and protection against certain disease (Bermingham et al., 2022; Buckinx & Aubertin-Leheudre, 2022). Loss of this hormonal support destabilizes these pathways, giving rise to increased fat mass, loss of muscle mass, increased visceral fat accumulation, insulin resistance, inflammation, lipoprotein remodeling, and more (Bermingham et al., 2022; Zhu et al., 2020). Such unfavorable changes in body composition subsequently increase a woman's risk of the leading causes of death; cardiovascular disease, diabetes, cancer, stroke, hypertension, and Alzheimer's disease (Tejada-Vera et al., 2025).

While the menopausal experience varies among women, they share a common sustained metabolic transition that elevates disease risk for almost a third of their lifetime (Bermingham et al., 2022). The increasing rates of muscle wasting with higher fat accumulation (sarcopenic obesity), lipoprotein remodeling, and metabolic syndrome add toward the projecting rise in cardiovascular disease, and metabolic disease, which cost the United States healthcare system over \$805 billion on an annual basis (American Diabetes Association, 2022; Kazi et al., 2024). With the global population of perimenopausal and postmenopausal women anticipated to exceed 1.2 billion within the next five years, and those 60 years and older expected to double to 2.1 billion by 2050, emphasis on reducing preventable disease and early detection will be imperative

to the longevity of the aging population, and the financial well-being of the healthcare system (Bermingham et al., 2022; World Health Organization [WHO], 2025).

Clinical Problem

Despite well-documented metabolic changes associated with menopause, current clinical practice guidelines remain inadequate, with outdated screening methods and a poor understanding and education about the effect of menopause on women's health. Current guidelines encourage primary care providers to use weight-based metrics, such as overall body weight or Body Mass Index (BMI), to assess for healthy composition (Gažarová et al., 2022). These methods are shown to be limited in their ability to detect body composition changes, with low rates of identifying sarcopenic obesity and visceral adiposity, key identifiers in menopausal metabolic changes (Busebee et al., 2023; Gažarová et al., 2022; Heymsfield et al., 2024). Although more precise assessment tools exist, such as the dual energy X-ray absorptiometry (DXA), its use is often restricted by cost, accessibility, and insurance limitations, with screening typically reserved for women 65 and older or those with preexisting symptoms of osteopenia or osteoporosis (Nicholson et al., 2025). As a result, current screening practices often occur after women are already symptomatic or have begun metabolic remodeling, limiting opportunity for impactful intervention.

At a small specialty clinic in Montana providing weight loss and hormone replacement therapy (HRT), providers lacked a standardized screening and education protocol for body composition assessment or patient education to recognize menopause-related changes. This gap limited providers' ability to recognize early risk factors, reduced patient comprehension of body composition changes, and restricted education on lifestyle modifications and long-term

preventive care strategies to reduce the risk of disease. Collectively, these practice gaps illustrated the need for a reliable, accessible, and evidence-based approach to body composition assessment as a functional solution for early risk detection, education, and treatment planning. To address these challenges, multi-frequency bioelectric impedance analysis (MF-BIA) emerges from the literature review as a superior option for assessing body composition, identifying metabolic risk among postmenopausal women, and providing insight for the development and implementation of standardized protocols essential to improving patient outcomes and educational support.

Review of the Literature

Recent studies have demonstrated that key indicators of healthy body composition include lean body mass (LBM) and percent body fat (PBF), which reflect the balance of muscle and adipose tissue, as well as visceral fat mass (VFM). Declines in estrogen and testosterone directly contribute to skeletal muscle atrophy, increased PBF, and increased VFM (Buckinx & Aubertin-Leheudre, 2022). Subtle variations in values and ratios of LBM, PBF, and VFM can indicate the development of sarcopenia, transformation to an atherogenic state, and tendency towards insulin resistance (Bermingham et al., 2022; Chiu et al., 2020; Cui & Zhao, 2023; Abildgaard et al., 2021; Zhu et al., 2020). In menopause specifically, sarcopenic obesity increases, with a 0.5% decline in muscle mass per year and a 1.7% increase in fat mass, contributing to a tendency towards a disease-risk state (Buckinx & Aubertin-Leheudre, 2022). Women seeking care from primary care providers or OBGYNs will have anthropometric measures, such as weight or BMI; these metrics do not account for body fat distribution or changes in muscle mass, often failing to detect sarcopenic obesity (Busebee et al., 2023;

Gažarová et al., 2022). Alternative measurements, such as the waist-to-hip ratio, may account for distribution but are inconsistent across gender, age, height, and ethnicity (Gažarová et al., 2022). Comprehensive indices quantifying LBM and fat deposition patterns show stronger correlation with metabolic risk (Gažarová et al., 2022).

Multi-frequency bioelectric impedance analysis (MF-BIA) devices, such as the InBody device, offer several clear advantages over other body composition measurement tools. MF-BIA provides reliable, comprehensive assessments of body composition, including total body weight, LBM, PBF, VFM, and fat distribution (Gordito Soler et al., 2025). Unlike standard tools such as BMI and waist circumference, MF-BIA accurately quantifies PBF and VFM and detects metabolic syndrome with greater precision (Gordito Soler et al., 2025). Studies show BIA-based technology doubles the diagnostic rate of obesity in women, particularly sarcopenic obesity, which is especially valuable in screening menopausal females (Berg et al., 2024). Additionally, MF-BIA can detect subtle shifts in LBM, PBF, VF, bone mineral density, and distribution, reflecting early hormonal changes and making it useful for early identification throughout perimenopause (Marlatt et al., 2022; Lee et al., 2024; Figuera et al., 2023; Park et al., 2020; Greendale et al., 2021). Early screening allows for targeted interventions to reduce sarcopenia and metabolic syndrome and to maintain favorable body composition, such as greater physical activity, resistance training, proper diet, and continued monitoring (Le et al., 2024; Dehghan et al., 2021; Park et al., 2020; Son et al., 2023; Rehunen et al., 2021; Liao et al., 2024; Juppi et al., 2020).

Although DXA is the gold standard for body composition, Looney et al. (2024) found the InBody MF-BIA highly reproducible and accurate ($\leq 3\%$) for total body fat, LBM, and fluid

compartments. Unlike CT, MRI, and DXA, MF-BIA is noninvasive, radiation-free, requires no additional orders or insurance approval, and is simple to use in any office (Gažarová et al., 2022). These features lower costs, speed wait times, improve access, and support widespread screening, making InBody MF-BIA ideal for this initiative.

Conceptual Framework

Using the Institution for Healthcare Improvement's (IHI) Quality Improvement Framework, a series of six week-long Plan-Do-Study-Act (PDSA) cycles was developed to support incremental testing of integrating body composition screening and patient education for eligible perimenopausal/menopausal patients receiving care for weight loss or HRT (Institute for Healthcare Improvement, 2026). Prior to implementation, a fishbone diagram and interviews with clinic stakeholders were utilized to identify the lack of a reliable screening tool, potential barriers, and priorities for improving clinical flow and patient care. These factors informed the decision to use a PDSA cycle structure, which would encourage data-driven adjustments and incorporate continuous feedback throughout the project.

As part of the Plan-Do-Study-Act (PDSA) structure, weekly assessments were conducted during the "Study" phase to analyze implementation, patterns of improvement, and address necessary workflow changes or staff concerns. During this time, the DNP candidate and staff met to discuss outcome measures, including screening rates, education delivery, and patient engagement, as reflected in survey scores and follow-up scheduling. Trends were tracked throughout each PDSA cycle to evaluate progress compared to pre-intervention rates, identify barriers, note workflow limitations, and monitor staffing changes. This approach enabled data-driven adjustments between cycles. Each cycle informed decisions to adopt, adapt, or abandon

changes to reduce obstacles, increase adoption, and improve patient satisfaction. As a result, clinical processes and patient engagement improved, supporting the intervention's positive impact on outcomes.

Aims

This quality improvement project aimed to adopt a standardized screening protocol using the MF-BIA body composition assessment to enhance early detection of compositional changes and to provide patients with personalized education on their metabolic risk and lifestyle modification strategies. The specific objectives were to complete the following across six week-long PDSA cycles: 1) educate 100% of clinic staff on the significance of body composition in postmenopausal health, 2) obtain a baseline MF-BIA scan on 100% of eligible patients, 3) provide each patient with a personalized plan to improve lean body mass, 4) achieve a patient satisfaction rate of $\geq 80\%$, and 5) ensure a 98% rebooking rate for follow-up visits. Ultimately, this project aims to advocate for more accessible and reliable screening for changes in body composition to reduce the disease risk for postmenopausal women and enhance overall longevity.

Methods

Context

The clinical site for this quality improvement project is a small specialty clinic located in Montana, and is comprised of a close-knit interdisciplinary team, consisting of a Physician Assistant (PA), an Advanced Practice Registered Nurse (APRN), a Registered Nurse (RN), a medical assistant (MA), and a patient care coordinator (PCC). Core services include HRT and

weight loss counseling for a population comprised of approximately 60% peri- or postmenopausal women, with a self-promoted focus on optimizing longevity and quality of life. During the clinic assessment, stakeholders expressed strong buy-in for the project, with the intention of enhancing patient education and increasing profitability through high satisfaction rates and patient retention. Each clinical staff member is well-versed in HRT and weight loss services, as well as the foundations of body composition and cardiometabolic health, providing high engagement with the proposed intervention.

In the original clinical work flow for patient care visits, patients were initially met by the PCC, who checked them in prior to seeing their provider, the PA or APRN. Once with the provider, the patients were assessed, including body weight using a traditional digital scale, and provided education as part of their treatment plan. The provider would then document the patient's status, treatment, body metrics, and education in the electronic medical record (EMR). At the conclusion of the visit, the patient would return to the front desk to be checked out by the PCC, and rescheduled for their next visit. Generally, patients were then sent an automated survey, initiated through the EMR, asking how satisfied they are with their visit.

Intervention

In accordance with the clinic's identified needs and the specific aims of the project, clinical flow was adjusted and standardized to include staff education, screening for eligible patients, promotion of lean body mass, and assessment of patient satisfaction and follow-up retention. Prior to the implementation of the improvement project, the DNP candidate provided a preliminary staff education meeting, including final debriefing of the PDSA cycle workflow, as well as educational materials created from key evidence from Chapter One summarizing the

benefits of body composition analysis and menopausal compositional changes, along with concise, bulleted data points for lifestyle modification techniques to be provided (See Appendix B). The following week, the first PDSA cycle began.

For patients presenting for weight loss or HRT services, and self-reporting as peri- or postmenopausal, they were considered eligible for participation in body composition screening as part of their visit. After checking in with the PCC, the MA, RN, or provider (PA or APRN) was then responsible for completing the screening assessment using the MF-BIA InBody 380 during the patient's visit, in place of the traditional digital scale. Once the screening was complete, a printout of the body composition assessment was then printed for the provider's review (See Appendix D). The EMR charting template for HRT and weight loss visits was modified to include documentation of the InBody metrics – including total body weight (pounds [lbs]), skeletal muscle mass (SMM, lbs), percent body fat (PBF, percent [%]), and visceral fat mass (VFM, Level [Lv]) – as well as whether the patient was provided personalized education on body composition and lifestyle modifications (See Appendix C). If patients declined the composition screening, the provider would indicate this in the chart but could still provide education regarding composition screening and menopausal changes if the patient was receptive. Following the patient visit, standard check-out procedures continued, including rescheduling for their next visit. The PCC also verified the preferred contact method, such as email and phone number, to ensure the correct method for surveying satisfaction scores. Once patient visits concluded, the survey was then selected to be sent within 72 hours via text or email, depending on the patient's preferences. Patients were asked a single question, rated on a Likert scale from 1

to 10, about their satisfaction with the education received during their visit. This survey method is a free integration with the EMR system that guarantees patient confidentiality.

Modifications to the PDSA cycle were implemented throughout the six-week period in response to workflow analysis and emerging barriers. Early cycles revealed that many patients were uncertain of their perimenopausal status; therefore, inclusion criteria were expanded to patients ≥ 40 years who were unsure of their status, broadening the sample size while aligning with the average age of menopause (45-50 years) (Bermingham et al., 2022). For patients declining use of the InBody380, assessment using a traditional scale measuring total body weight was substituted, requiring scales to be available in exam rooms. Traditional scales were also necessary in the case of physical inability to use MF-BIA, such as injury or prosthesis.

Additional modifications addressed workflow disruptions due to patient and provider illness. Telehealth visits for patients unable to attend in-person impeded patients' ability to undergo InBody380 assessment until a subsequent in-person visit, which in some cases occurred after the completion of the PDSA cycles, thereby reducing available data. Provider illness further decreased scanning capacity and increased time constraints upon return to the clinic due to increased scheduling demands. Survey administration processes were also consistently modified, transitioning from email to text-based distribution with follow-up reminders, and subsequently to QR code-based anonymous survey available at checkout.

Measures

At the end of each week, the PDSA cycles concluded with the PCC and RN compiling chart audits for data collection. The PCC collected data, including the number of eligible patients seen, screened, and rebooked, as well as total satisfaction survey scores. The RN then audited the

same charts to verify screening completion, documentation of body metrics, and education delivery. All data was then recorded on a standardized data collection form maintained in the clinic office, free of any possible patient identifiers, ensuring confidential, accurate, and efficient data retrieval for analysis (See Appendix E).

Five outcomes were measured during the PDSA cycles to align with the project's quality improvement goals (See Appendix F). Percentage of staff educated on body composition assessment was measured by the total number of those completing education out of the total number of staff members. Percentage of eligible patients scanned for body composition was measured by the total number of eligible weight loss and HRT patients scanned out of the total number of eligible weight loss and HRT patients seen in the six week period. Percentage of eligible patients educated on body composition was measured by the total number of eligible weight loss and HRT patients educated out of the total number of eligible weight loss and HRT patients seen in the six week period. Patient satisfaction rating was measured using a Likert rating from 1 to 10, with the average score expressed as a percentage (i.e. $10/10 = 100\%$). Percentage of eligible patients rebooking follow-up appointments was measured by the total number of eligible weight loss and HRT patients rebooked for their next appointment out of the total number of eligible weight loss and HRT patients seen in the six week period.

Analysis

Data collected from chart audits and documented on the PDSA Cycle Data Collection Form were summarized using descriptive statistics. Central tendency and variability was utilized to assess all five aims, including the percentage of staff educated on body composition assessment, the percentage of eligible patients receiving an assessment, the percentage of

patients educated regarding body composition, the percentage of patient satisfaction, and the percentage of patients rebooked for follow-up. A paired t-test was also used to compare the average patient rebooking rate before the intervention with that during the six PDSA cycles to assess statistical significance. Bar charts and donut charts were used to reflect variability throughout the PDSA cycles, as well as overall average ratings. Qualitative data were obtained from staff and stakeholders during PDSA assessment meetings and organized by thematic categories to support systematic review and reflection on intervention outcomes.

Ethical Considerations

This quality improvement project was reviewed by the Institutional Review Board (IRB) at Montana State University (Reference #2475) and received approval prior to implementation, and was not considered human subject research. Patient confidentiality was prioritized throughout the PDSA cycles using standardized safeguards, such as data collection performed by staff members with appropriate EMR access, and data recordings free of patient identifiers. The InBody380 was passcode-protected, and printed handouts contained no patient identifiers, accessed only by the overseeing provider and patient. All project materials were kept securely within the clinic with restricted access. These measures ensured patient privacy while supporting accurate project evaluation.

Results

Prior to implementation, staff education was conducted, and 100% of staff attended, received education about how to use MF-BIA technology, how to disseminate education to

patients regarding postmenopausal composition changes, and how to adjust workflow with visit structures and charting.

During the six-week implementation, 138 eligible patients were seen for weight loss counseling or HRT visits, self-reporting peri- or postmenopausal status, or ≥ 40 years old. Of these patients, 47.8% (n=66) were documented as completing baseline body composition screening, while fewer than 8% (n=10) were documented as overtly declining due to personal reasons, such as history of disordered eating or preference to not know their exact weight and metrics. Telehealth utilization and provider illness reduced opportunities for InBody380 data collection, contributing to diminished data capturing during PDSA cycles 3, 4, and 6. During PDSA cycle review, staff also cited general time constraints for lower-than-anticipated screening rates or incomplete charting which voided inclusion data. Regardless of assessment, 65.2% (n=90) of eligible patients' charts indicated they received targeted education on body composition changes during menopause and related lifestyle modifications.

Figure 3. Eligible Patients Screened

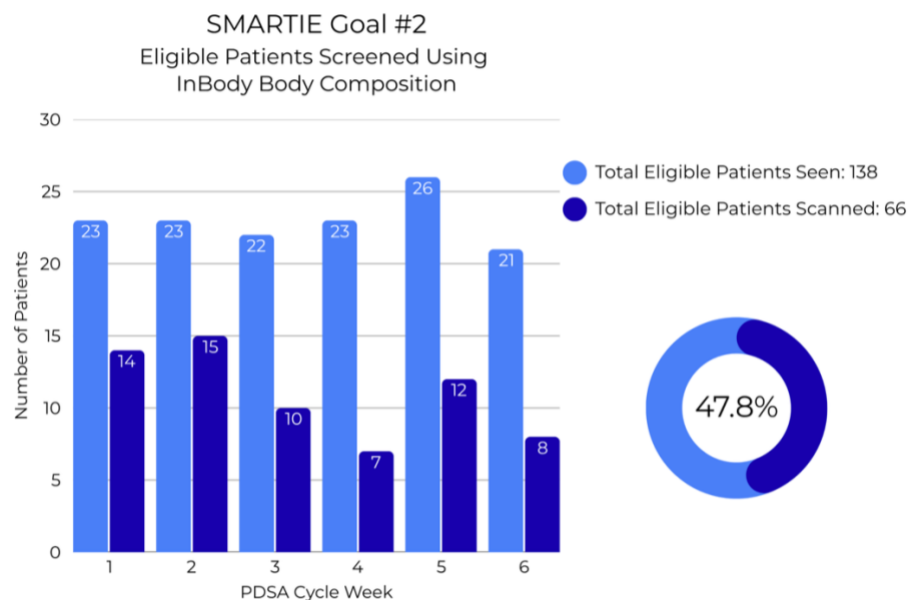
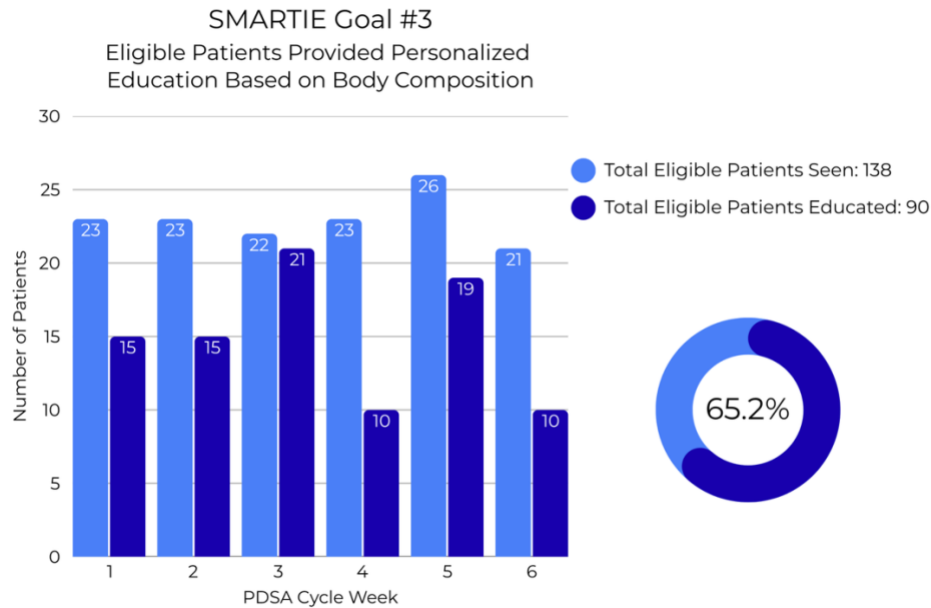


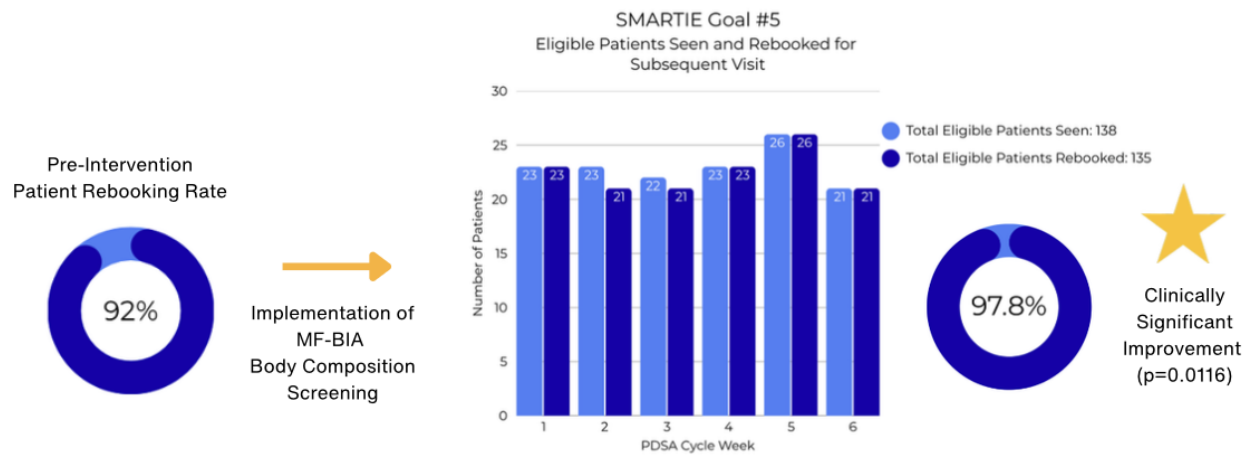
Figure 4. Eligible Patients Receiving Education



Thirty-five patients completed a post-clinic satisfaction survey (scale of 1 to 10), with 100% of respondents reporting a score of 10. This represents a 25% response rate among eligible patients who received the survey. Implementation of survey adaptations resulted in modest improvements across cycles; however, overall response rates remained below expectation due to persistent barriers such as filtering of email surveys to junk mail, limited access to mobile devices for QR code scanning, and delayed survey completion despite reminders.

Patient rebooking rates for follow-up appointments rose from 92% pre-intervention to 97.8% (n=135) post-intervention ($p=0.0116$), showing a statistically significant retention increase.

Figure 5. Patient Retention Rates



Discussion

The quality improvement initiative achieved several of its intended aims following implementation of MF-BIA body composition screening. All staff received comprehensive education on body composition changes in postmenopausal women and the clinical importance of composition screening. Patient satisfaction with the education received exceeded expectations, reaching 100%. Although post-implementation patient retention (97.8%) fell slightly below the predefined 98% goal, it was significantly improved from the baseline rate of 92%. Overall, these findings suggest that integrating MF-BIA composition screening into clinical practice enhanced both patient and provider understanding of metabolic health and was associated with high levels of patient satisfaction and retention.

Measurements falling short of the intended aims included patient screening rates and patient education rates, as well as the overall amount of patient engagement with surveys. These findings highlight the practical challenges of implementing workflow-dependent interventions in a dynamic clinical setting. Barriers related to patient engagement, technology access, and clinic

operations limited full protocol adherence. However, the use of the PDSA cycle facilitated real-time identification and modification of these challenges, underscoring the importance of the “Act” phase, allowing for the adoption, adaptation, or abandonment of processes to improve feasibility and effectiveness for future implementation.

Utilization of the MF-BIA technology for comprehensive body composition screening addressed the gap in assessing peri- and postmenopausal women for more subtle, yet impactful body composition changes that they may be silently suffering from. Equipped with more composition metrics (such as total body weight, lean body mass, percent body fat, visceral fat, etc.), providers were better prepared to assess the health of the patient, the impact of their current treatment, and future recommendations.

In the weight loss counseling patients, the MF-BIA technology shifted the definition of success for both patients and providers. Weight loss success was no longer simplified as weight-reduction alone, but measured by overall metabolic health. The inclusion of metrics such as muscle mass, percent body fat, and visceral fat increased identification of sarcopenic obesity in many women with otherwise healthy BMIs, consistent with prior literature (Berg et al., 2024; Busebee et al., 2023; Gažarová et al., 2022; Abildgaard et al., 2021). Identification of sarcopenic obesity allowed providers to target specific interventions for the preservation of lean body mass. The objective data of the MF-BIA assessment also suggested the success or failure of certain lifestyle habits, creating clarity for patients of their treatment goals while also creating accountability for increasing movement and weight-resistance training, and maintaining a healthy diet. Patients who demonstrated interest in receiving education, modifying their habits,

and returning for body composition screening voiced positive feedback for the targeted treatment changes the body assessment provided them, and their subsequent success in the program.

Patients undergoing HRT also benefited from the ability to monitor changes in body composition over time. Individuals with previously identified inflammation, dyslipidemia, metabolic resistance, and poor lifestyle habits were able to closely monitor visceral fat and percent body fat changes more frequently without invasive procedures such as lab draws or DXA scans. This supports early identification of cardiometabolic risk and optimization of treatment strategies (Bermingham et al., 2022; Heymsfield et al., 2024). Patients who were streamlined in HRT therapy with high levels of movement and resistance training also benefitted from screening by the ability to monitor levels of muscle mass with treatment and training adjustments (Juppi et al., 2020; Dehghan et al., 2021; Park et al., 2020; Son et al., 2023).

Patient and provider feedback received during the Study phase of the PDSA cycle was imperative to the success of this project. By enhancing the education and information available to providers, many verbalized increased confidence in screening, assessing changes in body composition, educating patients, and planning treatment adjustments. Patients echoed this response in the overwhelming success of satisfaction rates, while providers also reported patients stating in office that they felt the body composition took the care to a deeper level of assessment. This is reflected in the follow-up retention rate increasing to almost all patients booking for their next visit prior to leaving the clinic.

Limitations

Several limitations should be considered when interpreting the results of this quality improvement project. Variability in clinic workflow and staffing impacted the consistency of

intervention implementation. Periods of staff illness and reduced provider availability during select PDSA cycles limited the ability to perform body composition screenings, potentially contributing to lower screening rates. Time constraints during complex patient visits, particularly HRT encounters, made it difficult to consistently complete the screening, as providers had to manage competing clinical priorities. Not all eligible patients participated in the composition screening. Patients seen via telehealth during illness were unable to undergo in-office assessment, and some declined screening. Refusals were attributed to physical limitations, discomfort with weight-related measurements, and personal preference, especially among individuals with a history of disordered eating or anxiety related to body metrics. These factors may introduce selection bias, as patients who participated in the screening and follow-up survey may have been more engaged or receptive to lifestyle interventions. The project was conducted within a single specialty clinic, which may limit generalizability to other clinical settings, such as primary care or larger healthcare systems with different workflows and patient populations. The short duration of the intervention and reliance on process and satisfaction measures also limit the ability to assess long-term clinical outcomes, including sustained changes in body composition or reduction in cardiometabolic risk.

Implications for Practice

The findings of this quality improvement project demonstrate that integrating multifrequency bioelectrical impedance analysis (MF-BIA) is both feasible and valuable for routine body composition screening in menopause-focused clinical care. Incorporating MF-BIA into standard workflows enables providers to move beyond weight-based metrics and facilitates more accurate detection of early metabolic changes, including sarcopenic obesity and other

adverse alterations. These changes are often not identified by traditional methods such as body mass index (BMI). Enhanced assessment supports more individualized, prevention-oriented treatment planning and aligns with the increasing emphasis on advancing women's health.

From a clinical practice perspective, the implementation of a standardized screening and education protocol was well received by both patients and providers, as evidenced by high satisfaction and follow-up retention rates. These findings suggest that integrating body composition analysis into routine visits may enhance patient engagement, increase accountability, and support adherence to lifestyle and therapeutic interventions. Provider education proved essential for successful implementation, highlighting the importance of equipping clinicians with the knowledge and resources necessary to interpret and apply findings to actionable care plans.

Recommendations

Future initiatives should prioritize expanding the implementation of MF-BIA screening into a wider range of clinical settings, such as primary care and women's health practices, to enhance patient access to early detection of metabolic risk in diverse populations. Beginning with the development of standardized clinical guidelines for the application of body composition metrics in menopausal care will be imperative. Additionally, integrating these metrics into electronic medical record systems to support tracking and clinical decision-making is also important. Clinics may customize screening guidelines to include quarterly, semiannual, or annual screenings, and adjust appointment times accordingly to accommodate screening and education requirements. Development of trauma-informed techniques are also encouraged to enhance provider language around body composition for patients with history of disordered

eating. Longitudinal patient evaluations are recommended to determine the sustained effects of body composition-guided interventions on clinical outcomes, including lean body mass, fat distribution, and cardiometabolic markers.

Conclusion

Implementing a standardized body composition screening protocol with patient education is feasible and well-accepted in menopause-focused care. Body composition assessment improves patient engagement. It also supports early identification of metabolic risk factors and promotes targeted lifestyle interventions. These findings support a shift toward prevention-focused, individualized care and empowers patients in combating the long-term risks of menopause.

Funding

No external funding was received for the implementation of this project.

Conflict of Interest

There are no conflicts of interest to disclose.

CHAPTER FOUR

ADVANCED NURSING ESSENTIALS REFLECTION

Introduction

Core competencies essential to the Doctorate of Nursing Practice (DNP) are outlined by the American Association of Colleges of Nursing (AACN). These competencies provide the framework for the Advanced Nurse Practitioner to remain grounded in their practice, reflect on expectations, and maintain the essence of nursing that unifies them in their approach to patient care. Throughout my experience at Montana State University, these competencies have kept the foundation of both my project and patient care on a steady path towards improving health outcomes for those I serve. It is with these essential practices of the AACN that I reflect on how my quality improvement initiative, culminating education, and clinical practice align with that of the expectations of the DNP program.

Essential II: Person-Centered Care

According to the AACN, Essential II emphasizes individualized patient care within complex contexts, advocating for holistic, respectful, and coordinated evidence-based practice that is developmentally appropriate (American Association of Colleges of Nursing, 2021). Throughout my doctoral education, I have consistently prioritized holistic care and recognized how individual complexities contribute to broader community health. In N614 – Vulnerability and Health Care in Diverse Communities, I evaluated social determinants of health relevant to rural southwest Montana, which enabled me to analyze healthcare disparities in local counties,

identify deficits, and raise awareness among my cohort. Comprehensive assessments of physical, cultural, economic, and resource-related determinants informed targeted strategies to reduce vulnerabilities and improve quality of life, including screening for substance abuse, firearms in the home, and mental health concerns such as depression or suicide. I further developed these skills in N605 – Evidence-Based Practice II, where I focused on the underserved population of menopausal women and investigated best practices for lifestyle interventions to improve health outcomes. This work directly inspired my Quality Improvement (QI) project, which aimed to promote lean body mass in postmenopausal women. The guiding principle of understanding the holistic, complex individual within their context shaped the project's objectives, which included enhancing patient education and comprehension amid the complexities of menopausal healthcare. I achieved this by conducting a rigorous scoping review of the literature, developing accessible patient education materials, individualizing care plans, and implementing targeted interventions to foster shared decision-making and improve access to comprehensive health metrics. Introducing body composition screening shifted the focus from weight-centric treatment to holistic metabolic health for menopausal women. As an Advanced Practice Registered Nurse (APRN), I intend to continue integrating these practices by routinely screening body composition, tailoring treatment objectives, and advocating for enhanced screening and discussions on metabolic health and disease prevention based on individual risk. Furthermore, I will provide inclusive referrals for my patients, including dietitians, behavioral health, physical therapy, and social work, to provide a team-based approach to meet their complex needs. For advocacy at a systematic level, I plan to disseminate my manuscript to various conferences to

share the literature review and project findings with other providers in an effort to promote more accessible and equitable healthcare.

Essential IV: Scholarship for the Nursing Discipline

Essential IV reiterates the importance of the generation, synthesis, translation, application, and dissemination of knowledge to improve the health care provided (American Association of Colleges of Nursing, 2021). During N612 – Ethics, Law, & Policy, I assessed the efficacy of a rural healthcare facility’s policy to ensure that protocols for blood product administration aligned with national guidelines while maintaining clinical feasibility and clear pathways for staff education. I translated these findings into an advocacy letter to the medical director, recommending workflow enhancements to support evidence-based practices, including patient blood bank identification band use and scanning compliance techniques. N604 and N605 – Evidence-Based Practice I and II were foundational in cultivating the concepts of Essential IV, through the review, critique, and dissemination of knowledge supportive of evidence-based practice and systems. Key teachings from N608 – Design of Healthcare Systems further reinforced the application of evidence to practice by informing strategies to optimize clinical environments, streamline provider workflows, and modify electronic medical records (EMRs) functionality for improved provider compliance. These competencies were integrated into my QI project through the critical appraisal of evidence, development of a theoretical framework, modifications of clinical workflow, synthesis of Plan-Do-Study-Act (PDSA) cycle data, and reflection for translation into clinical practice. In my future career, I will continue to emulate Essential IV by remaining up to date in evidence-based care through the routine consultation of current guidelines and literature, identifying care gaps in my own clinical practice and develop

QI initiatives to improve patient care, and I will disseminate knowledge to my care team to ensure standard guidelines are being supported on a systematic level throughout the practice.

Essential V: Quality and Safety

Essential V outlines the application of both foundational and emerging principles in safety and quality improvement, emphasizing the minimization of harm to patients and providers through systems and individual performance practices. In N602 – Advanced Pathophysiology, N603 – Advanced Pharmacology, as well as throughout my clinical practice in primary care clinics and specialty clinics, I have consistently practiced quality and safety for my patients through preventing medication errors and exercising medication safety, adhering to infection control measures, assessing for fall risks, implementing time-outs during procedures, utilizing SBAR for comprehensive reports, and promoting a culture of safety when asking questions and reporting errors. Through N609 – Advanced Nursing Leadership, I specifically examined the quality and safety measures of a rural medical center, creating a Collaborative Practice Initiative advocating the implementation of a Clinical Nurse Educator to establish a structured education program to prioritize staff education, policy review, and consistent skill development. Essential V was also key to the implementation of my QI project, as it promotes quality screening for postmenopausal patients while minimizing the harms of alternative options that may expose patients to radiation. As I progress into my career, I will continue to assess evidence-based safety protocols, receive up-to-date training on all procedures for the safety of my patients, investigate any adverse events for root-cause analysis and prevention, and keep a curious mind for how I can improve the systems around myself, my colleagues, and my practice.

Conclusion

These domains have provided a comprehensive foundation for the development of my clinical, scholarly, and leadership competencies as a doctorate-prepared APRN. Through the integration of not only Essential II, IV, and V, but all of the Essentials, I have centered my practice on the specific needs of my patients, evidence-based scholarship, and a commitment to ensuring safe, high-quality care. While my doctoral education and QI project have strengthened my ability to analyze and translate evidence into practice, adapt to complex clinical environments, and implement meaningful changes, I plan to further these skills as I advance into practice as an APRN through deeper understanding and commitment to my patients.

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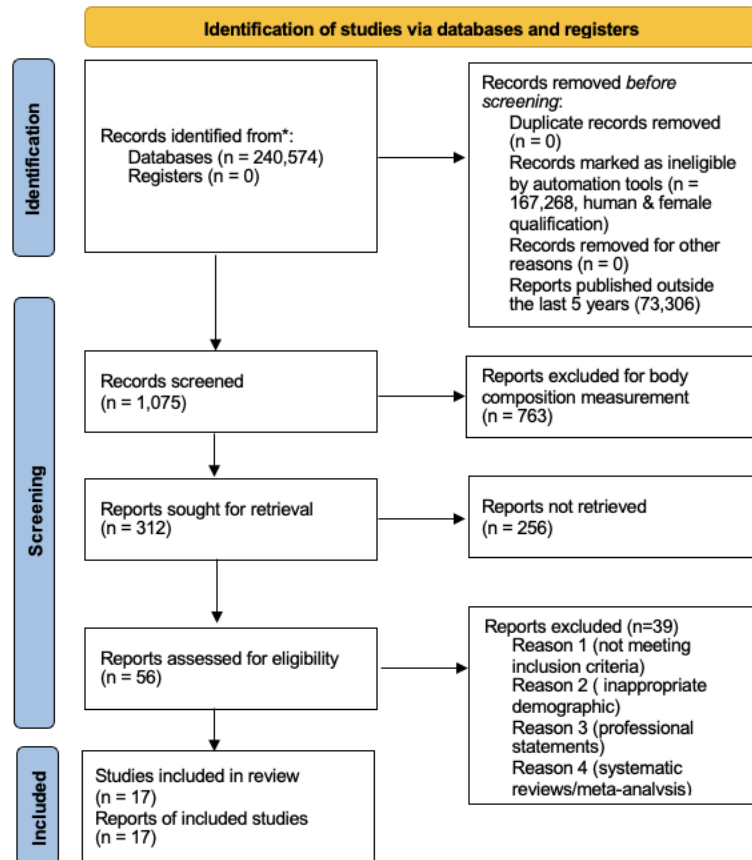
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APPENDICES

APPENDIX A

PRISMA FLOW DIAGRAM: SCOPING REVIEW

PRISMA 2020 flow diagram for new systematic reviews which included searches of databases and registers only



*Consider, if feasible to do so, reporting the number of records identified from each database or register searched (rather than the total number across all databases/register).

**If automation tools were used, indicate how many records were excluded by a human and how many were excluded by automation tools.

APPENDIX B

STANDARDIZED SCREENING EDUCATION FORM

COMPREHENSIVE BODY COMPOSITION SCREENING IN MENOPAUSE

What is the menopausal transition?

- Ovaries shut down hormone production, resulting in decrease of key reproductive hormones, including estrogen, progesterone and testosterone

What is the role of these hormones?

- Supporting metabolism, insulin sensitivity, healthy fat distribution, cardiovascular and cognitive health, and protection against certain cancers
- Lack of these hormones increase health risks including:
 - Heart disease, cancer, stroke, Alzheimer's, diabetes, hypertension, and more

What body composition changes are seen with Menopause?

- Increased subcutaneous fat (superficial fat pads, soft and fluffy fat)
- Increased visceral fat (high-risk fat located around the central organs)
- Decreased muscle mass

What are the long-term implications of these composition changes?

- Sarcopenic obesity (high fat with muscle wasting)
- Increased risk of heart disease, stroke, hypertension, Alzheimer's, diabetes
- Increased risk of hospitalization later in life
- Increased financial burden
- Decreased independence
- Increased risk of death

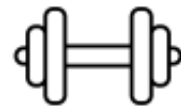
WHAT POSITIVE CHANGES CAN I START TO IMPROVE MY HEALTH?



Drink 100-120oz water
Goal: 1g protein / lb body weight
Limit processed foods



Sleep 8 hours per night
for adequate recovery



Strength train 3-5x
per week

APPENDIX C

CHARTING INCLUSIONS AND INCLUSIONS EXPANDED

Charting Inclusions

Vitals		
Weight (lbs)	Height (in)	BMI (lb/in ²)
<input type="text"/>	<input type="text"/>	<input type="text"/>

InBody Measurements	
Weight (lb):	
SMM (lb):	
PBF (%):	
VFM (Lv):	

Patient Education	
Was patient education regarding body composition provided? ▼	

Change in weight	
☐ Starting weight	<input type="text"/>
☐ Pounds lost	<input type="text"/>
☐ Goal weight	<input type="text"/>

Charting Inclusions – Expanded

Vitals		
Weight (lbs)	Height (in)	BMI (lb/in ²)
<input type="text"/>	<input type="text"/>	<input type="text"/>

InBody Measurements	
Weight (lb):	
SMM (lb):	
PBF (%):	
VFM (Lv):	

Patient Education	
<div> <div> ✓ Was patient education regarding body composition provided? </div> <div> Yes No Other (see clinical note) </div> </div>	

☐ Starting weight	<input type="text"/>
☐ Pounds lost	<input type="text"/>
☐ Goal weight	<input type="text"/>

APPENDIX D

INBODY 380 METRICS EXAMPLE REPORT

InBody

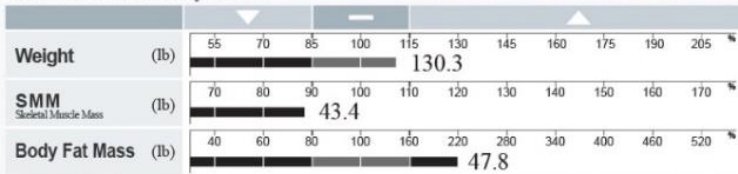
[InBody380]

SEE WHAT YOU'RE MADE OF

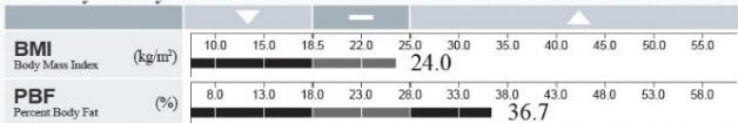
Body Composition Analysis

	Values	Total Body Water	Fat Free Mass	Weight
Intracellular Water (lb)	36.6	60.8 (59.5~72.8)	82.5 (80.9~98.8)	130.3 (99.2~134.0)
Extracellular Water (lb)	24.3			
Dry Lean Mass (lb)	21.6			
Body Fat Mass (lb)	47.8			

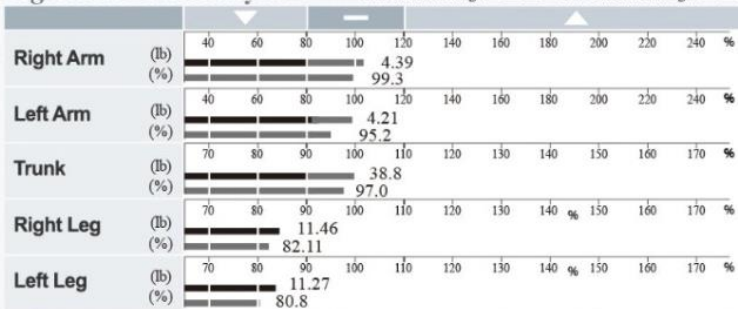
Muscle-Fat Analysis



Obesity Analysis



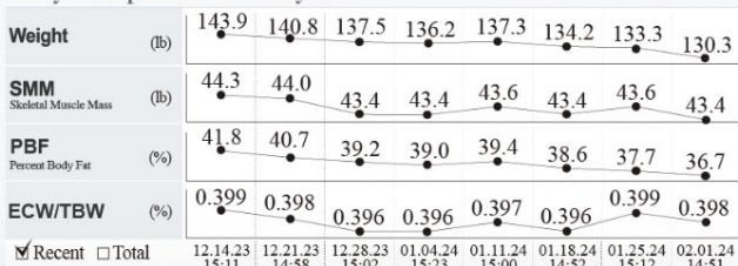
Segmental Lean Analysis



ECW/TBW-Phase Angle



Body Composition History



InBody Score

67

* Total score that reflects the evaluation of body composition.

SMI

5.6 kg/m²

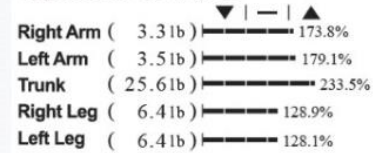
5.4	5.5	5.4	5.9	5.6
01.04.24 15:23	01.11.24 15:00	01.18.24 14:52	01.25.24 15:12	02.01.24 14:51

Body Fat - Fat Free Mass Control

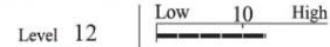
Body Fat Mass -20.9 lb
 Fat Free Mass +7.5 lb

(+) means to gain fat/lean (-) means to lose fat/lean

Segmental Fat Analysis



Visceral Fat Level



Basal Metabolic Rate



Research Parameters

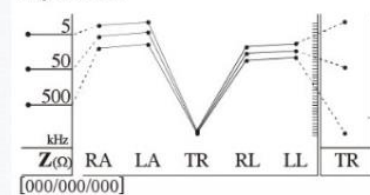
Fat Free Mass	82.0 lb	(80.9 ~ 98.8)
Arm Circumference	11.9 in	
FFMI	15.1 kg/m²	
FMI	18.9 kg/m²	
SMI	15.6 kg/m²	
SMM/WT	33.0 %	

Results Interpretation QR Code

Scan the QR Code to see results interpretation in more detail.



Impedance



APPENDIX E

PDSA CYCLE DATA COLLECTION FORM

[illegible]

APPENDIX F

GOAL EVALUATION: SMARTIE GOALS

SMARTIE Goal # 1		
Educate 100% of clinic staff on the significance of body composition in postmenopausal health within two days utilizing a 30 minute session to present data from Chapter One's Scoping Review with a concise reference sheet during first PDSA cycle		
Data to be collected:	Collection process:	Planned data analysis:
Education completion rate (%): Numerator: # of those completing education Denominator: # of staff members Target: 100%	Survey staff on completion of educational review	Intellectus Statistics: -central tendency and variability
SMARTIE Goal # 2		
Obtain a baseline MF-BIA scan on 100% of eligible patients in the weight loss and HRT programs across the six PDSA cycles		
Data to be collected:	Collection process:	Planned data analysis:
Baseline scan completion rate (%): Numerator: # of total eligible weight loss counseling and HRT patients scanned Denominator: # of total eligible weight loss counseling and HRT patients seen Target: 100%	Chart auditing on weekly basis by the clinic RN Data entry into data entry form	Intellectus Statistics: -central tendency and variability -weekly run charts
SMARTIE Goal # 3		
Provide each eligible patient with a personalized plan to improve lean body mass across the six PDSA cycles		
Data to be collected:	Collection process:	Planned data analysis:
Baseline scan completion rate (%): Numerator: # of total eligible weight loss counseling and HRT patients educated Denominator: # of total eligible weight loss counseling and HRT patients seen Target: 100%	Chart auditing on weekly basis by the clinic RN Data entry into data entry form	Intellectus Statistics: -central tendency and variability -weekly run charts
SMARTIE Goal # 4		

Administer an automated survey question via text or email through EMR notifications to each weight loss and HRT patient seen, using a Likert scale from 1 to 10 to assess satisfaction of education received, achieving an average patient satisfaction rate of $\geq 80\%$ across the six PDSA cycles		
Data to be collected:	Collection process:	Planned data analysis:
Patient satisfaction (%): Numerator: Likert rating from 1 to 10 for satisfaction Denominator: Maximum rating possible (10) Target: $\geq 80\%$	Chart auditing on weekly basis by the clinic PCC Data entry into data entry form	Intellectus Statistics: -central tendency and variability -weekly run charts
SMARTIE Goal # 5		
Ensure a 98% rebooking rate for follow-up visits across the six PDSA cycles		
Data to be collected:	Collection process:	Planned data analysis:
Rebooking rate (%): Numerator: # of total eligible weight loss counseling and HRT patients rebooked Denominator: # of total eligible weight loss counseling and HRT patients seen Target: 98%	Chart auditing on weekly basis by the clinic PCC Data entry into data entry form	Intellectus Statistics: Central tendency and variability Paired t-test for pre-implementation comparison