BMI and Waist Circumference for Increased Overweight and Obesity Diagnosis

Krystal M. Scarbrough

University of Missouri Kansas City

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Abstract

Overweight and obesity rates in the United States are reaching epidemic proportions and is a greater reality to rural communities. The purpose of this quasi-experimental, quality improvement project was to increase rates of accurate overweight and obesity diagnoses and documentation by implementing evidence-based guidelines in weight screening practices using body mass index and waist circumference. The setting for this project was a rural Missouri primary care clinic and the participants consisted of 104 adult patients at their annual wellness visits. The intervention included the provision of educational resources to clinic staff and patients, as well as implementation of standardized weight screening, using body mass index and waist circumference. The results indicated an increase in the documentation of overweight and obesity diagnoses, which was clinically significant. Despite the marginal success of the project, evidence-based weight screening fosters improvement in the health of adults in rural Missouri.

Keywords: obesity, overweight, BMI, waist circumference, rural, guidelines, Missouri, weight

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Obesity is the second leading cause of premature death in the United States and a leading cause of morbidity, disability, healthcare utilization, and rising healthcare costs (Glauser, Roepke, Stevenin, Dubois, & Ahn, 2015). From 2015-2016, the prevalence of obesity in the United States was approximately 39.8% and affected over 90 million adults, costing the obese adult over $1,400 more in health care expenditures annually when compared to adults of normal weight (Centers for Disease Control and Prevention [CDC], 2019). Being overweight or obese carries significant risks to health, including the development of cardiovascular disease (CVD), stroke, high blood pressure, high cholesterol, diabetes, metabolic syndrome, gallbladder disease, sleep disorders, and certain cancers (McTigue et al., 2003; National Heart, Blood, Lung Institute [NHBLI], 2013).

Despite obesity reaching epidemic proportions, a discrepancy remains between actual obesity rates and corresponding electronic medical record (EMR) documentation (Aleem, Lasky, Brooks, & Batsis, 2015). Several approaches exist to screen for overweight or obesity including body mass index (BMI), waist circumference (WC), waist-to-height ratio (WHR), and skinfold thickness. Evidence synthesis demonstrates the easiest-to-use and most accurate screening test for obesity is BMI but noted that WC and WHR are more closely correlated to visceral adiposity (McTigue et al., 2003), which independently increases morbidity risk, specifically cardiovascular risks (Amirabdollahian et al., 2018; Shuster et al., 2012). *Healthy People 2020* supports the attainment of overall health and reduction of chronic disease risk through goals promoting a diet rich in healthy foods and maintenance of healthy body weight, as well as improved fitness and quality of life through daily physical activity (Office of Disease Prevention and Health Promotion [ODPHP], 2019). By increasing adherence to published guidelines for weight

management (WM), primary care providers (PCPs) are in a position to increase rural patients' overall health and wellness and decrease health care expenditures.

Local Issue

Nearly two out of every three Missourians are considered overweight or obese (Missouri Department of Health & Senior Services [DHSS], n.d.). In Missouri, the leading cause of mortality for rural and urban residents is CVD, with the rural rate significantly higher than the urban rate (225.4 per 100,000 residents and 193.5 per 100,000 residents, respectively) and more than double the target rate set by the *Healthy People 2020* (MDHSS, n.d.).

Diversity Considerations

When providing WM within the rural Missouri primary care setting, it is essential to consider the role that geographic location and culture has on the patient population. The setting for this evidence-based practice (EBP) project was a rural Missouri primary care clinic located in a county where 34% of adults are obese (County Health Rankings, 2019). Racial and ethnic demographics demonstrate that the population consists of greater than 95% Caucasian residents, 1.8% Hispanic, 0.4% African American, 0.2% Asian, and 1.8% mixed ethnicity (U.S. Census Bureau, 2018). The current project incorporated barriers that providers and patients experience when screening and treating overweight and obesity in the rural primary care setting. These barriers include knowledge deficits, lower sociodemographic status, inadequate access to healthy foods and built environments for physical activity, and the lack of accurate and timely diagnosis and documentation of overweight and obesity.

Problem & Purpose

Problem Statement

The problem is inadequate screening and diagnosis of weight status in the primary care setting, negatively impacting rural Missourians by serving as an adjunct to the provision of inadequate WM services.

Intended Improvement with Purpose

The purpose of this project was to increase rates of obesity screening by implementing evidence-based screening methods using BMI and WC as recommended in practice guidelines provided by the American Heart Association, the American College of Cardiology, and The Obesity Society (AHA/ACC/TOS), as well as the American Association of Clinical Endocrinologists and American College of Endocrinology (AACE/ACE), the Endocrine Society Task Force, and the Society of Behavioral Medicine. The intended improvement of this project was higher rates of accurate overweight and obesity diagnoses as documented in the EMR and identification of cardiometabolic risk factors, specifically visceral adiposity.

Facilitators & Barriers

Several facilitators of the project were present during implementation, including clinic staff participation and the relatively low associated costs. The clinical staff were considered facilitators due to the personalized nature of their professional relationships with the rural patients. The clinical staff gathered the anthropometric data from the patients, and staff attitudes and overall impressions conveyed had the potential to help or hinder with the project intervention success. The low cost associated with the project was also a facilitator. The overall cost of this project was minimal, not exceeding $50.00, and consisted of five measuring tapes, a clinic stadiometer, and a scale. Additionally, a major facilitator was the existence of EBP guidelines in the WM of adults. Potential barriers to this project included the provider and staff perceptions of offending the patient when gathering data, staff resistance to change, and the perceived clinical

time of follow-up visits that included goal-setting, behavioral counseling, problem-resolution, and weight-monitoring.

Review of Evidence

Inquiry

In the rural adult population, does screening for obesity using BMI and WC during annual wellness visits, compared to screening with weight or BMI alone, increase accuracy of overweight or obesity diagnoses and documentation over six months within a Missouri primary care clinic?

Search Strategies

A comprehensive literature search was performed using the PubMed database, and additional literature was obtained via EBSCOhost database through the University of Missouri, Kansas City (UMKC) Health Sciences Library. Keywords used for this search were *obesity*, *waist circumference, BMI, screening, primary care, management, rural, barriers, guidelines,* and *adult*. The PubMed search yielded 26 publications, and the EBSCOhost search and review of similar articles yielded 340. Studies, articles, and EBP guidelines that included the following criteria were considered for data synthesis: adult population age 18 years or older, primary care or community health settings, conducted within the United States or other industrialized and medically-advanced nations, publication within the last 10 years, English language, and full-text. Research involving patients under 18 years of age, pregnant, acute care settings, and specific cardiovascular risk screening tools such as the Framingham or Reynolds Risk Score were excluded from data synthesis. After application of criteria, a total of 31 studies were identified: four EBP guidelines, two Level I systematic review (SR) of randomized control trials (RCT) and non-randomized trials, two Level II single RCTs, two Level III single non-randomized

experimental research or SR of observational studies, 11 Level IV observational studies, two Level V SR of qualitative studies, and eight Level VI descriptive studies (see Appendix A).

Evidence by Themes

After appraisal of the studies, several themes were identified within the literature. These themes included (a) discrepancies between provider attitudes regarding WM and actual rates of supporting documentation within the EMR, (b) barriers to screening and providing weight-loss interventions in rural primary care settings, and (c) interventions to improve practice including evidence-based WM guidelines (see Appendix B).

Diagnosis Discrepancy

A significant predictor of WM counseling, including diet and lifestyle recommendations, is the receipt of an obesity diagnosis (Bleich, Pickett-Blakely, & Cooper, 2011). The U.S. Preventative Services Task Force (n.d.) recommends providers screen all patients for obesity and offer or refer patients with a BMI $\geq$ 30 kg/m^2 to intensive, multicomponent behavioral interventions. This recommendation aligns with evidence-based guidelines involving the assessment of overweight and obesity using BMI and WC, and management via weight-loss counseling with or without the use of pharmacologic and/or surgical adjuncts within the clinical setting (Garvey et al., 2016; Jensen et al., 2014; McTigue et al., 2003). Despite these recommendations, diagnosis and management of overweight and obese patients are suboptimal, demonstrating consistently low rates of accurate and timely diagnosis and weight-reduction counseling offered (Befort et al., 2016; Bleich et al., 2011; Glauser et al., 2015; Granara & Laurent, 2017; Post et al., 2011; and Woodruff et al., 2016). It is estimated that PCPs, in particular, often fail at diagnosing obesity. Aleem, Lasky, Brooks, and Batsis (2015) found that only 27% of patients meeting criteria for obesity had EMR documentation supporting the

diagnosis, and Befort et al. (2016) reported only 20% to 40% of obese patients were offered weight-loss counseling by their PCP. Furthermore, surveys provided to overweight or obese patients at four Federally Qualified Health Centers located in rural southwestern Georgia validated that their provider told only 45.2% that they were overweight or obese (Woodruff, Schauer, Addison, Gehlot, & Kegler, 2016). These findings mirror data collected from the 2005-2008 National Health and Nutrition Examination Survey (NHANES), revealing only 45% and 66% of patients meeting criteria for overweight and obesity reported ever having their weight status addressed by their PCP (Post et al., 2011). Despite guideline recommendations for WM via frequent monitoring using BMI and other anthropometric measures including WC, Ghosh et al. (2015) noted that only 30.9% of patients throughout seventeen primary care clinics over two years had a height and weight documented in their EMR for calculation of BMI and only 8% had documentation of a WC measurement. Over one-third of primary care patients are obese (Glauser, Roepke, Stevenin, Dubois, & Ahn, 2015), which highlights the importance of accurate diagnosis and supporting documentation.

Barriers in Rural Primary Care

The prevalence of obesity in the United States is notably higher in rural communities when compared to urban counterparts (Cohen et al., 2017; Trivedi et al., 2015). When providing WM in the primary care setting, a trade-off exists between the intensity of the services and the effectiveness of the intervention (Garies, Irving, Williamson, & Drummond, 2015). Rural populations, regardless of age or wealth, demonstrate higher morbidity rates, poorer mortality, and less access to high-quality care when compared to urban populations (Anderson et al., 2015; Cohen et al., 2017). Addressing WM within rural primary care clinics is multifaceted and can be difficult for the PCP to establish a management plan. Weight management includes the

documentation of the overweight or obesity diagnosis, discussion of associated risk factors, behavioral counseling, lifestyle interventions such as diet and exercise, and recommendations for adjunctive pharmacological or bariatric therapies (Granara & Laurent, 2017). Behavioral counseling can include goal setting, self-monitoring of energy intake and expenditures, regular self-weighing, reinforcement, and incentives (Roberts, Standage, Olaoye, & Smith, 2015). This intense behavioral counseling can require frequent follow-up visits and is considered time-consuming in the presence of an already strained primary healthcare system. Primary care providers perceive many barriers to providing WM including time constraints, inadequate compensation, and lack of training and self-efficacy in weight-loss counseling or general lifestyle management (Epling et al., 2011; Roberts et al., 2015; Woodruff et al., 2016; Wynn et al., 2010). Glauser et al. (2015) identified a gap between provider attitudes surrounding obesity and their understanding of obesity pathophysiology, as well as their limited familiarity with published evidence-based WM guidelines. Inadequate resources and referral options present another barrier to obesity management in primary care (Epling, Morley, & Ploutz-Snyder, 2011).

Negative Stereotypes. Provider attitudes regarding their obese patients and the perceived patient barriers to WM are factors in the care provision of services. The negative characterization of obese patients include providers' perceptions that obese patients lack motivation, discipline, and knowledge required to make changes necessary for a healthier lifestyle (Epling et al., 2011; Nemeth et al., 2018; Teixeira et al., 2012; Woodruff et al., 2016), and providers were less sympathetic toward their obese patients and less optimistic that these patients would follow proper diet and exercise recommendations (Menez et al., 2013; Nemeth et al. 2018).

Confounds of Obesity. Providers describe many factors they perceive to be outside of their control when addressing WM with their overweight or obese patients. Factors such as poverty and limited economic resources, lower levels of education and literacy, and poorer access to healthcare, healthy foods, and an environment conducive to physical activity are perceived barriers to care of obese patients (Roberts et al., 2015; Wolters et al., 2016; Woodruff et al., 2016), and these perceptions are particularly prevalent in rural communities. Individuals living in U.S. counties with a robust supply of PCPs were 20% less likely to be obese than those living in counties where the PCP supply is poor (Gaglioti et al., 2016). Currently, Missouri has 210 Health Professional Shortage Areas for primary medical care (Missouri DHSS, 2015). Transportation and length of distances to providers are challenges faced by many rural residents in accessing health care. These factors are further exacerbated by the overall lack of primary care and specialty providers in their communities (Batsis et al., 2017).

In general, obesity prevalence increases when per-capita income decreases (Cohen et al., 2017). Providers note the effect that scarce economic resources have on patients' abilities to access healthy weight-promoting resources and services (Woodruff et al., 2016). Rural communities have limited access to healthier food options, which are more expensive, and have increased availability of cheaper, unhealthy convenience store foods and fast food restaurants (Trivedi et al., 2015; Wolters et al., 2016; Woodruff et al., 2016). One study measuring sedentary behavior, physical activity levels, and dietary intake among obese adults within rural and urban settings noted that rural residents were more likely to report no physical activity and less leisure-time physical activity, daily screen times in excess of four hours a day, skipping breakfast, higher consumption of sweetened beverages, and lower intake of fruit and foods high in fiber (Trivedi, Probst, Merchant, Jones, & Martin, 2015). With the built environment of rural

communities displaying limited facilities for physical activity such as gyms, parks, recreational centers, and sidewalks, rural residents on average spend less than the recommended time engaging in physical activity. Limited education and literacy levels also compound the obesity epidemic. When WM education is complex and time-consuming, low literacy levels further complicate the provider's ability to deliver counseling and the patient's ability to understand effectively (Woodruff et al., 2016). In addition, cultural and social differences play a role in WM services, and cultural norms surrounding weight can be seen in the idea that *skinny babies* are sick and *chubby babies* are healthy (Nemeth et al., 2018; Woodruff et al., 2016), and in the concept of *southern* or *country* cooking.

Provider Non-adherence. Another factor in the non-adherence of WM services includes provider perspectives involving safety and efficacy of weight-loss medications and surgical interventions. A systematic review of RCTs, collectively named the POWER trials, demonstrated that adding weight-loss medication to lifestyle counseling increases participant weight-loss, compared to counseling alone (Wadden et al., 2013). Despite the pharmacotherapy role in managing overweight and obesity, a study by Granara and Laurent (2017) demonstrated 60% of surveyed PCPs reported not prescribing weight-loss medications for short-term weight-loss therapy, and 58% of PCPs described a *negative* or *very negative* impression of weight-loss pharmacotherapy. Another study by Glauser et al. (2015) noted that only 42% of surveyed PCPs felt current obesity medications were safe, and only 39% felt they were effective.

Improving Practice

Several published evidence-based guidelines exist on addressing obesity within the primary care setting. These guidelines support the use of BMI and WC when assessing the overweight or obese patient, and encompass lifestyle, pharmacologic, and surgical interventions

for weight-loss and weight-loss maintenance (Apovian et al., 2015; Fitzpatrick et al., 2016; Garvey et al., 2016; Jensen et al., 2014). Identification of patients in need of WM services begins with screening all patients using height and weight to calculate BMI. A BMI of 25.0 to 29.9 kg/m² is classified as overweight, and a BMI $\geq$ 30 kg/m² is considered obese (Apovian et al., 2015; Fitzpatrick et al., 2016; Garvey et al., 2016; and Jensen et al., 2014). Another tool used in measuring overweight and obesity is WC, and in most ethnicities a measurement of > 40 inches (101cm) in men and >35 inches (88cm) in women is associated with increased risk of developing CVD (Fitzpatrick et al., 2016; Garvey et al., 2016; and Jensen et al., 2014). Anthropometrics such as WC measure visceral adiposity and are superior to measures of general obesity such as BMI, in discerning cardiometabolic risk factors (Amirabdollahian et al., 2018; Garvey et al., 2016; Jensen et al., 2014; Recio-Rodriguez et al., 2012; and Shi et al., 2017) and are successful in targeting overweight and obese patients at increased cardiovascular risk when used as a weight screening tool in the primary care setting (Fitzpatrick et al., 2016; Garvey et al., 2016; Jensen et al., 2014; and Korhonen, Jarvenpaa, & Kautiainen, 2014).

AHA/ACC/TOS. A task force comprised of expert panel members from the AHA, ACC, and TOS published an updated summary on the recommendations for WM, titled the *2013 AHA/ACC/TOS Guideline for the Management of Overweight and Obesity in Adults*. These guidelines provide strong evidence for WM and consist of practice recommendations addressing five specific areas involved in clinical decision-making when managing overweight and obese patients: (a) identifying patients who need to lose weight by screening practices including BMI and WC, (b) matching treatment benefits with risk profiles, (c) prescribing diets for weight-loss, and (d) counseling on comprehensive lifestyle interventions using the 5 As framework [**A**ssess,

Advise, **A**gree, **A**ssist, and **A**rrange], and (e) selecting patients for bariatric surgical treatment of their obesity (Jensen et al., 2014).

AACE/ACE. In 2016, the AACE/ACE published a standardized set of protocols named *The American Association of Clinical Endocrinologists and American College of Endocrinology Comprehensive Clinical Practice Guidelines for Medical Care of Patients with Obesity*. These guidelines stem from nine clinical questions and provide the core recommendations for care of all patients with overweight and obesity including screening using BMI and WC, diagnosis, evaluation, selection of goals and treatments, and individualization of care (Garvey et al., 2016).

The Endocrine Society Task Force. Experts from the Endocrine Society, the European Society of Endocrinology, and The Obesity Society reviewed the evidence on obesity pharmacotherapy and developed a set of clinical guidelines regarding medications used to treat obesity. These guidelines titled, *Pharmacological Management of Obesity: An Endocrine Society Clinical Practice Guideline,* adhere to the AHA/ACC/TOS recommendations for weight assessment using BMI and WC, while promoting the use of lifestyle and behavioral modifications and guiding providers on the use of weight-loss medications to ameliorate comorbidities and amplify patient adherence (Apovian et al., 2015).

The Society of Behavioral Medicine. The clinical practice guidelines provided by the Society of Behavioral Medicine titled, *An Evidence-based Guide for Obesity Treatment in Primary Care,* utilizes the 5 As counseling framework for WM in the primary care setting. This framework consists of (a) *assessing* BMI, WC, patient characteristics and comorbidities associated with poor weight-loss outcomes, and their readiness to change, (b) *advising* the patient about health risks associated with their current weight and the health benefits of modest weight-loss, (c) *agreeing* on goals that are specific, measurable, attainable, relevant, and time-

based [SMART], (d) *assisting* the patient in identifying barriers to achieving their goals and developing a plan to overcome these barriers, and (e) *arranging* regular follow-up visits to increase patient accountability (Fitzpatrick et al., 2016). Intensive behavioral therapy using the 5 As framework has produced significant weight losses across clinical trials, and reduced patients' risk of developing diabetes and CVD (Fitzpatrick et al., 2016).

Theory

Health Promotion Model

Nola Pender's Health Promotion Model (HPM) is appropriate in guiding the project, specifically the assessment and management of obesity. The HPM describes the multidimensional nature of persons as they interact with their interpersonal and physical environments in their pursuit of health (Butts & Rich, 2018). A critical step in overweight and obesity management is assessing the individual's readiness in making lifestyle changes to achieve a healthy weight, as well as identifying barriers to their weight-loss (see Appendix C). The WM guidelines provided by the AHA/ACC/TAS and the Society of Behavioral Medicine include this step for health promotion which addresses the clinician and patient collectively assessing whether the patient is prepared and ready to change their behavior to support weight-loss (Fitzpatrick et al., 2016; Jensen et al., 2014). If the patient is not dedicated to making positive changes, then weight-loss counseling attempts will likely be unsuccessful (Jensen et al., 2014).

Methods

IRB Approval, Site Approval, Ethical Issues

The project was considered evidence-based quality improvement (QI) and classified as non-human subject research by the University of Missouri, Kansas City Institutional Review

Board. The project team leader adhered to the nursing professional standards, and the ethical principles of autonomy, beneficence, and justice were ingrained in all aspects of the project (see Appendices D & E).

Data were obtained from the patients' EMR, and the concepts of confidentiality and privacy were upheld throughout the project. All provisions and standards of HIPAA were upheld for the protection of individually identifiable health information. Patients were provided with a HIPAA privacy notice upon their first appointment with the clinic.

Funding

Due to the low cost to implement this project, no external sources of funding were utilized. Expenses included costs associated with printing the educational materials and purchasing five 80-inch measuring tapes, which was less than $50 (see Appendix F).

Setting & Participants

Inclusion criteria for this project were adults age 18 years and older and BMI ≥ 25 kg/m^2 with or without an ICD 10 code consistent with overweight or obesity. Exclusion criteria included younger than 18 years of age and BMI ≤ 24.9 kg/m^2. The project team leader used convenience sampling to screen patients presenting for annual wellness visits, and data collection occurred via record extraction from the EMR. The sample size for this project was 104 adult patients. Additional project members included one family nurse practitioner (FNP) with over four years of clinical experience and one licensed practical nurse (LPN) with over 10 years of clinical experience. The project setting was a primary care clinic located in rural Missouri.

EBP Intervention

The first phase of the project intervention included organization and provision of educational materials for clinic staff to assist in accurate weight screening (see Appendix G).

The educational handout included patient resources simplifying BMI and WC as risk factors for increased morbidity and mortality, tips for setting weight-loss goals, and recommendations for cutting calories and increasing physical activity. This handout, provided by the National Institutes of Health (NIH), was intended to foster open communication between the provider and patient regarding weight status and management. Additionally, an easy-to-read infographic provided by the American College of Cardiology was displayed in each examination room. The infographic provided details on metabolic syndrome and the role that increased BMI, WC, blood pressure, lipids, and blood glucose have in the development of CVD.

Retrospective data collection occurred from June 2019 to August 2019 and included age, sex, height, weight, calculated BMI, WC if measured, presence of comorbidities increasing cardiovascular risk (hypertension, lipid disorder, and type 2 diabetes mellitus or pre-diabetes), and ICD 10 code consistent with obesity if applicable and documented by provider. Intervention implementation took place from September 2019 to February 2020 and consisted of the LPN measuring the WC, in addition to the height and weight for BMI calculation, during the intake portion of the visit (see Appendix H). Post-intervention data collection included sex, height, weight, BMI, WC, presence of the documented comorbidities, and ICD 10 overweight and obesity codes.

Change Process & EBP Model

The change model utilized in this evidence-based QI project was the Transtheoretical Model of Health Behavior Change. This change model was chosen due to its applicability in promoting system change while decreasing resistance, stress, and time needed (Melnyk & Fineout-Overholt, 2019). The EBP model used in this project was The Iowa Model. The Iowa Model was chosen because this project team leader wishes to emphasize the national initiative

constructed by *Healthy People 2020* regarding the achievement and maintenance of a healthy weight, as well as highlight recommendations from the U.S. Preventative Services Task Force for primary care services. The Iowa Model is easy to understand and uses concepts from QI and research utilization (Gawlinski & Rutledge, 2008).

Study Design

The evidence-based project used a quasi-experimental QI design, pretest-posttest, two groups. The QI project compared data from the pre-intervention group where weight screening was performed using height, weight, and calculated BMI, and the post-intervention group that received weight screening using BMI and WC, as well as PCP documentation reinforcement (see Appendix I).

Validity

The QI project possessed several aspects which promoted internal and external validity. Internal validity was enhanced by utilizing the sample size of 104. Because the measurements of height, weight, and BMI do not differ in their definition or calculation, the threat to instrumentation validity is low. A potential threat existed in the differing methods for measuring WC and was reduced by utilizing a standardized method of measuring midway between the lower margin of the rib cage and top of the iliac crest for each patient. Furthermore, the ICD 10 diagnoses are specific for overweight, obesity, and morbid obesity, thus adding to the internal validity of this project. The threat to external validity was high in this study because the setting is located only in a rural primary care clinic, so there could be an interaction between causal effects and treatment variations in obesity screening and management. The intervention is transferable to various types of clinics and offices, including primary care or specialty care.

Outcomes

The primary outcome was to increase rates of accurate and timely overweight and obesity diagnoses and documentation in the EMR. The primary outcome aligned with the guidelines provided by the AHA/ACC/TOS, AACE/ACE, the Endocrine Society, and the Society of Behavioral Medicine in the screening and management of the overweight or obese patient. The secondary outcome was to standardize assessment and diagnosis of overweight and obesity in the rural primary care clinic by supporting current EBP standards of care utilizing WC in weight screening (see Appendix J).

Measurement Instruments

Measurements for this QI project included the patient's height, weight, BMI calculation, and WC. The height and weight were gathered from the patient at the point of care and did not require the use of a dedicated screening instrument. The BMI was calculated by dividing the patient's weight in kilograms by their height in meters squared. An electronic BMI calculator was used in this project. A BMI of $\geq$ 30 kg/m² has a high specificity of 95% in men and 99% in women in detecting body fat percentage obesity, but a low sensitivity of 36% and 49%, missing more than half of people who could classify as obese (Romero-Corral et al., 2008), leading to decreased validity when used as a weight screening method in the primary care setting. Despite BMI weaknesses, BMI estimation is a gold standard for overweight and obesity assessment methods, partly due to the overall simplicity and ease of use.

To better estimate the weight-related risks to rural primary care patients, the measurement of WC was added during the screening process for patients with a BMI $\geq$ 25 kg/m². Waist circumference measured at the midpoint between the lower margin of the rib cage and upper margin of the iliac crest was found to be a more accurate measure of visceral fat than other methods of measuring WC, including measurements at just the level of the iliac crest, below the

lowest rib, at the narrowest point between the lower costal border and the top of the iliac crest, and at the level of the umbilicus (Shi, Neubeck, & Gallagher, 2017).

This method of measuring WC midway between the lower margin of the rib care and upper margin of the iliac crest was found to have a higher Area Under the Curve (AUC) in both sexes (0.87 in males and 0.86 in females), with the highest sensitivity and specificity (80% and 82%, p =.003) in females (Ma et al., 2013).

Quality of Data

Assuming normal distribution, with a 95% confidence interval, alpha of .05, and a margin of error at 10%, the sample size for this study was determined by *a priori* power analysis to be at least 60 people for statistical significance and reduce threats to internal validity. Body mass index calculation and WC measurements were obtained during point-of-care service completed by the clinic nurse during the intake portion of the clinical visit. The educational resources used for provider and patient distribution are published by the NHLBI of the NIH, and the ACC and are in the public domain and free to use and distribute barring no changes are made to the content.

Statistical Analysis

Descriptive statistics were used to describe the sample (age, gender, height, weight, BMI, WC, selected comorbidities, and weight-specific ICD 10 codes) (see Appendix K). Chi-square analysis was used to determine if a relationship exists between the addition of WC in obesity screening and EMR documentation of overweight or obesity. Statistical analyses were conducted using the Statistical Software Package for Social Sciences version 26.

Results

Intervention

Analyses focused on the addition of a WC measurement during annual wellness visits and EMR documentation supporting an appropriate diagnosis of overweight or obesity. Data were collected on 46 adult wellness visits prior to the intervention of weight screening using BMI and WC, and 58 visits post-intervention (N = 104). In the pre-intervention group, 76.1% of patients (n = 35) had a BMI consistent with overweight or obesity, and of these, only 2.9% (n = 1) had EMR documentation of the ICD 10 code indicating their overweight or obese weight. In the post-intervention group, 82.8% of patients (n = 48) had a BMI consistent with overweight or obesity and 75% (n = 36, p = .001) had a WC indicating visceral adiposity, but only 8.3% (n = 4) had EMR documentation of the corresponding ICD 10 code indicating their overweight or obesity status.

Outcome Data

The results indicated an increase in documentation of overweight and obesity diagnoses which was clinically significant, although Pearson chi-square analysis indicated no statistically significant relationship in the addition of a WC measurement and EMR documentation of weight status (χ^2 = 2.176, df = 2, N = 104, p = .337). Additionally, among all overweight or obese patients from both groups, 36.1% (n = 30) were diagnosed with all three comorbidities (hypertension, lipid disorder, and type 2 diabetes mellitus or pre-diabetes), indicating a statistically significant relationship (p = .018) between excessive weight and the presence of comorbidities increasing their cardiovascular risk (see Appendix L).

Discussion

Successes & Strengths

The most important success of this QI project was identification of increased rates of concomitant cardiovascular disease risk factors among the overweight and obese adults cared for

at one primary care clinic in rural Missouri. When PCPs are able to assess all risk factors affecting overweight or obese patients, it lends not only to improved WM but ultimately holistic patient care provision. Implementation of this QI project was strengthened by the continued support from the clinic staff, namely the participating nurse practitioner and LPN. Their dedication to the success of this project was evidenced by their enthusiasm and willingness to obtain WC measurements and provide education during the project implementation phase.

Comparison to Evidence

The results of this QI project are similar to those found in the literature demonstrating a disparity between rates of obesity and documentation supporting the diagnosis (Aleem et al., 2015; Bleich et al., 2011; Ghosh, 2016). These results also mirrored evidence demonstrating higher cholesterol, blood glucose, and blood pressure in individuals with visceral adiposity (Despres, 2001; Gruzdeva et al., 2018)

Limitations

Threats to Validity

A threat to the internal validity of this evidence-based QI project is that of selection bias and temporal ambiguity because the pre- and post-intervention groups could possess pre-existing differences making it difficult to infer any causal relationship between the addition of WC measurements and the accuracy of weight status documentation. Additionally, the threat to external validity exists in the rurality of the primary care clinic utilized and that documentation of only one provider was reviewed for this project. These threats were reduced by utilizing a large sample size of 104 patients and a standardized method for obtaining the WC.

Sustainability, Efforts to Minimize Limitations

The potential for any modest increase in overweight and obesity diagnosis and documentation to weaken over time is high, as the project team leader found it challenging to engage the clinic LPN to consistently obtain WC measurements during adult annual wellness visits. To maintain this EBP, the project team leader purchased measuring tapes for the clinic to keep upon completion of the project and placed laminated educational materials throughout the clinic for continued reinforcement of the importance in thorough weight screening measures including a WC. In the future, the project team leader must remain motivated and attentive to the QI intervention practices, as well as keep current with data extraction, to increase the effectiveness of the change intervention.

Interpretation

Outcomes

The primary outcome of this project was to increase the rate at which accurate and timely overweight and obesity diagnoses are documented within the EMR. This outcome was partially met by the noted increase in weight status documentation, albeit small, after adding WC measurements during weight screening at adult annual wellness visits. The education provided to patients and clinic staff serves as a success in the initiative to improve the health of rural residents, and the clinic staff's willingness to support and engage in this QI project demonstrates a potential strength is its continued provision. The results of this QI project are similar to those found in the literature indicating low rates of diagnosis, documentation, and subsequent management of the overweight or obese patient.

Inferences

The receipt of a weight-specific diagnosis plays a pivotal role in managing the overweight or obese patient, yet evidence demonstrates consistently low rates of accurate

diagnoses and documentation within EMRs (Befort et al., 2016; Bleich et al., 2011; Glausier et al., 2015; Granara & Laurent, 2017; and Post et al., 2017). Leaders in cardiovascular and metabolic care published EBP guidelines to assist clinicians in caring for their overweight and obese patients, and these guidelines emphasize the importance of weight screening using BMI and WC measurements to better identify cardiovascular risk (Fitzpatrick et al., 2016; Garvey et al, 2016; Jensen et al., 2014). Despite evidence highlighting the necessity for accurate weight-screening methods and EMR documentation of patients' overweight or obese status, achievement of these recommendations is suboptimal.

Revision

One suggested modification to this QI project to improve identification of cardiometabolic risk factors and rates of documentation would be to better tailor the educational resources to the providers as well as the patients. During the implementation phase of this project, the project team leader focused education more towards the patients, perhaps as a means of decreasing patient anxiety and unease with having their WC measured. In the future, education reviewing the pathology of visceral adiposity could be beneficial to providers.

Impact to Health System

By using BMI alone when assessing weight status, providers are vulnerable to missing the cardiometabolic risks associated with visceral adiposity, as these can be still present in patients with healthy BMIs. Measuring WC during preventative visits is a simple and low-cost means of better assessing these risks. Additionally, by documenting BMI, WC, and weight-specific diagnoses in EMRs, providers and health systems are provided an opportunity to improve the monitoring of their community's health and intervention impact.

Conclusion

Practical Usefulness & Further Study

The evidence reviewed for this project indicated the need for a more thorough assessment of patients' weight status as the forerunner to accurate overweight and obesity diagnoses within the EMR. By implementing evidence-based guidelines supporting the practice of measuring patient's WC during weight screening, PCPs are better equipped to counsel on obesity and its comorbidities in an effort to more effectively and holistically treat their patients. This is especially applicable in Missouri's rural communities, where health status is poor and access to care is limited. This study can lead to more research in the area of obesity management within the primary care setting, but remains successful in the continued efforts of improving health care delivery in rural America.

Dissemination

Dissemination of this QI project proposal took place November 7-9, 2019, at the Advanced Practice Nurses of the Ozarks *Caring Cradle to Grave* conference held in Branson, Missouri. It was presented via a poster session attended by Dr. Angie Golden, an expert in obesity medicine.

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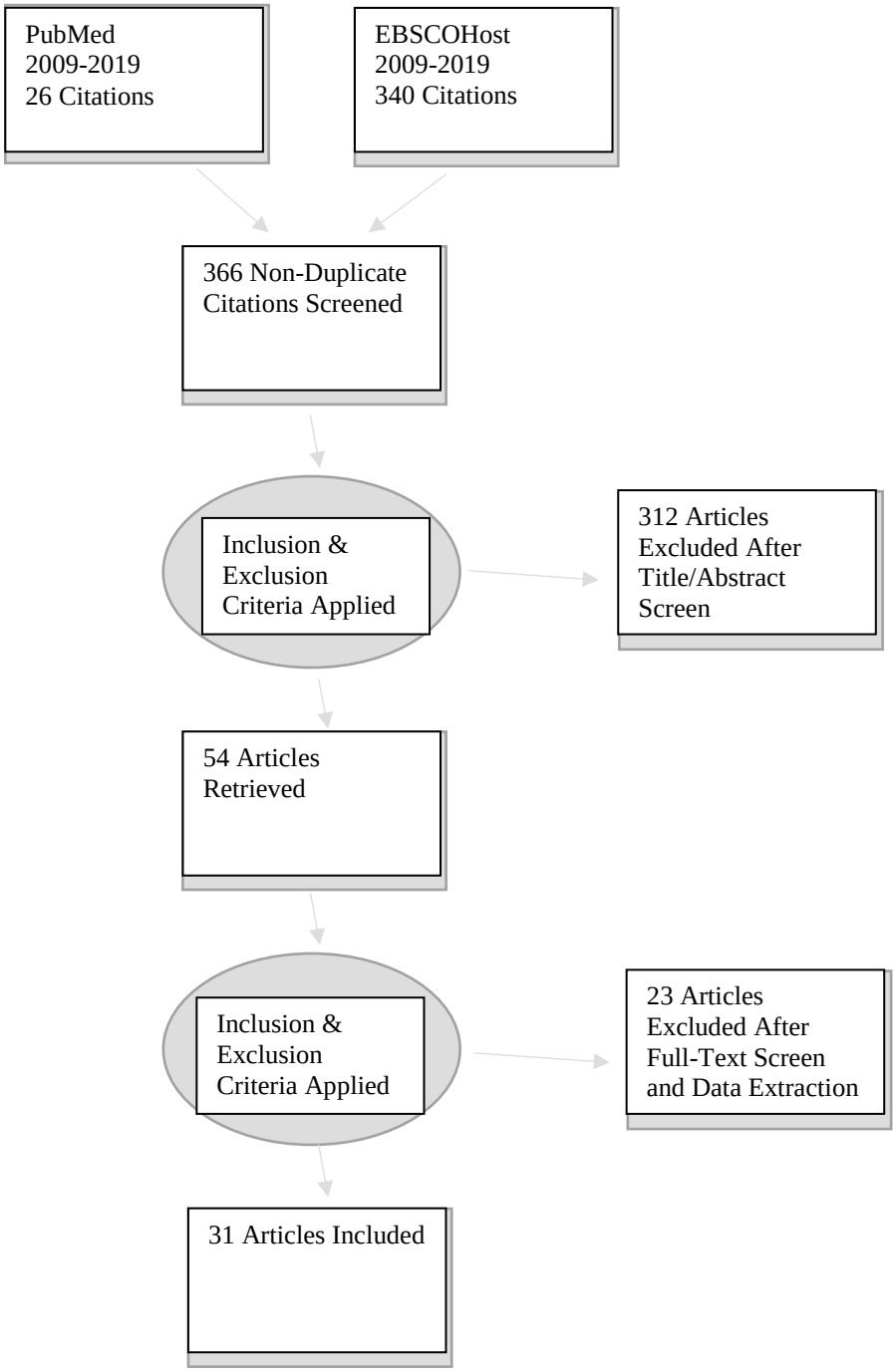
Appendix A

PRISMA Flow Diagram



Appendix B

Synthesis of Evidence Table

First author, Year, Title, Journal	**Purpose**	**Research Design[1], Evidence Level[2] & Variables**	**Sample & Sampling, Setting**	**Measures & Reliability (if reported)**	**Results & Analysis Used**	**Limitations & Usefulness**
Jensen, M.D. (2014). 2013 AHA/ACC/TOS guideline for the management of overweight and obesity in adults. *Journal of the American College of Cardiology, 63*(25).	To define practice regarding weight management.	EBPG Theme: Improving Practice	Chronic Disease Management Model for Primary Care of Patients With Overweight and Obesity – treatment algorithm		Provides obesity recommendations and an algorithm to serve as a guide for PCPs in making evaluations and treatment decisions.	Baseline comorbid conditions and CV risk factors modify the response to weight loss. Needs further research involving specific patient populations.
Apovian (2015). Pharmacological Management of Obesity: An Endocrine Society Clinical Practice Guideline. *Journal of Clinical Endocrinology and Metabolism.*	Formulate clinical practice guidelines for the pharmacological management of obesity.	EBPG Theme: Improving Practice	SR compared 54 commonly used drugs, used for > or equal to 30 days, with the outcome of weight change expressed as absolute and relative terms. Also SR of medications causing weight gain.	N/A	Adjunctive use of weight loss medications produce greater weight loss and cardiometabolic improvements.	Chronic weight management medications are useful adjunct to patients where diet and exercise alone have failed.
Fitzpatrick (2016). An	Provide providers with	EBPG	N/A	N/A	Modified 5As Framework	PCP time constraints.

Evidence-based Guide for Obesity Treatment in Primary Care. *The American Journal of Medicine.*	practical guidance on how to maximize obesity treatments.	Theme: Improving Practice Design represents opinion of Society of Behavioral Medicine, but does reference some systematic reviews in weight management among primary care patients.				Provides PCPs with brief, targeted methods (The USPS task force-recommended 5As model to build multidisciplinary team to treat overweight and obesity)
Garvey, W.T. (2016).). American association of clinical endocrinologists and American college of endocrinology comprehensive clinical practice guidelines for medical care of patients with obesity. *Endocrine Practice.*	Guidelines recognizing obesity as complex, chronic disease, and recommendation and resources for clinicians treating obese patients.	EBPG Theme: Improving Practice	Total of 1,790 articles/studies reviewed including 524 evidence-level (EL) 1, 605 EL 2, 308 EL 3, and 353 EL 4. Cochrane Library and PubMed without timeframe limitations and using keywords "obesity" and/or "weight loss"		123 clinical practice recommendations and 160 specific statements, organized in response to 9 broad questions covering the spectrum of obesity management.	
Bleich, S.N. (2011). Physician practice patterns of obesity diagnosis and weight related counseling. *Patient*	Examine whether obese patients receive an obesity diagnosis and weight-related counseling from their physician.	Retrospective, cross-sectional review; Level IV. Theme: Diagnosis Discrepancy	Physicians in sample included pcps (62.6%), surgical care (14.4%), cardiology and other internal med specialists (10.4%), OB/GYN (5.2%), and other (7.3%). Independent variables – patient sociodem, patient		Multivariate logistic regression with binary outcomes. For both sexes, all race/ethnicity groups, age groups, and each region of the country, rates of	One of the largest predictors of weight management counseling is the actual diagnosis of obesity.

Education and Counseling, 82.			risk, physician characteristics, and characteristics of clinical encounter.		obesity diagnosis were considerably lower than rates of obesity.	Need for improved adherence to screening and diagnosing weight per guidelines.
Aleem. (2015). Obesity perceptions and documentation among primary care clinicians at a rural academic health center. *Obesity Research & Clinical Practice.*	Comparison of PCP-reported documentation, management practices, beliefs and attitudes toward obesity versus actual documentation of obesity in EHR.	Correlational study; Level IV. Theme: Diagnosis Discrepancy	Survey of 56 family and/or internal medicine providers (91% response rate) administered within single system Dartmouth-Hitchcock Medical Center within three primary care centers.	High response rate likely due to clinicians practicing within a single system.	Two-sample t-tests, Wilcoxon rank sum, chi-square, Fisher's exact test were performed. STATA v.10.0 used for data analysis. Among the 74.4% of respondents with clinician-reported obesity documentation practice, only 30.8% of them actually did. Medicaid patients had high BMIs, prevalence and rate of obesity documentation. Only 27% of patients meeting criteria for obesity had obesity documentation in the EHR.	Primary care providers have high potential for addressing obesity with their patients. Limits to external validity include the homogenous sample of mostly Caucasian patients. Could lead to selection bias.
Garies, S. (2015). Using EMR data to evaluate a physician-developed lifestyle plan for obese patients in primary care.	Evaluate the effects of a lifestyle intervention delivered to obese patients compared to patients who did	Retrospective cohort study; Level IV. Theme: Diagnosis Discrepancy	Obese patients who received intervention (n=68) and those who did not (n=365). Intervention was a physician-developed lifestyle plan to address obesity.		Only statistically significant weight change was noted in older male patients 65+ that received intervention lost more weight than control group (m= 3.02 kg, p=.008).	Smoking cessation recommendation could have attributed to the lack of weight loss or even the weight gain in younger adults.

Canadian Family Physician, 61.	not receive the intervention.				No group differences seen in secondary health outcomes (glycated hemoglobin A1C, BMI) but reductions in SBP was significant after adjusting for covariates (p=.01).	This study notes the tradeoff that exists between the intensity and extensiveness of an intervention and its effect size.
Ghosh, A. (2016). Depressed, anxious and breathless missing out: Weight screening in general practice in a regional catchment of New South Wales. *Aust. J. Rural Health, 24.*	Assess records of weight status among adults in primary care.	Cross-sectional; Level IV Theme: Diagnosis Discrepancy	17 general practice clinics in New South Wales over 2 years. Demographic indicators, chronic disease status, overweight & obesity measurements. (n=118,709 adults)		30.9% had recorded BMI, only 8% had recorded waist circumference in EMR. Pts with mental health conditions (p<.001) and respiratory conditions (p=.001) less likely to have BMI recorded.	Measurements lower than optimal. Weight screening needs increased in primary care to reflect guidelines.
Glauser. (2015). Physician knowledge about and perceptions of obesity management. *Obesity Research and Clinical Practice*.	To assess the knowledge and practice patterns of PCPs, endocrinologists (ENDOs), cardiologists (CARDs), and bariatricians (BARIs) regarding obesity.	Survey; Single cross-sectional design; Level IV Theme: Diagnosis Discrepancy	100 PCPs, 100 ENDOs, 70 CARDs, and 30 BARIs from a nationally representative random sample of providers in the US.		Results analyzed using PASW Statistics 18 for descriptive statistics. BARIs and ENDOs saw higher percentage of obese patients compared to PCPs and CARDs. 70% of BARIs and ENDOs correctly identified ghrelin as hormone responsible for increases in food intake, where fewer than 30% of PCPs	Physicians require more knowledge about EB guidelines in the management of obesity. Also need greater understanding of the hormonal basis of appetite regulation and overall pathophysiology of obesity and further

					and CARDs correctly identified. Low numbers of providers (from all four disciplines) were familiar with guidelines from USPSTF, NHBLI, AACE/TOS/ASMBS, and ICSI. In order of frequency used as screening tool; BMI, weight, waist circumference. Perceptions of medication safety and efficacy were PCPs 42% and 39%, ENDOs 36% and 40%, CARDs 54% and 57%, and BARIs 20% and 37%.	knowledge regarding pharmacotherapy and surgical outcomes in obesity treatment. The survey results were self-reported
Befort (2016). Protocol for the Rural Engagement in Primary Care for Optimizing Weight Reduction (RE-POWER) Trial: Comparing three obesity treatment models in rural primary care. *Contemporary Clinical Trials.*	Evaluate the effectiveness of three obesity treatment models in primary care: 1) Intensive behavior therapy FFS, 2) Team-based model that uses the patient-centered medical home (PCMH), and 3) Centralized disease management	Single RCT; Level IIa Theme: Diagnosis Discrepancy	36 PC practices in Kansas, Nebraska, Wisconsin, and Iowa randomized to deliver obesity treatments to 40 patients using the FFS, PCMH, and DM models (n=1440) aged 20-75 with a BMI 30-45kg/m2.	Anthropomorphic (BMI, waist circumference, BP) and lab measures (fasting glucose and lipids) collected at baseline, 6, 18, and 24 months in person at the practice sites; questionnaires	Ongoing. Anticipated completion date of January 2021. Primary outcome: weight. Secondary outcomes: BP, blood sugar, cholesterol, quality of life, sleep quality, stress levels.	

	(DM) model using phone-based counseling outside of PCP offices.					
Post, R.E. (2011). The influence of physician acknowledgement of patients' weight status on patient perceptions of overweight and obesity in the United States. *Arch Intern Med, 171 (4).*	Evaluated whether patient reports of their weight status are associated with pt perceptions of their own weight and desire to lose weight.	Cross-sectional analysis; Level IV. Theme: Diagnosis Discrepancy	Pts aged 25-64 y/o with BMI equal or greater to 25.0 (n=5474) and BMI equal or greater than 30.0 (n=2874).	Report height and weight and self-reported BMI compared to NHANES actual data. Participants asked their perceptions of their weight and asked to report if healthcare provider ever told them they were overweight.	BMI 25 +, 45.2% told by provider they were overweight. BMI 30 +, 66.4% told by provider they were overweight. Participants who reported they were told by provider they were overweight ($p<.001$) or obese ($p<.001$) and were more likely to identify as overweight and attempt to lose weight.	Risk perception; being aware of problem of weight is first step in behavior change.
Woodruff R.C. (2016). Barriers to weight loss among community health center patients: qualitative insights from primary care providers. *BMC Obesity 3*(43).	Describe the depth the barriers that CHC clinicians perceive their patient populations face in maintaining a healthy weight.	Interviews with providers; qualitative study; Level VI. Theme: Diagnosis Discrepancy	30 providers – physicians(n=14), PAs(n=11), & NPs(n=5); four CHCs in rural southwestern Georgia		Clinicians identified barriers: 1)individual, 2)interpersonal, and 3)community	Useful in developing community-clinic partnerships to address obesity, using public health providers to educate and implement. Patient perspectives on what their patients experience may differ from

						actual patient experiences.
Epling, J.W. (2011). Family physician atitudes in managing obesity: a cross-sectional survey study. *BMC Research Notes*, 4(473).	To examine PCP attitudes on causes of obesity, comfort and accommodations for obese pts, and barriers to implementation of interventions.	Cross-sectional surveys using 31-item Likert scale; Variables were rural vs. non-rural, sex, race/ethnicity Level VI Theme: Barriers	Survey of 204 family physicians from urban, suburban, and rural areas of Central and Northern New York; n=75 responded		7 underlying constructs: 1) medical causation – endocrine, metabolic, and genetic factors; along with tendency to reject the idea that obesity was under the patients' control. 2) motivational causation – those that agree that physical inactivity, overeating, lack of will power, and restaurant eating were fundamental to obesity 3) psycho-behavioral causation – aggressive physician role, medication usage, physician nihilism, and physician dyssympathy T-test, Pearson's correlations, analysis of covariance, themes developed from qualitative data	Regardless of setting, pcps need ebp guidelines and tools for screening and managing obesity, more referral options, better reimbursement for services, improved coordination with non-physician providers, reimbursement for dietician consultation and fitness activities Self-reporting of rurality – could vary; small sample size; homogenous sample size
Menez. (2013). Perspectives on obesity and its treatment: Health	To determine and compare perspectives from the general	Non-randomized study – only physicians responded to the survey; Level IIb.	200 respondents from general public in WV and 171 from Baltimore and		Data organized using REDcap and analyzed using Minitab16. Surveys	HCPs must consider patient's education level

care providers and the general public in rural West Virginia and Urban Baltimore. *Health Education & Behavior*.	public and health care providers (HCPs) on obesity and treatment.	Theme: Barriers	25 HCPs from WV and 15 from Baltimore.		used Likert-type scores and were analyzed using Chi-square analyses. BMI >30 was associated with stronger belief in heritability of obesity and belief that obesity could be controlled by controlling food costs, compared to those with normal BMI. Having a high school education showed less likely to agree that obesity is a problem and that proper diet and exercise are realistic expectations compared to those with higher educational levels. HCP perspectives differed from general public perspectives at both locations.	and level of understanding when discussing obesity management. Small sample sizes limit the power to compared HCPs at both locations.
Anderson (2015). A cross-sectional study on health differences between rural and non-rural U.S. counties using the *County*	Determine health variances between U.S. residents living in rural vs. urban areas.	Quantitative, cross-sectional, Level VI; dependent variable: rural vs urban counties; six indexed domains (independent variables): mortality, morbidity, health behaviors, clinical	2013 CHR data; n=3053 counties; non-rural counties (n=1088) and rural counties (n=1965)	Indexed quartiles where the first quartile are the top 25% of counties within each state and the fourth quartile are	Greater amount of rural counties in fourth quartile. Rural areas have lower scores in health behavior, morbidity factors, clinical care, and physical	Definition of "rural", CHR does not take into account all factors that determine community health (air &

Health Rankings. BMC Health Services Research.		care, social and economic factors, physical environment Theme: Barriers		bottom 25%. Chi-square, OR, logistic regression.	environment ($p \leq 0.05$).	water pollution, built environment). Meaningful observations. Largest differences between rural and urban in domains of mortality and clinical care.
Roberts, J.L. (2015). Overcoming barriers to weight loss practice guidelines in primary care. *The Journal for Nurse Practitioners 11*(5).	Identify clinically significant findings from current research addressing barriers in obesity care.	Review of correlation studies; Level III	EBP guidelines – CDC, NIH, 5As, FDA approved weight loss medications, ASBP		Identification of barriers to implementation, barriers to effectiveness, barriers to treatment, barriers in society.	Highlight the importance of identifying each barrier, need for updated practice guidelines, emphasizing the importance of weight loss in patients, correctly diagnosing and treating obesity in primary care clinic.
Teixeira, F.V. (2012). Beliefs and practices of healthcare providers regarding obesity: A systematic review. *Revista da Associacao Medica Brasileira*	Assess how health care providers' personal beliefs about obesity guide their clinical practice and treatment delivery to obese patients.	Systematic review; Level V. Theme: Barriers	Inclusion criteria: written in English, Portuguese or Spanish, 1991-2011, obese adults, general/family practitioners, regarding healthcare providers' beliefs, knowledge, attitudes & practices	Questionnaires (Likert scales)	Data from 13 studies used; majority of providers do not feel properly prepared to treat obesity, stigmas and social stereotypes surrounding obese patients found among healthcare providers' attitudes	Limited study of this topic; Only English-written publications available for review

(English Edition).						
Trivedi, T. (2015). Obesity and obesity-related behaviors among rural and urban adults in the USA. *Rural and Remote Health, 15*(3267).	Examine the differences in obesity-related behaviors across rural-urban adult populations in the USA.	Single descriptive study using data from 1999-2006 NHANES; Level VI. Theme: Barriers	Participants aged 20+ (n=14,039), having BMI > or equal to 30. Physical activity, sedentary behaviors, dietary intake.		Descriptive statistics. OR, multiple logistic regression models used to examine urban-rural differences after adjusting for sociodemographic, health, dietary, and lifestyle factors. Prevalence of obesity higher in rural than urban residents (p<.01), among both men and women. Rural adults reported less leisure time physical activity (p<.01) and fewer rural adults met more than recommended physical activity recommendations (p<.01). Rural adults had worse diets and more sedentary behaviors.	Even after adjusting for variables, rural adults are more likely to be obese than their urban counterparts. This highlights the need for weight management service provision in primary care clinics.
Gaglioti (2016). Access to Primary Care in U.S. Counties is Associated with Lower Obesity Rates. *Journal of the American Board of Family Medicine.*	Characterize the association between PCP supply in U.S. counties and adult obesity.	Non-experimental correlational study; Level VI; Individual variables are sex, race, marital status, income, insurance status; county-level variables included rurality and poverty. Theme: Barriers	Patients: Sample drawn from 2012 BRFSS data; total sample size was 392,535 (noninstitutionalized civilian adults $\geq$ 18), from 2507 U.S. counties; representing about 80% of all counties in U.S.	Controlled for contextual variables (percentage black, percentage poverty, county-wide poverty, metropolitan status)	Association between robust PCP supply and decreased obesity rates in U.S. counties ($p \leq 0.01$). 25.8% of adults were obese in counties with the most PCPs (quartile 1) compared with	The association between improved primary care access and decreased obesity rates does not imply causality. BMI data would be

			PCPs: Data from 2012 AMA Physician Masterfile and 2010 U.S. Consensus used to compute ratios of populations to PCPs for each of the 2507 counties, divided these into quintiles from lowest to highest primary care access.	Multivariate logistic regression analysis.	30.8% of adults in counties with the fewest PCPs (quartile 5).	more accurate then self-reported height and weight. Useful by the findings warranting further research to discern mechanisms of action responsible for the increased rates of obesity in counties with fewer PCPs.
Wolters, E.A. (2016). Sustainable futures: Healthy lifestyles, obesity, and access to food in U.S. counties 2012. *Agriculture and Agriculture Science Procedia, 8.*	Examines the impact of local food systems and other variables on adult obesity rate, general health conditions, and mortality rates in counties across the U.S.	Using data from U.S. Census, U.S. Department of Agriculture, U.S. CDC, and the Robert Wood Johnson Foundation. Single correlational study; Level IV. Theme: Barriers	Dependent variables: % of adult obesity, % fair/poor health, county health behavior ranking, county mortality ranking (all 2012). Independent variables: access to fast food, % of population with limited access to healthy foods, % of county without health insurance, % unemployed, economic inequality (Gini coefficients), and % of county with college degree.		ANOVA, Pearson's r, F-test Metropolitan counties (on average) have higher healthy behavior and mortality rate rankings when compared to rural and micropolitan counties. Limited access to fast foods leads to positive results for adult obesity rates, percent of county residents with poor/fair health, county ranking for health behavior, and county ranking for mortality rates. Access to healthy foods leads to	Food choices are dictated by cost and availability, so more public education to encourage better food choices is needed, as well as policy change to make healthier foods more affordable and available to people of lower socioeconomic conditions.

					positive results for each of the four dependent variables. Higher percentages of college graduates, lower rates of inequality, lower rates of unemployment, and lower rates of uninsured are all correlated with positive health outcomes (lower obesity rates, lower rates of poor/fair health, higher county rankings for health behavior and mortality).	
Cohen, S.A. (2017). A closer look at rural-urban health disparities: Associations between obesity and rurality vary by geospatial and sociodemographic factors. *The Journal of Rural Health, 33.*	To assess potential nonlinearity in the association between rurality and obesity, and to evaluate the potential for socioeconomic status and geographic area to moderate the associations between rurality and obesity.	Single correlational/observational study; Level IV. Theme: Barriers	Adults aged 65+ with obesity (BMI >or equal to 30). Rural vs. urban status.		The prevalence of obesity was highest in the intermediate rurality areas and lowest in the most rural and most urban areas. Obesity highest in low and middle income areas, regardless of rural-urban status. In high income areas, obesity was highest in areas of intermediate rurality and lowest in the most rural and most urban areas. Substantial	Important to tailor obesity reduction approaches to areas-specific rural-urban gradients in health. Associations varied by degree of rurality, socioeconomic status, and geography.

					differences among states.	
Granara. (2017). Provider attitudes and practice patterns of obesity management with pharmacotherapy. *Journal of the American Association of Nurse Practitioners.*	To determine current prescribing patterns and attitudes of weight loss medications in management of obesity among PCPs, comparing physicians to advanced practice clinicians.	Descriptive study; Level VI. Theme: Barriers	Convenience sample of primary care NPs, PAs, and physicians. Surveys dispersed to 964 PCPs with responses back from 105 (response rate of 11%). N=94 included in study, MDs=46 and NPs=43, and Pas=5		Descriptive statistics and frequency tables. Pearson chi-square analysis to determine differences between groups (physician vs NPs/PAs). SPSS v 23 used. 46% of APC prescribed weight loss medications for <3 months compared to 33% of MDs. 58% of APCs had "neutral" or "very positive" impression of weight loss medications compared to 20% of MDs (p=.002). Most frequently reported factors preventing PCPs from prescribing weight loss medications: fear of adverse events, fear of medication interactions, cost and insurance coverage, lack of time.	Demonstrates need for supplementary education for providers regarding safe and effective use of pharmacologic therapies in managing obesity. Limited by small sample and low response rate. Causal inferences could not be determined.
Nemeth (2017). Priorities and Preferences for Weight Management and	To examine patient and provider priorities and perspectives	Qualitative descriptive study; Level VI; Four Key Questions for Providers 1) Current priority and process for	29 Providers – from 8 PPRN network practices consisting of PCP practices in urban, small	Focus groups, questionnaires	Data themes: 1) Providers' frustration, 2) Patients do not feel that providers are	Bias towards practices that interested in implementing best practice and

Cardiovascular Risk Reduction in Primary Care. *Fam Community Health.*	regarding the delivery of lifestyle modification and health behavior change counseling in weight management.	WM? 2) Local resources available that support weight loss interventions? 3) Provider and staff assets? 4) Provider and staff barriers? Patient Questions: 1) Kind of weight loss advice wanted? 2) Patient barriers to follow through? 3) Patient facilitators to follow through? 4) Types of information/support wanted from providers? Theme: Barriers	city, and rural areas throughout U.S. 63 Patients – from 6 practices.		supportive of WM, 3) Providers' perceived barriers, 4) Patients' perceived barriers, and 5) Cultural differences in WM.	EBP guidelines. Stigma may have affected patient focus groups. Resource restraints. The strength of this research is its broad perspectives of a nationally representative sample. Adds important knowledge from patients' and providers' perspectives on weight loss management programs in primary care setting.
Wynn, K. (2010). Nutrition in primary care: Current practices, attitudes, and barriers. *Canadian Family Physician, 56*.	To investigate the role of family physicians in the management of nutrition-related issues.	Single descriptive study using 10 point Likert scale; Level VI. Theme: Barriers	Family physicians located in British Columbia (n=451); asked to indicate their level of comfort discussing general nutrition, nutrition for chronic diseases, and special topics in nutrition.		Overall participants were more comfortable discussing general nutrition topics ($p<.0005$) compared to nutrition for chronic diseases and special topics in nutrition. Scores did not differ significantly between urban and rural providers.	Indicates further need for adequate training in counseling techniques to improve patient outcomes.

					Discrepancy between reporting the benefit of nutrition counseling for their patients and actually performing the counseling. Physician attitudes scores strongly associated with providing nutrition counseling (p<.005)	
Wadden, T.A. (2013). Managing obesity in primary care practice: an overview with perspective from the POWER-UP study. *International Journal of Obesity, 37*.	Provide further information about the development, implementation, and efficacy of weight loss interventions tested in POWER-UP trial and compare to 2 other studies.	SR of RCTs; Level Ia. Theme: Improving Practice	POWER-UP study – 2 year RCT with 390 obese patients assigned to one of three conditions, 1) Usual Care, 2) Brief LC, or 3) Enhanced Brief LC in primary care setting delivered by familiar PCPs and MAs. Be Fit, Be Well trial & POWER Hopkins trial using telephone and internet-delivered interventions.		POWER-UP and POWER Hopkins both successful in weight management services but by using markedly different approaches.	While both are effective means, the POWER Hopkins approach is more cost-effective as it uses a call center rather than face-to-face delivery of counseling services provided by physicans, PAs, and NPs.
Amirabdollahian, F. (2018). Anthropometric indicators of adiposity related to body weight and body shape as cardiometabolic risk predictors in British young adults:	Assess prevalence of metabolic syndrome in young adults. Compare weight, BMI, and body-shape orientation measures to ID which is best at predicting risk	Cross-sectional study; Level IV. Theme: Improving Practice	550 young adults from UK recruited from universities using questionnaires to collect demographic data (physical measurements, diet and physical activity logs, lipids and serum glucose levels, BP)		57.6% had at least one risk factor for metabolic syndrome; 18.1% had at least two risk factors. Pearson correlation coefficient showed significant association between all anthropometric indicators of adiposity and	WC is a simple anthropometric measure and shows significant association with body fat and ultimately cardiometabolic risk.

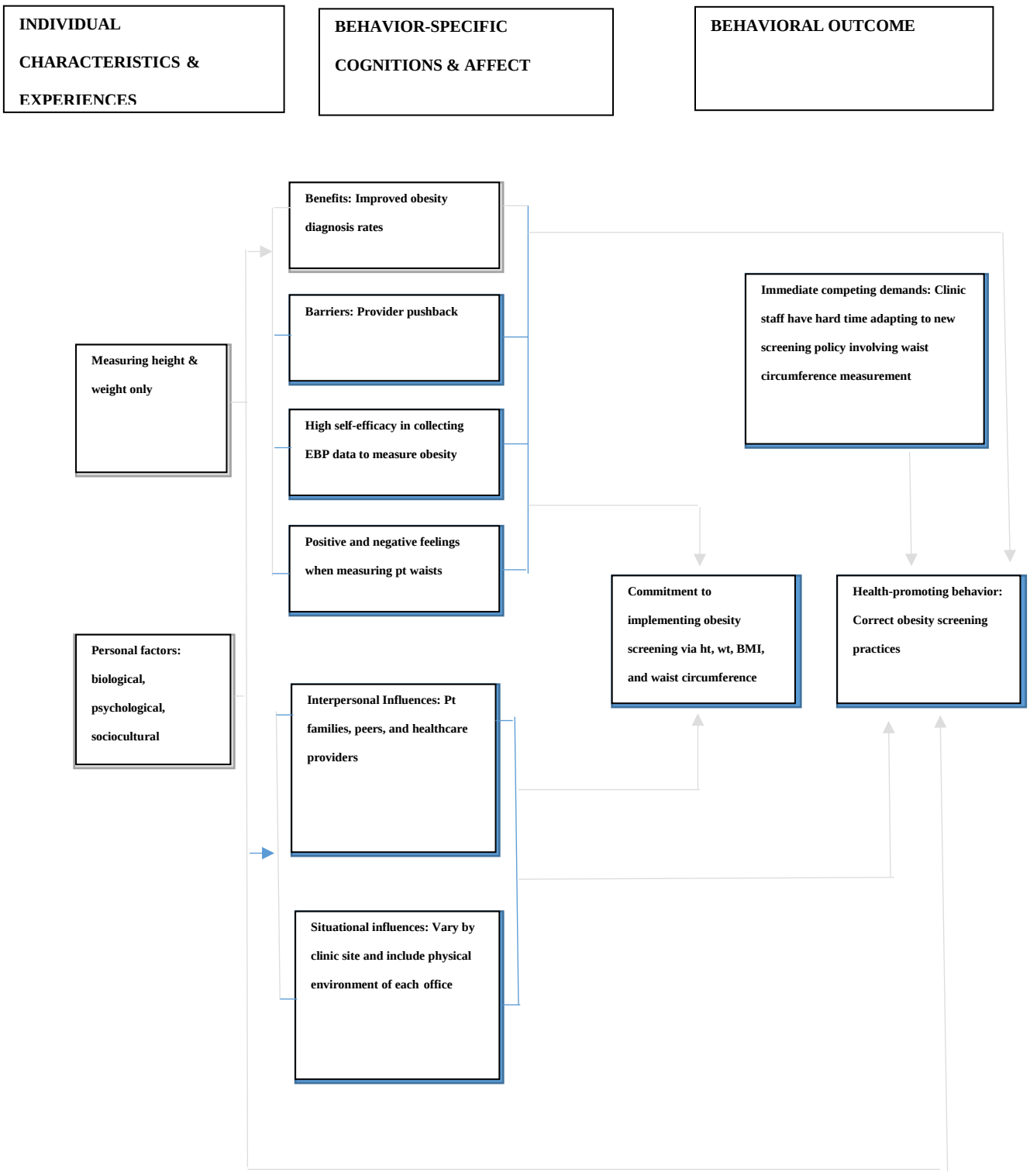
Superiority of waist-to-height ratio. *Journal of Obesity, 2018.*	of developing metabolic syndrome.				measured percentage of body fat ($p<.0001$), for BMI $r=0.546$, for WC $r=0.307$.	
Batsis, J.A. (2017). Telemedicine and primary care obesity management in rural areas – innovative approach for older adults?	Describe the impact and implementation challenges of the new Medicare Obesity Benefit (MOB) Regulatory Coverage determination in the U.S.	Review of descriptive studies; Level V. Theme: Improving Practice	Review of 12 RCTs involving face-to-face counseling; 6 RCTs of weight loss interventions		Identified barriers: 1)workforce shortages and lack of specialized services, 2) transportation challenges, 3) poor reimbursement mechanisms	Telemedicine as a potential solution for rural healthcare to deliver MOB weight management visits. Potential for increasing service gap between primary care providers and CMS regulatory coverage requirements.
Korhonen, P.E. (2014). Primary care-based, targeted screening programme to promote sustained weight management.	To ID overweight and obese pts at increased CV risk and provide them with simple lifestyle counseling.	Longitudinal cohort study; Level IV. Theme: Improving Practice	Risk factor questionnaires and tape measurement tool mailed to adult homes. 4421 respondents total; 2752 had at least one CV risk and then examined by public health nurse. Subjects with high CV risk (n=1950), 1605 had BMI > or equal to 25 with goal of 5% weight loss. N=906 completed study and results measured for weight loss success at the end of 3 years.		18% lost > or equal to 5% body weight, 70% stabilized their weight, 12% gained > or equal to 5% weight. New dx of glucose disorder predicted success in WM, while depressive sxs, alcohol abuse, or drugs used predicted poor outcomes.	Psychological factors, especially depressive sxs, must be considered before lifestyle changes made.

McTigue, K.M. (2002). Screening and interventions for obesity in adults: Summary of the evidence for the U.S. Preventative Services Task Force. *Annals of Internal Medicine, 139.*	Evaluate efficacy of pharmacotherapy and counseling on weight loss. No trials found for mass screening of obesity	SR of RCTs, non-randomized trials; Level Ib. Theme: Improving Practice	Review of RCTs, non-randomized trials, and pharmacotherapy efficacy trials.		J-shaped or U-shaped relationships between absolute mortality and BMI. Risk strongest with CV disorders, then breast, colon, uterine, and ovarian cancer. BMI most common screening test and highly reliable and closely correlated with body fat (r=0.7 to 0.8). WC captures increased CV risk and more closely approximates visceral adiposity. Counseling for low-calorie diets reduced weight by average of 8% over 3-12 months and decreased abdominal fat. Counseling for exercise led to 2-3% reduction of abdominal fat. Behavioral therapy as an adjunct to diet and exercise effective for long-term maintenance.	More intense weight loss programs, and those using behavioral therapy generally more successful.
Recio-Rodriguez et al. (2012). Abdominal obesity vs general obesity for identifying	Analyze relationship bt abdominal vs general obesity.	Single cross-sectional descriptive study; Level IV. Theme: Improving Practice	305 pts; 32.8% diabetics, 37% hypertension, 30.2% healthy. Measurements: BMI, WC, BF%, WHR. Arterial stiffness per		WC and WHR positive correlation to PWV and C-IMT after adjusting for sociodemographics, labs, and	Measuring abdominal obesity via WC better evaluates CV risk than BMI or BF%.

arterial stiffness, subclinical atherosclerosis and wave reflection in healthy, diabetics, and hypertensive. *BMC Cardiovascular Disorders 12* (3).			pulse wave velocity (PWV), intima-media thickness of common carotid artery, augmentation index (central and peripheral), ABI, and central and peripheral pulse pressure.		medications. Every 1cm increase in WC, the PWV increased 0.029 m/sec and C-IMT increased 0.001mm.	
Shi, W. (2017). Measurement matters: A systematic review of waist measurement sites for determining central adiposity. *Collegian 24* (5).	Compare WC from differing locations/using different methods; correlation with BMI.	SR of correlational studies; Level III. Theme: Improving Practice	SR of 11 observational/correlational studies measuring WC at 4 sites (WC rib, WC narrow, WC mid, WC IC).		WC-mid most accurate measure of visceral fat and % body fat in both sexes.	Requires clinicians training to identify WC-mid bc it is determined by two separate sites WC rib and WC IC.

Appendix C

HPM THEORY TO APPLICATION



Appendix D

Faculty Project Approval

July 17, 2019

DNP Project Proposal Approval

UMKC DNP Student

This letter serves to provide documentation regarding Krystal Scarbrough's Doctor of Nursing Practice (DNP) project proposal. Ms. Scarbrough obtained approval for her proposal, *BMI plus Waist Circumference for Increased Overweight or Obesity Diagnosis and Weight Management*, from the School of Nursing and Health Studies DNP faculty on July 17, 2019.

If we can provide further information, please feel free to contact us.

Sincerely,

Cheri Barber, DNP, RN, PPCNP-BC, FAANP
Clinical Assistant Professor
DNP Program Director
UMKC School of Nursing and Health Studies
barberch@umkc.edu

Lyla Lindholm, DNP, ACNS-BC
UMKC MSN-DNP Program Coordinator
Clinical Assistant Professor
DNP Faculty

Appendix E

IRB Approval Letter

Institutional Review Board
University of Missouri-Kansas City

5319 Rockhill Road
Kansas City, MO 64110

816-235-5927

umkcirb@umkc.edu

University of Missouri-Kansas City

Dear Lyla Jo Lindholm,

A member of the UMKC Research Compliance Office screened your QI Questionnaire to project #2016124-QI entitled "BMI and Waist Circumference for Overweight and Obesity Diagnoses and Weight Management" and made the following determination:

QI Determination: The project has been determined to be a quality improvement activity not requiring IRB review.

If you have any questions regarding this determination, please feel free to contact our office at 816-235-5927, umkcirb@umkc.edu, or by replying to this notification.

Note Regarding Publications: It is appropriate to disseminate and replicate QI/program evaluation successes, including sharing the information external to an organization. This may include presentations and publications. The mere intent to publish the findings does not require IRB review as long as the publication does not refer to the activity as research.

Thank you,

UMKC Institutional Review Board

Appendix F

Budget

Item	**Item Description**	**Quantity**	**Unit Cost**	**Anticipated Cost**
Print materials	Clinic staff educational handouts	15	$0.30/page	$4.50
Equipment	Computers with EMR access (as already provided within each clinic)	N/A	N/A	N/A
Miscellaneous	80in measuring tape	5	$5.99/piece	$30.00
Student Time	Collecting clinical data; reviewing EMRs; synthesizing data	50+ hours	N/A	N/A
Total				$34.50

Appendix G

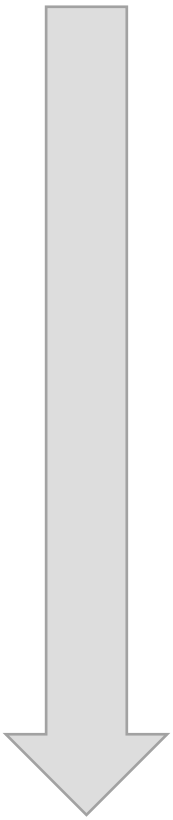
Educational Handouts/Infographics

NIH Facts About Healthy Weight handout can be found at https://www.nhlbi.nih.gov/health-topics/all-publications-and-resources/aim-healthy-weight-facts-about-healthy-weight.

American College of Cardiology educational poster about metabolic syndrome displayed in examination rooms can be found at https://www.cardiosmart.org/~/media/Images/Infographics/2016/Metabolic-Syndrome_FINAL.ashx.

Appendix H

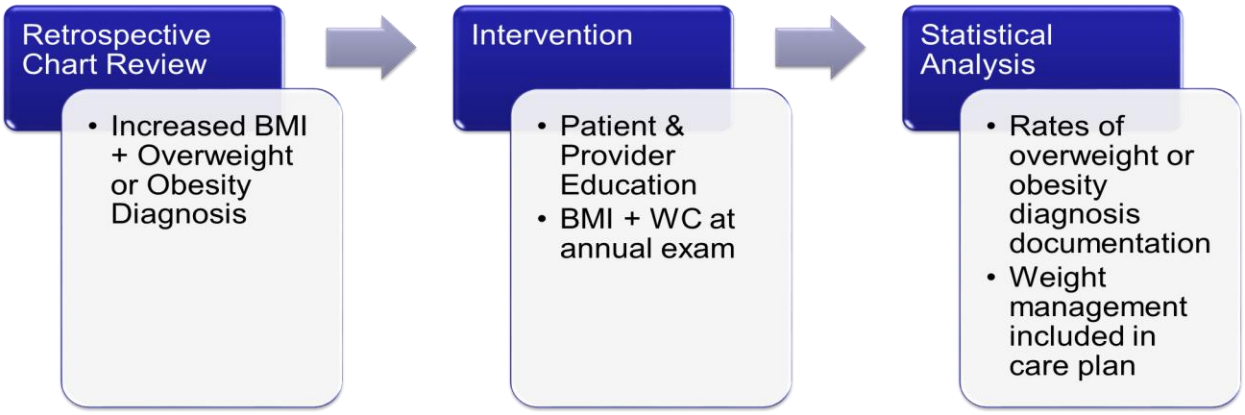
Project Timeline



May 2019	Present project at Clinical Institute
June-August 2019	Faculty and IRB approval Gather and print educational resources for providers and patients Retrospective data collection
September 2019-February 2020	Intervention: Implementation of revised weight screening at wellness visits Data collection
February-April 2020	Statistical analysis

Appendix I

Intervention Flow Diagram



Appendix J

Logic Model

Logic Model for DNP Project					
Student: Krystal Scarbrough					
Inquiry, PICOTS: In the rural adult population, does screening for obesity using BMI and WC during annual wellness visits, compared to screening with weight or BMI alone, increase accuracy of overweight or obesity diagnoses and documentation, over 6 months within a Missouri primary care clinic?					
Inputs	**Intervention(s)** *Activities*	**Outputs** *Participation*	**Outcomes -- Impact** *Short*	*Medium*	*Long*
Evidence, sub-topics 1. Diagnosis discrepancy 2. Barriers in rural primary care 3. Improved adherence to national obesity guidelines/recommendations **Major Facilitators or Contributors** 1. Clinical preceptors 2. Clinic staff 3. Faculty mentor 4. Low cost **Major Barriers or Challenges** 1. Provider perceptions 2. Delayed IRB approval 3. Anticipated time spent on follow-up appointments (could be facilitator as well)	**EBP intervention which is supported by the evidence in the Input column.** Using BMI and WC as weight-screening and cardiometabolic risk screening. **Major steps of the intervention (brief phrases)** 1. Data extraction from EMR involving height and weight and rates of obesity diagnosis 2. Determine BMI and measure WC, risk status, lifestyle behaviors, and determine if weight treatment needed 3. Provide obesity treatment per guidelines 4. Follow-up visits	**The participants:** Primary care patients, aged 18+, seen in clinic for annual preventative visit **Sites:** Bothwell Cole Camp Clinic **Time Frame:** 6 months **Consent or assent Needed:** No **Other person collecting data:** Yes, clinic nurse collecting biometric patient data **Others directly involved in consent or data collection:** Yes, nurse practitioner and clinical nursing staff	**(Completed during DNP Project)** **Outcome(s) to be measured** **Primary:** Overweight and obesity diagnoses and documentation in EMR **Secondary:** Standardize weight assessment and diagnosis in rural primary care **Measurement tool** 1. EMR – BMI & WC values, ICD 10 diagnosis consistent with overweight & obesity **Statistical analysis to be used** 1. Chi-square 2. Descriptive statistics	**(after student DNP)** **Outcomes to be measured** 1.BMI 2. WC 3. ICD 10 code in problem list	**(after student DNP)** **Outcomes that are potentials** 1.Decreased risk status (improved fasting glucose, HgbA1C, triglycerides, cholesterol, and blood pressure values) 2. Increased dietician referrals 3. Increased patient satisfaction with weight management strategies in their primary care clinic 4. Increased provider satisfaction with weight screening and management

Appendix K

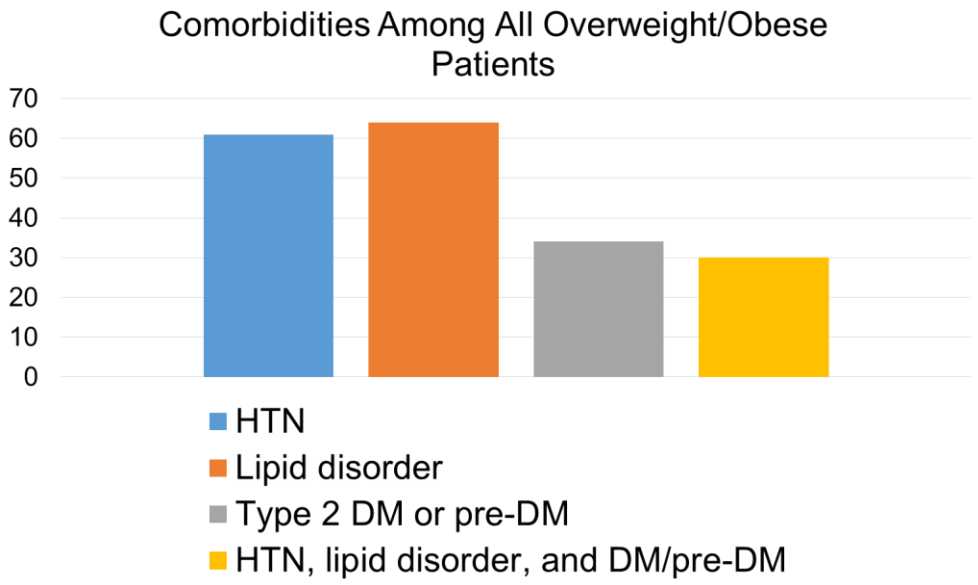
Data Collection Template

Pre-Intervention Variables	Values
Age	
Gender	
BMI (kg/m²)	
Dx of HTN	
Dx of lipid disorder	
Dx of Type II DM	
Dx of pre-DM	
EMR Documentation	

Post-Intervention Variables	Values
Age	
Gender	
BMI (kg/m²)	
WC (inches)	
Dx of HTN	
Dx of lipid disorder	
Dx of Type II DM	
Dx of pre-DM	
EMR Documentation	

Appendix L

Statistical Analysis



Intervention Group * Documentation of overweight or obesity in EHR using ICD10 code Crosstabulation

			Documentation of overweight or obesity in EHR using ICD10 code			
			Yes	No	NA	Total
Intervention Group	Pre-Intervention (no WC)	Count	1	34	11	46
		Expected Count	2.2	34.9	8.8	46.0
		% within Documentation of overweight or obesity in EHR using ICD10 code	20.0%	43.0%	55.0%	44.2%
	Post-Intervention (after education; plus WC)	Count	4	45	9	58
		Expected Count	2.8	44.1	11.2	58.0
		% within Documentation of overweight or obesity in EHR using ICD10 code	80.0%	57.0%	45.0%	55.8%
Total		Count	5	79	20	104
		Expected Count	5.0	79.0	20.0	104.0
		% within Documentation of overweight or obesity in EHR using ICD10 code	100.0%	100.0%	100.0%	100.0%

Appendix

Definition of Terms

HIPAA – Health Insurance Portability and Accountability Act of 1996 – Law to improve efficiency and effectiveness of national health care system, and includes provisions regarding electronic technology use and privacy protection of transmitted health information (HHS, 2008).

EMR – electronic medical record

BMI – body mass index; calculated from height and weight; estimate of body fat and risk profile.

Waist circumference – measured in inches; increased risk for comorbidities with waist circumference > 35 inches in women and > 40 inches in men

Overweight – BMI 25-29.9 kg/m^2

Obese – BMI 30+ kg/m^2

Rural: Open countryside, places with fewer than 2,500 people, or nonmetropolitan areas with populations ranging from 2,500 to 49,999 (USDA, n.d.).