IMPROVING PRIMARY CARE PROVIDERS' KNOWLEDGE AND INTENT TO PRESCRIBE EXERCISE FOR OVERWEIGHT AND OBESE ADULTS

by

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As members of the DNP Project Committee, we certify that we have read the DNP project prepared by *Eric Michael Sievers*, titled *Improving Primary Care Providers' Knowledge and Intent to Prescribe Exercise for Overweight and Obese Adults* and recommend that it be accepted as fulfilling the DNP project requirement for the Degree of Doctor of Nursing Practice.

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ABSTRACT

Background: Obesity and lack of exercise prescription is a major national and local health concern in a mostly rural, northwestern part of the United States. A brief educational intervention and exercise prescription template were used to address this issue in a primary care setting at a local healthcare organization.

Purpose: The purpose of this quality improvement (QI) project is to: (1) improve provider knowledge on exercise recommendations and how to write exercise prescriptions, (2) increase intent and feasibility for prescribing exercise, and (3) evaluate satisfaction with the educational intervention.

Methods: A one group, quasi-experimental pre-test/post-test design was used. The project was conducted at a local healthcare organization. All primary care providers (n=16) were invited. The intervention included a 15-minute, in-person PowerPoint presentation covering current exercise recommendations and prescription of exercise and an exercise prescription template. The pre-test and post-test surveys utilized multiple choice and five-point Likert-scale questions. However, free text responses were allowed at the end of the post-test. Surveys assessed: basic demographics, knowledge, self-rated knowledge, comfortability, self-reported need, feasibility, current prescription habits, and satisfaction with the intervention. Surveys were given immediately prior and after the presentation. Descriptive statistics were used for data analysis.

Results: Five primary care providers participated. Physicians (n=3), physician assistants (n=1), and nurse practitioners (n=1) were present. The majority of participants were 36-50 years old (n=3) and had practiced for >15 years (n=3). On a five-point scale, with greater numbers associated with more positive responses, current exercise prescription habits had a mean of ‘3.8,’

min of ‘2,’ and max of ‘5’ and satisfaction with the intervention had a mean of ‘4.4,’ min of ‘4,’ and max of ‘5.’ Improvements were seen in means associated with: knowledge (22.58%), self-rated knowledge (21.43%), comfortability (28.57%), and feasibility (16.67%). No improvement was seen in need for exercise prescriptions; both pre-test and post-test had a mean of ‘4.6,’ min of ‘4,’ and max of ‘5.’

Conclusion: At this organization, an in-person presentation and exercise prescription template were found satisfactory and effective at improving: knowledge, self-rated knowledge, comfortability, and feasibility associated with exercise recommendations and its prescription.

INTRODUCTION

Obesity has become a major national concern due to its wide spread and detrimental health effects (Ogden, Carroll, Fryar, & Flegal, 2015; National Health Service [NHS], 2016). If the current national trend continues, it is estimated that 85% of the United States' adult population will be overweight or obese by 2030 (Hruby & Hu, 2016). This quality improvement (QI), doctorate of nursing practice (DNP) project aimed to reverse this extreme trend in overweight and obesity rates. This project focused on improving the exercise prescription practices of primary care providers at a local healthcare organization for otherwise healthy, overweight and obese adults by implementing a brief educational intervention on the benefits of exercise and how to prescribe exercise. In addition to the presentation, the providers were given a printable exercise prescription template to be used to facilitate the appropriate prescription of exercise. Data on the effectiveness of and satisfaction with this intervention will be gathered to analyze for future use. This paper describes: the background knowledge, the project's purpose and aims, a theoretical framework, a synthesis of current evidence, the methods used, the results of the intervention, and a discussion of these results.

Background Knowledge

Obesity Rate and Comorbid Conditions

Currently in the United States, 36.5% of the adult population is obese (Ogden et al., 2015). Obesity is known to be associated with a variety of comorbidities including: type II diabetes mellitus, hypertension, atherosclerotic diseases (i.e., coronary heart disease & stroke), asthma, metabolic syndrome, several types of cancer, gastroesophageal reflux disease, gallstones, osteoarthritis, sleep apnea, liver disease, kidney disease, and a variety of pregnancy

complications (NHS, 2016). Shockingly, in 2000, 15% of the deaths in the United States were attributed to being overweight (Hruby & Hu, 2016). In fact, being overweight or obese during the middle years of one's life may shorten their life expectancy by four to seven years (Hruby & Hu, 2016).

Counseling and Patient Education

Unfortunately, this epidemic continues to be poorly managed as evidenced by less than half of obese adults seen in a primary care clinic in a 12-month span being counselled about exercise which, along with diet, is considered an effective, first-line treatment for this ailment (Barnes & Schoenborn, 2012; Laskowski, 2012). Perhaps this lack of counseling is partly to blame for the dismal statistic of only 21.4% of the adult population meeting the full physical activity guidelines (Centers of Disease Control and Prevention [CDC], 2014). Interestingly, research findings have identified a lack of knowledge as a major barrier to physical activity (Justine, Azizan, Hassan, Salleh, & Manaf, 2013; Baruth, Sharpe, Parra-Medina, & Wilcox, 2014; Connelly, Brown, van der Pligt, & Teychenne, 2015; Joseph, Ainsworth, Keller, & Dodgson, 2015). Therefore, one can assume that patient education and a written prescription on what and how to perform exercises will mitigate this particular barrier. In fact, tailored, written, exercise prescriptions have been shown to be effective in increasing exercise participation in healthy, community-dwelling older adults (Petrella, Koval, Cunningham, & Paterson, 2003).

Lack of Knowledge and Formal Training

Unfortunately, healthcare providers may not be properly equipped to educate patients on exercise or write prescriptions for this intervention. During 2013, less than half of the medical schools in United States offered courses focused upon exercise, and in one research study, only

half of physicians surveyed felt confident in their exercise counseling abilities (Cardinal, Park, Kim, & Cardinal, 2015; O'Brien, Shields, Oh, & Fowles, 2017). Furthermore, research conducted found many providers have a lack of knowledge on exercise recommendations and counseling for both arthritis and pregnancy (Hootman et al., 2018; Bauer, Broman, & Pivarnik, 2010). Certainly, this gap in provider knowledge is present in Montana where this QI project will take place. Therefore, the current problem is two-fold; exercise is an underutilized intervention for otherwise healthy, overweight and obese adults, and there is a lack of provider knowledge regarding the act of prescribing exercise.

Benefits of Provider Education

Fortunately, provider education is a solution. Provider education can improve provider knowledge, attitudes, skills, behavior, and clinical outcomes which in turn increases confidence with exercise prescriptions and even increases the rate of exercise counseling (Marinopoulos et al., 2007; Jones, Brooks, & Wylie, 2013; Joyce & O'Tuathaigh, 2014).

Benefits of Exercise

Not only are there clear benefits of provider education, but physical activity and exercise also have clear benefits (Office of Disease Prevention and Health Promotion [ODPHP], 2018a). There is strong evidence that physical activity lowers the risk of: premature death, coronary heart disease, stroke, hypertension, dyslipidemia, type II diabetes, metabolic syndrome, colon cancer, breast cancer, weight gain, falls, and depression, and improves cognitive function, functional health, and cardiorespiratory and muscular fitness (ODPHP, 2018a). Moderate evidence also suggests that physical activity lowers risk of hip fracture and both lung and endometrial cancer, maintains weight loss, and improves bone density and sleep quality (ODPHP, 2018a).

Current Exercise Recommendations

Interestingly, most health benefits occur with at least 150 minutes/week of moderate-intensity physical activity, but additional health benefits occur as intensity, frequency, and duration increases (ODPHP, 2018a). Furthermore, both aerobic and resistance training are recommended for full health benefits (ODPHP, 2018a). Preferably, aerobic activity should be spread throughout the week in at least 10-minute increments, and if 150-minutes/week of moderate-intensity aerobic activity is considered too much of a time burden, 75-minutes/week of vigorous-intensity aerobic activity has comparable health benefits (ODPHP, 2018b). However, even greater health benefits are seen with 300-minutes/week of moderate-intensity and 150-minutes/week of vigorous-intensity aerobic activity (ODPHP, 2018b).

As for muscle strengthening activities, these should be performed at least two times per week, and each workout session should include all major muscle groups such as: the legs, hips, back, chest, abdomen, shoulders, and arms (ODPHP, 2018b). Each lift should be completed with 8-12 repetitions and two to three sets (ODPHP, 2018b). Of course, both resistance and aerobic activity should be started gradually and increase in intensity, frequency, and duration over time (ODPHP, 2018b). This is especially true since as little as 60-minutes/week of moderate-intensity physical activity has positive effects in inactive adults (ODPHP, 2018b). Finally, the addition of flexibility and warm-up/cool-down activities is also appropriate to prevent injuries related to physical activity (ODPHP, 2018b).

It is important to note that the beneficial effects of exercise are related to three concepts: overload, which is defined as placing greater stress on the body than usual, progression, which is defined as increasing the intensity, duration, and/or frequency of the activity as the body adapts,

and specificity, which implies that the body system doing the work receives the most benefit such as the leg muscles receiving the most benefit from a squatting exercise (ODPHP, 2018a). However, it must be stressed that these recommendations are dependent on the patient's capability. The patient's physical and mental health, weight, and age should be considered; patients should gradually workup to these guidelines if previously inactive or unable to exercise (ODPHP, 2018a).

Local Problem

Montana's adult obesity rate is 25.5% (The State of Obesity, 2016). Even though below the national average, the fact that one in four adults are obese in Montana is still disheartening. Furthermore, the obesity rate was only 8.4% in 1990 and 15.6% in 2000; this rise in obesity is discouraging, but thankfully, a provider owned clinic in a mostly rural part of Montana has expressed interest in confronting the rising obesity rates in Montana and the nation. This healthcare organization has a total of 50 providers providing a full range of outpatient services including: walk-in care/family practice, pediatrics, obstetrics/gynecology, urology, nephrology, oncology, endocrinology, cardiology, pulmonology, gastroenterology, otolaryngology, and ophthalmology. Of these providers, 16 are in family practice, and their patient load includes patients from the entire age-time continuum and those with a variety of health conditions. Even though specific demographic information is not available, this clinic sees many obese patients and has shown interest in addressing this issue. Addressing the local obesity rates is needed as it is the initial step in reducing the impact of obesity on the entire state of Montana and the nation.

Stakeholders

The key stakeholders in this project include the primary care providers at the local clinic, the director of nursing (DON) and management, the nursing staff, the committee, composed of three graduate-level nursing instructors, overlooking this QI project, and the overweight and obese patients of the clinic. Interestingly, not only does there need to be buy-in from the providers participating in the QI project, but the healthcare workers complimenting the providers practice such as nurses, medical assistants, certified nursing assistants, and front-desk workers also need to have buy-in to assist the provider in the continued use of the practices learned from this QI project. The DON is also important since she organizes and manages the: QI process, continuing medical education (CME), and medical staff meetings at the healthcare institution discussed in this proposal. Additionally, the project committee are important since they have provided and continue to provide support and guidance in developing the entire project which includes the intervention and means of data collection described below. The support of these stakeholders will be required to reach the overarching purpose of this quality improvement project which is to reduce the overweight and obesity rates of patients receiving care at a mostly rural clinic in the Northwestern United States.

Purpose

The project specific aim is to evaluate the effectiveness and satisfaction of a brief educational intervention on exercise prescriptions for otherwise healthy, overweight and obese adults. Therefore, the purpose of this project is threefold: (1) improve provider knowledge on exercise recommendations and on how to write exercise prescriptions, (2) increase provider's

intent and feasibility for prescribing exercise, and (3) evaluate satisfaction with the content and delivery of this educational intervention.

Study Question

Reflecting the purpose of this project, the following study questions will be used: (1) Will an in-person, 15-minute, PowerPoint presentation on exercise prescriptions given to primary care providers improve their knowledge and increase their intent to prescribe exercise to otherwise healthy, overweight and obese adult patients at a mostly rural clinic site? (2) Is a brief, in-person PowerPoint presentation a satisfactory form of education as rated by the primary care providers?

FRAMEWORK AND SYNTHESIS OF EVIDENCE

Theoretical Framework

To guide this QI project, the framework offered by the Model for Improvement (MFI) created by the Institute for Healthcare Improvement (IHI) will be utilized. This change model is widely used for QI and consist of two parts (IHI, 2018). The first part consists of three questions establishing aims, measures, and wanted changes of the QI project, and the second part consists of a rapid cyclical process known as the Plan-Do-Study-Act cycle (PDSA) which guides implementation, measurement, and dissemination of change (Agency for Healthcare Research and Quality [AHRQ], 2013). Together the two parts of the MFI act as a tool to keep a QI project focused and effective.

MFI Concepts

As stated above, the MFI is composed of two distinct sections. The first section primarily focuses on forming the foundation of the QI project. The first concept of this section is setting aims (IHI, 2018). This concept creates an intent to change, and the aims formulated during this

step of the MFI must be time specific, measurable, and define a target population (IHI, 2018). The aims set during this step will help direct a healthcare organization to safer, more effective, patient-centered, timely, efficient, and equitable care (IHI, 2018). The second concept of the MFI is establishing measures (IHI, 2018). These measures allow the QI team to determine if the changes being made actually lead to an improvement within the facility, and to attain a well-rounded understanding if the changes are leading to improvement, a balanced set of outcomes, process, and balancing measures must be formed (IHI, 2018). The third concept of the MFI is selecting changes, and it is in this section of the MFI where a broader change concept is selected to help focus the QI project (IHI, 2018). Generating specific ideas that correlates to the selected concepts and incorporating specific knowledge into these ideas and change concepts is needed before moving into the PDSA cycle (IHI, 2018). The last major concept of the MFI is the PDSA cycle which involves four distinct steps, planning, doing, studying, and acting, to help test the change decided upon in the third concept (IHI, 2018). During the planning stage, the objective of the test will be stated, hypotheses will be formed, and a plan for testing the change will be formed (IHI, 2018). The doing stage involves carrying out the test decided in the planning stage, documenting any problems or observations, and beginning to analyze the data (IHI, 2018). The studying stage of the PDSA cycle finishes the analysis of the data, compares the data to the hypotheses, and summarizes what has been learned from the test (IHI, 2018). Finally, the action phase will refine the change based on the results gathered from the test (IHI, 2018). These concepts are depicted in Figure 1.

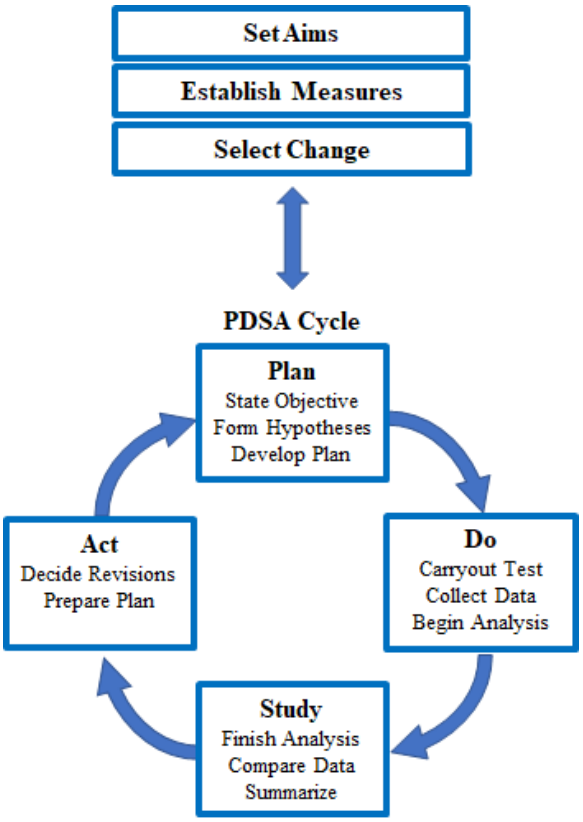

FIGURE 1. A diagram of the concepts that make the MFI with specific steps listed in the PDSA cycle. (Adapted from IHI, 2018.)

Use in Similar Projects

Furthermore, not only is the MFI widely used for QI projects, which makes it an excellent framework in guiding this project, but it also has been used in various other QI projects that have similar interventions and goals (IHI, 2018). The PDSA successfully guided a project that focused on the early recognition of compartment syndrome which used a multifaceted intervention which included both formal and informal provider education and written reminders (Schaffzin et al., 2013). Another QI project that utilized the PDSA framework focused on reducing cardiometabolic risk factors in primary care patients (Joyner et al., 2017). The authors did this by using the PDSA framework to guide the formation, implementation, and examination

of an intervention which included provider education through modules and a two-hour, in-person lecture (Joyner et al., 2017). Yet another QI project that successfully utilized the PDSA framework involved the use of a pre-test, post-test design using educational posters to guide the prescription of oxygen (Dolan et al., 2013). Finally, a QI project that implemented provider education through emailing providers the recommended guidelines for treatment of upper respiratory infections, sinusitis, and pharyngitis, hanging posters on the subject matter, and providing specialized prescription pads was successfully guided by the PDSA framework (Alweis, Greco, Wasser, & Wenderoth, 2014). These four projects not only establish the legitimacy of provider education improving patient care, but they also set a precedent for using the MFI and the subsequent PDSA cycle to guide QI projects that involve provider education on health-related recommendations and guidelines.

MFI Concepts in Relation to this Project

With regards to this specific QI project, the first part of the MFI will help guide the formation of the aims, objectives and measures, and quality improvement intervention (AHRQ, 2013). The project specific aims are created by answering the first question of the MFI; "what are we trying to accomplish?" Answering this question, this project is attempting to evaluate the effectiveness of and satisfaction with a brief educational intervention on exercise prescriptions in improving provider knowledge on exercise recommendations and prescriptions while increasing providers' intent to prescribe exercise to otherwise healthy, overweight and obese adults. Then the objectives and measures can be formed by answering the second question of the MFI: "how will we know that a change is an improvement?" The answer to this question is relatively straightforward for this particular project; an improvement will have taken place if the providers

state they are satisfied with the educational presentation, have an increase in knowledge on exercise recommendations and prescriptions, and if there is an increase in self-reported intent to prescribe based on the post-test and pre-test results. Finally, the QI intervention will be shaped by answering the third question of the MFI; "What changes can we make that will result in improvement?" And for this project, a brief educational presentation given to primary care providers on exercise recommendations and prescription may improve their intent to prescribe exercise to obese and overweight adults (AHRQ, 2013).

The second part of the MFI, which is known as the PDSA cycle, will guide the implementation and refinement of this QI project (IHI, 2018). However, for this project, only one cycle of the PDSA will be performed. The following brief paragraphs will expand on the use of the four sections of the PDSA cycle in this project.

Plan. Following the guidance of the IHI (2018), this project will use the planning concept of the PDSA to further develop objectives, form hypotheses, and develop a plan to test the implementation of a brief educational presentation given to primary care providers on exercise recommendations and prescriptions for otherwise healthy, overweight and obese adults. This section of the PDSA cycle has led to a plan of using a pre-test, post-test survey to study the effectiveness of the intervention. Additionally, in this stage arose the plan of giving the aforementioned brief educational presentation to primary care providers at a medical staff meeting in a small clinic in a mostly rural northwestern area of the United States. The results of this step of the PDSA cycle can be seen in the abovementioned objectives and in the methods section discussed later on in this document.

Do. In this step of the PDSA cycle, the intervention of a brief educational presentation on exercise will be carried out in the small primary care clinic noted above. Also, in this step, the pre-test and post-test survey data will be collected, and initial data analysis will be performed.

Study. Once the data has been collected during the abovementioned step, the third step will be to analyze the data collected in the previous step and summarize the findings (IHI, 2018). The results of this QI project will be formed using statistical analysis. Again, the statistical analysis portion of this step of the PDSA cycle is elaborated upon in the methods section, but the results of the analysis can be seen in the results and discussion sections which are discussed later.

Act. Then the last step in the PDSA cycle will work on modifying the intervention used in order to enhance its success. Even though this particular project will stop at this phase, this section of the PDSA cycle will begin the set up for a second QI project and PDSA cycle. The results of this phase are elaborated upon in the discussion section of this project. This phase helped identify limitations and weaknesses of the project in order to improve it for further cycles.

Overall, the MFI and its PDSA cycle is widely used in QI projects (IHI, 2018). Its use in guiding the planning and implementation of similar projects has been substantiated in a variety of studies and projects such as the four discussed previously. As outlined above the concepts of the MFI are a good fit for this project. The MFI and PDSA cycle will guide the formation, implementation, assessment, and dissemination of this QI project.

Project Specific Concepts

In addition to the theoretical concepts outlined above, it is also important to understand the project specific concepts, terminology, and definitions. For this project, the term otherwise healthy, overweight and obese adults will refer to adults who have a body mass index (BMI)

greater than 25kg/m^2 but less than 40kg/m^2 and who do not have comorbid conditions that may inhibit full participation in physical activity such as morbid obesity, severe heart disease, severe joint malfunction, lung disease, and kidney failure. Other important concepts to understand include: "exercise prescriptions" which refer to a physical piece of paper with physical activity intensity, frequency, and duration recommendations, "a brief educational intervention" which refers to a 15-minute PowerPoint lecture, and the term "primary care providers" which refers to nurse practitioners, physician assistants, and physicians that work in outpatient primary care clinics.

Synthesis of Evidence

To gain a better understanding of the literature supporting this project, a total of six searches were conducted through PubMed. Each search was refined, and only articles with full text available and that were relevant to this QI project were selected. Topics included involved: the effects of physical activity on overweight and obese adults, the dosage of exercise, and the effectiveness of exercise prescriptions and provider education. Of the searches conducted, four of them used the inclusion criteria of articles five years old or less and having human subjects. These searches used the terms: 'physical activity,' 'weight loss,' and 'obese adults,' with 92 results and four selected articles; 'resistance training' and 'obese adults' with 22 results, and five selected articles; 'physical activity guidelines,' 'adult, and obesity' with 44 results and two selected articles; and 'effectiveness,' 'education,' 'intent,' and 'prescribe,' with five results and two selected articles. The last two searches continued to be limited to human subjects, but a 10-year limit was set for publication date due to relatively few articles being found within a five-year limit. The search terms used for these two searches include the phrases: "effectiveness of

continuing medical education increasing physician knowledge" and "effectiveness of physical activity advice and prescription." The searches resulted in 16 results with three selected articles and 15 results with two selected articles respectively. A total of 18 articles were selected to be part of this synthesis of evidence. Information on the benefits of physical activity for obese and overweight adults, the dosage of physical activity needed to see benefits, and effectiveness of both exercise prescriptions and provider education was found with the aforementioned searches. The search results can be found in Appendix E.

Literature Search Results

Benefits of Physical Activity

Physical activity has a variety of benefits for overweight and obese adults.

Weight loss. One benefit supported by literature is a reduction in adiposity in overweight and obese adults. Along with diet, physical activity is effective in weight loss maintenance for one to two years (Dombrowski et al., 2014). Furthermore, even a small increase in moderate to vigorous activity and a small decrease in sedentary behavior is associated with weight loss over the course of two years (Pellegrini et al., 2016). Interestingly, one study suggests that the weight loss associated with physical activity may be due to enhanced metabolic phenotype expression (Piccolo et al., 2015).

Resistance training. More specific than the term "physical activity," resistance training has also been shown to have benefits in the overweight and obese adult population. Similar to the evidence stated above, when resistance training is combined with diet, there is an improvement in lipid profiles, blood pressure, and body mass (Normandin, Chmelo, Lyles, Marsh, & Nicklas, 2017). In another study, resistance training with diet was found to produce a decrease in fat mass

while improving physical strength and function (Nicklas et al., 2015). Furthermore, resistance training alone has been shown to decrease fat mass without affecting total or lean mass (Nicklas et al., 2015). Interestingly, when compared to aerobic exercise, resistance training has its own place in the treatment of adiposity in overweight and obese adults. Evidence shows that aerobic exercise results in a reduction of fat mass in all adults, but an increase in lean mass is only seen in non-obese adults (Drenowatz et al., 2015). On the other hand, resistance training is shown to not only reduce fat mass but to also increase lean mass in both non-obese and obese adults (Drenowatz et al., 2015). The evidence clearly demonstrates that physical activity should be included in the management of adiposity in overweight and obese adults.

Dosage of Physical Activity

Unlike the clear evidence associated with the benefits of physical activity in overweight and obese adults, there is varying evidence on the dosage needed for weight loss and other benefits. For example, in a systematic review, it was found that the recommendations for the dosage and intensity of physical activity for weight loss varies greatly (Dombrowski et al., 2014). One randomized controlled trial found that after 24 weeks, even though low amounts of low intensity exercise, high amounts or low intensity exercise, and high amounts of high intensity exercise were all associated with a reduction in abdominal obesity, there was no difference in abdominal obesity between the different dosages of exercise (Ross, Hudson, Stotz, & Lam, 2015). These results were supported by another randomized controlled trial where high amounts of low-moderate intensity aerobic exercise, low amounts of high intensity aerobic exercise, and low amounts or low-moderate aerobic exercise over an eight-week period have equal efficacy in the reduction of liver and visceral adiposity (Keating et al., 2015). However,

over that eight-week period, no significant total weight loss was observed (Keating et al., 2015). Interestingly, even bouts of moderate-vigorous activity lasting less than 10 minutes and light physical activity were associated with a reduction in BMI, fat mass, and waist circumference in older adults (Jefferis et al., 2016).

On the other hand, evidence supports the use of high-intensity training for overweight and obese adults. Even though no difference BMI or body composition was seen between standard aerobic/strength training and high-intensity circuit/functional training, two randomized controlled trials found that high-intensity functional and circuit training had higher levels of exercise enjoyment, and intent to continue exercising with lower levels of perceived exertion (Heinrich, Patel, O'Neal, & Heinrich, 2014; Balachandran, Krawczyk, Potiaumpai, & Signorile, 2014). High-intensity exercise was also found to be related to a greater increase in lower body power compared to standard strength training (Balachandran et al., 2014).

Finally, the dosage of physical activity may need to be higher according to one large observational prospective cohort study (Moholdt, Wisløff, Lydersen, & Nauman, 2014). Both men and women who performed more physical activity than the recommendations of 30-minutes for five days per week, or vigorous activity for a minimum of 20-minutes for three days per week, had both lower weight gain on average and a lower risk in general of weight gain (Moholdt et al., 2014). The literature clearly shows that the dosage of exercise can vary but amounts of high intensity circuit/functional training that exceed current recommendations may be beneficial for overweight and obese adults.

Effectiveness of Exercise Prescription

Not only does the literature support the efficacy of physical activity in the treatment of obesity, but there is also literature supporting the effectiveness of exercise prescriptions. In one randomized controlled study, general practice providers providing exercise prescriptions to inactive patients increased their activity at a six-month follow-up with 1.72 more metabolic equivalent (MET) hours/week, 25 minutes more of moderate-vigorous activity per week, and 5.3% more of the participants meeting minimal activity guidelines (Grandes et al., 2011). These results of exercise prescription increasing physical activity at six months after prescription are supported by an earlier study as well (Grandes et al., 2009). However, this trend disappeared at the 12- and 24-month follow-up when only one exercise prescription was written (Grandes et al., 2011). Interestingly, if the exercise prescription was written for the patient a second time, the effect of increasing physical activity was preserved at the 12- and 24-month follow-ups (Grandes et al., 2011). Although exercise prescription did increase physical activity levels, there was no difference seen in VO_2 max or health-related quality of life (Grandes et al., 2011; Grandes et al., 2009). Surprisingly, a subgroup analysis in one randomized controlled trial suggests that exercise prescriptions had a greater effect on patients over the age of 50 compared to those younger than 50 (Grandes et al., 2009). Although there is evidence supporting the use of exercise prescriptions, the literature is limited making this QI project and further research important.

Effectiveness of Provider Education

Much like the literature supporting the efficacy of exercise prescription, there is a limited amount of research assessing the effectiveness of provider-focused continuing education. This is especially true when looking for literature supporting the efficacy of provider education in

increasing knowledge and practice intent. However, the literature below substantiates the use of provider-focused education.

Knowledge. Supporting the use of primary care provider education in improving knowledge, one small-sampled study utilized a multifaceted CME using two seminars with reminders in the form of booklets and penlights and other educational materials such as training newsletters and DVDs covering colorectal cancer screening guidelines (Nguyen et al., 2010). In this study, the primary care providers took a pre-test and post-test, and from these surveys, it was found that provider knowledge increased on colorectal screening guidelines following the seminars (Nguyen et al., 2010). Another study utilizing a three-day, provider-focused, interactive training on STD and HIV prevention found that knowledge on STD and HIV prevention was increased immediately after the education and even six months later compared to pre-test knowledge (Dreisbach et al., 2011). Furthermore, self-reported skills and improvement in practice was also reported at six months after the interactive training (Dreisbach et al., 2011).

On the other hand, one study with a sample of 87 nurses and general practitioners utilized an educational interventional consisting of a web-based program, a practical exercise, and case seminar on nutrition in palliative care (Berggren et al., 2016). The authors of this study found that the educational intervention used improved familiarity with important concepts and collaboration with other caregivers, but it did not significantly improve level of knowledge with the subject matter (Berggren et al., 2016). As seen with these differing results in the literature, the high levels of variability associated with provider-focused education make it difficult to study the effectiveness of comparable educational interventions.

Change in practice. The efficacy of provider-focused education in improving practice intent with regards to improved prescription practices is also supported by literature. In a study using a theory and evidence-based provider education presentation known as "Changing Minds, Changing Lives" was shown to significantly improve providers' attitudes, subjective norms, and intentions to discuss leisure time physical activity (Tomasone, Martin Ginis, Estabrooks, & Domenicucci, 2014). This improvement was seen despite relatively strong, positive attitudes, subjective norms, and intentions for discussing leisure time physical activity (Tomasone et al., 2014). However, these results were not maintained at one and six months post educational presentation (Tomasone et al., 2014). Although somewhat limited, there is evidence within the literature that supports the efficacy of provider-focused education in improving knowledge and intentions to change practice.

Gaps, Weaknesses and Strengths

As seen in the aforementioned paragraphs, there are clear strengths and limitations within the literature supporting this QI project. One major strength is that there is an abundance of evidence supporting the benefits of physical activity in overweight and obese adults. Furthermore, the evidence informing the benefits of exercise, the dosage needed to see benefits, and effectiveness of exercise prescriptions are of higher levels of evidence such as randomized controlled trials and systematic reviews.

However, there are also many limitations in the evidence illuminated by this literature search. One limitation is a lack of high level of evidence studies supporting the effectiveness of provider-focused education. Another major weakness is that there are large gaps in evidence with regards to the dosage needed to see benefits and effectiveness of exercise prescriptions and

provider-focused education; there is limited current evidence supporting these topics. Furthermore, the literature covering these topics is contradictory at times. This seems to be especially true with regards to the dosage of exercise and the effectiveness of provider-focused education on increasing knowledge. Perhaps these variabilities are due to the highly variable nature of the human body and educational materials. Also, even though many of the studies included in this literature review are of high levels of evidence, their quality is lacking a times due to poor control of variables and small samples. Overall, this QI project will not only be important in possibly improving primary care provider's knowledge on and intent to prescribe exercise for overweight and obese adults at a local primary care clinic, but it will also be important in potentially reducing these gaps in literature.

Overall, this synthesis of evidence supports the conduction of this QI project by substantiating the effectiveness of: physical activity of a variety of dosages in the treatment of obesity, exercise prescriptions in increasing physical activity, and CME in improving provider knowledge. A summary of the articles used in this synthesis of evidence can be found in Appendix E.

METHODS

Design

A one group, quasi-experimental pre-test/post-test design utilizing convenience sampling was used for this QI project to assess the effectiveness and satisfaction of a brief education intervention to improve provider knowledge on prescribing exercise to otherwise healthy, overweight and obese adults at a local clinic. This design and sampling method was selected due to having a limited study population size at the practice site and to allow this project to gain data

directly from the population of interest. Within the pre-test and post-test, quantitative data was collected to assess provider knowledge, intent, and satisfaction, but qualitative data was also collected from a small free-text box on the post-test survey to allow the providers to make any suggestions for future improvement. The setting, participants, intervention, and data collection and analysis techniques are discussed in more detail below.

Setting

This project took place within the primary care department of a small, physician-owned healthcare organization in Cascade County, Montana which is a mostly rural, northwestern area of the United States. This healthcare organization offers a full range of outpatient services including family practice. At this organization there are 16 providers working in family practice. Patients across the entire age-time continuum with a variety of acute and chronic health conditions are seen in this family practice, and even though exact demographics are not known, the patient population includes many obese, adult patients. This site has shown interest in addressing the issue described in the background section of this paper. The intervention, outlined below, was implemented at a primary care medical staff meeting in the summer of 2018. These meetings are held monthly and all primary care providers within the organization are invited to attend. The DON at the healthcare institution described above has provided formal support of this project which can be found in Appendix D.

Participants

All providers working in family practice at this organization were invited to participate in this project. There are 16 providers, including physicians, nurse practitioners, and physician assistants, who provide primary care services at this site. Inclusion criteria include: (1) currently

practicing at this site in primary care and (2) caring for adult patients. A target sample of 25-50% of the total primary care providers at the facility is planned. Currently, as reported by the DON, providers at this site have buy-in with regards to prescribing exercise as it aligns with the facilities current quality improvement goals.

Intervention

Description

This intervention involved providing education to primary care providers at a local clinic via a brief educational presentation on the benefits of exercise and how to prescribe exercise for otherwise healthy, overweight and obese adults. The presentation was created via PowerPoint and was presented by this author, in-person at a medical staff meeting. It was approximately 15 minutes in duration and covered: the definitions of exercise, the literature supporting exercise, how to perform simple resistance and aerobic exercises at home, the literature supporting exercise prescriptions, and finally, how to write an exercise prescription with intensity, duration, and frequency recommendations. Additionally, during this presentation, the providers were introduced to a printable exercise prescription template that can be used to facilitate the proper prescription of exercise. It included both aerobic exercise recommendations and one full-body resistance exercise regimen with diagrams showing how to perform each exercise.

Purpose for Intervention Selection

This intervention has been selected to address the national, adult obesity rate of 36.5%, and to address the Montana's adult obesity rate of 25.5% (Ogden et al., 2015; The State of Obesity, 2016). Furthermore, less than half of obese adults seen by their primary care clinic within one year received physical activity counseling, and there appears to be a general lack of

knowledge regarding exercise recommendations and counseling among healthcare providers (CDC, 2014; Hootman et al., 2018; Bauer et al., 2010). These gaps in practice and knowledge also spurred the selection of this intervention.

Supporting Evidence

The supporting literature is presented in the above synthesis of evidence, but some supporting literature is also presented in the introduction. To summarize, provider education improves knowledge, attitudes, skills, behavior, clinical outcomes, confidence with exercise prescriptions, and the rate of exercise counseling (Marinopoulos et al., 2007; Jones et al., 2013; Joyce & O'Tuathaigh, 2014; Nguyen et al., 2010; Dreisbach et al., 2011). Furthermore, written exercise prescriptions have been found to be effective in increasing exercise participation (Petrella et al., 2003; Grandes et al., 2009; Grandes et al., 2011). Therefore, a multifaceted educational intervention will hopefully improve providers' knowledge and prescription habits.

Tools for Data Collection

Quantitative pre-test and post-test surveys were used for data collection in this QI project (Appendix A & B). The surveys were formatted with Microsoft Word in order to create paper copies. Each survey was composed of multiple-choice questions to assess knowledge and five-point Likert scales to assess intent to prescribe, self-reported knowledge and comfortability, and satisfaction with aspects of the QI project. The pre-test and post-test surveys were composed of the same questions except that the post-test also included Likert-scale questions assessing specific aspects of the QI project including: satisfaction with the presentation topics, satisfaction with the presentation's layout/flow, satisfaction with the survey design, satisfaction with the time length of the presentation, and if an online or in-person format would be preferred. Additionally,

the pre-test included one Likert-scale question inquiring about current exercise prescription habits that was omitted on the post-test, and the post-test survey included a free-text box to allow participating providers to make suggestions.

Data Collection Process

This project took place at a mutually agreed upon date and time between this author and the clinical site providers during a medical staff meeting. One week prior to the medical staff meeting, an invitation to participate was sent to the DON who then forwarded it to all primary care providers within the facility. This email contained a disclosure outlining the overview of project, risks, and benefits (Appendix C). Upon arrival to the medical staff meeting, the disclosure form was furnished to all attending providers and verbally summarized. Once the disclosure was articulated, the participants were given a paper copy of the pre-test survey. Once all pre-tests were returned, they were placed in a secured, manila envelope, and then the educational PowerPoint was presented. Upon completion of the intervention, a physical copy of the post-test was given to each participant. The pre-test was administered immediately before the intervention and the post-test immediately after. All surveys were secured in a manila envelope and placed in a lock box after adjournment of the medical staff meeting. No identifying data was collected. Data from these surveys was entered into Excel at a later date, and then the hard copies of the surveys were shredded and destroyed.

Data Analysis

Excel was used for data management. Data gathered from the pre-test and post-test surveys was entered. Descriptive statistics were utilized to summarize data on self-reported knowledge and comfortability, intent to prescribe, and satisfaction with aspects of the QI project.

The proportion of correct answers regarding the knowledge questions and the mean values of the Likert scale questions were compared form pre-test to post-test. Free-text box response data was summarized.

Dissemination

An executive summary of findings and evidence-based recommendations were shared with the DON for dissemination. Only aggregate data was shared with the host site in order to protect participants' identities.

Ethical Considerations

Even though the population studied in this project may not be considered a vulnerable population, there are certain ethical considerations that must be considered. The first, and perhaps most important is respect. Autonomy was maximized by offering the participating providers with a disclosure form allowing them to understand what the project is about and volunteer to take part in it (The University of Iowa, n.d.). Participation was voluntary and participants could withdraw at any time without penalty. Furthermore, respect was maintained by collecting only relevant, non-identifying, demographic information to maintain participant privacy and identity. Participants' identities were further protected by only sharing aggregate data with the host site. It is also important to consider the ethical principle of beneficence (The University of Iowa, n.d.). In this project, the benefits of a brief educational intervention far outweigh any risks. No identifiable information was collected and data was kept encrypted, locked, and password protected. Finally, the principle of justice must also be considered (The University of Iowa, n.d.). Justice was maintained in this project by having a sample selection that was unbiased. All primary care providers were invited to participate. Additionally, the sample

selected benefited from the intervention carried out in the QI project. This project may also have had indirect positive effects on the otherwise healthy, overweight and obese adult population. Finally, site approval and University of Arizona (UA) Institutional Review Board (IRB) review was obtained before implementing this project.

RESULTS

Participants

Five primary care providers attended the medical staff meeting, and all five completed the pre-test, intervention, and post-test. Three participants were physicians, one was a physician assistant, and one was a nurse practitioner. The majority of participants were aged 36-50 years old (n=3), and the rest were age 51-65 years old (n=2). Furthermore, two of the providers reported 6-10 years of experience in their current practice while three providers reported more than 15 years of experience. Graphic illustrations of these results can be seen in Figure 2, Figure 3, and Figure 4.

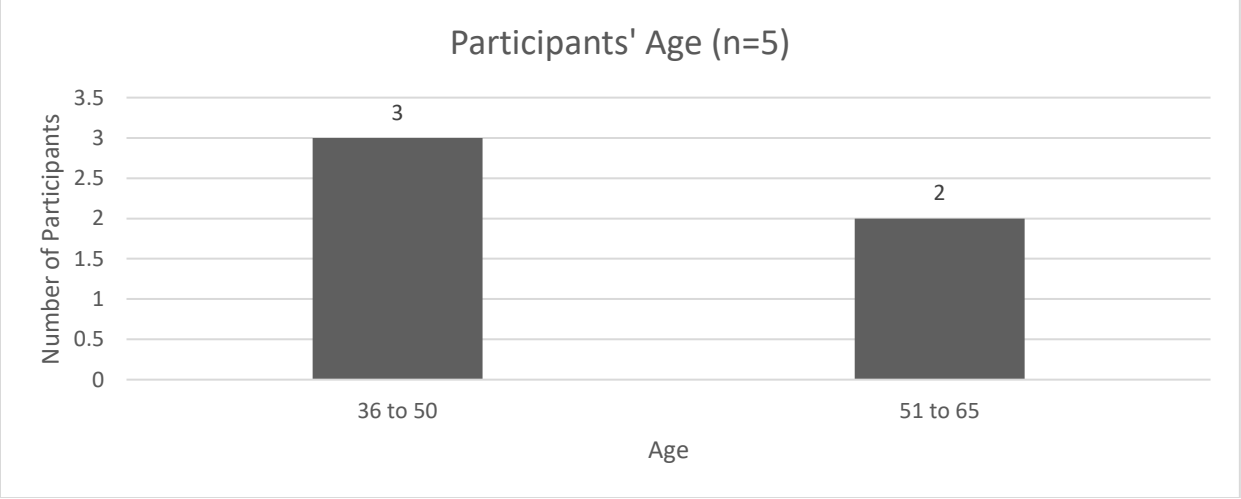

FIGURE 2. Age of participants.

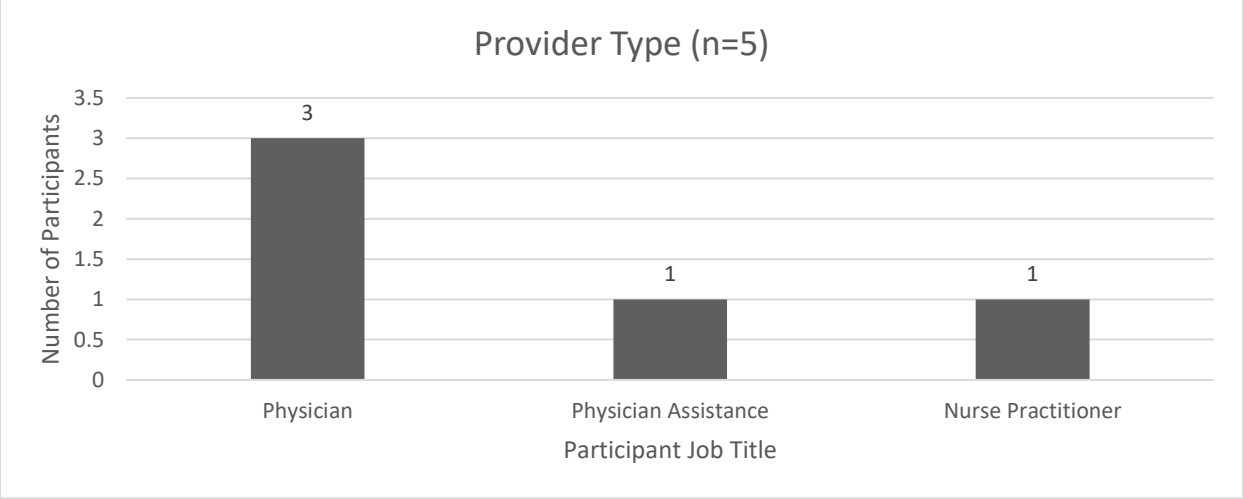

FIGURE 3. Participant job title.

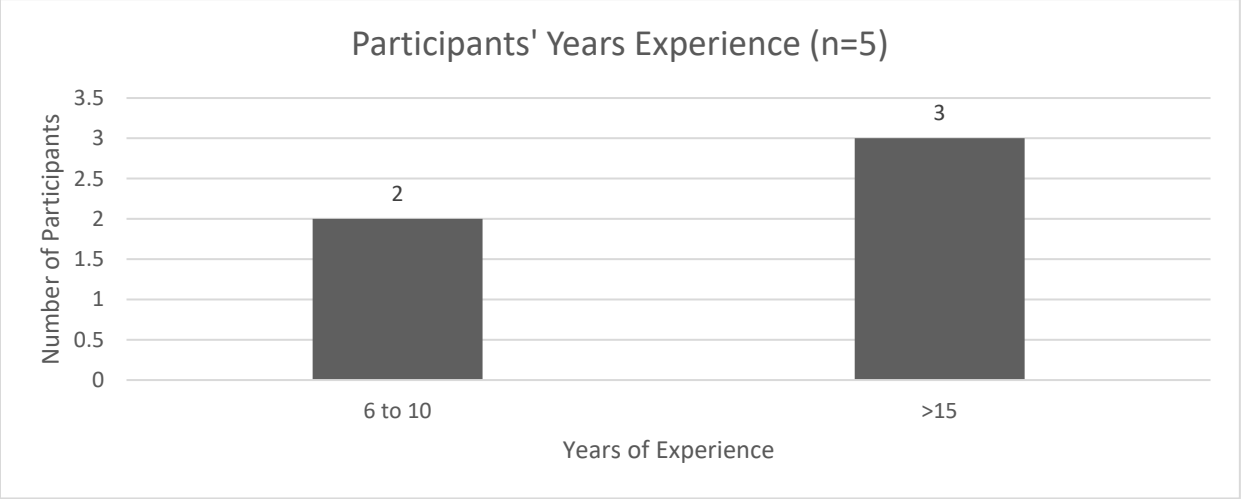

FIGURE 4. Years of experience in current position.

Pre-test

All questions were answered on the pre-test by each participant. There were eight multiple choice questions that assessed knowledge. For each participant, the total number of correct answers out of eight were counted. The average number of correct answers out of ‘8’ was ‘6.2’ with ‘7’ being the most correct answers and ‘5’ being the fewest. Self-rated knowledge on exercise prescription and guidelines, comfortability with prescribing exercise, whether or not

there is a need for exercise prescription for overweight and obese adults, feasibility of prescribing exercise in their current practice, and current exercise prescription habits were measured on a five-point Likert scale with ‘1’ being a more negative value and ‘5’ being more positive. Between the five participants, the mean, min, and max values for the different outcome measurements are as follows: self-rated knowledge (mean 2.8, min 2, max 3), comfortability (mean 2.8, min 2, max 4), need for exercise prescription (mean 4.6, min 4, max 5), feasibility (mean 3.6, min 1, max 5), and current exercise prescription habits (mean 3.8, min 2, max 5). These results are summarized in Table 1.

TABLE 1. *Pre-test results.*

	Mean	**Min**	**Max**
Knowledge* (Out of 8)	6.2	5	7
Self-Rated Knowledge (Out of 5)	2.8	2	3
Comfortability with Prescribing Exercise (Out of 5)	2.8	2	4
Need for Exercise Prescription (Out of 5)	4.6	4	5
Feasibility of Prescribing Exercise (Out of 5)	3.6	1	5
Current Exercise Prescription Habits (Out of 5)	3.8	2	5

*Knowledge values are calculated based on the total number of correct answers of questions 4-11 on the pre-test.

Post-test

Like the pre-test, all questions were answered on the post-test by each participant. The same eight multiple choice questions on the pre-test assessing knowledge were also on the post-test. For each participant, the total number of correct answers out of eight were counted. The average number of correct answers out of ‘8’ was ‘7.6’ with ‘8’ being the most correct answers and ‘7’ being the fewest. Self-rated knowledge, comfortability, need for exercise prescription, and feasibility were measured with the same questions and five-point Likert scales as the pre-test for each outcome measurement respectively. Between the five participants, the mean, min, and max values for the different outcome measurements are as follows: self-rated knowledge (mean

3.4, min 3, max 4), comfortability (mean 3.6, min 3, max 5), need for exercise prescription (mean 4.6, min 4, max 5), and feasibility (mean 4.2, min 3, max 5). Satisfaction of the educational intervention was measured through questions 13-18 of the post-test covering satisfaction with content of the intervention, layout of the PowerPoint presentation, length of the presentation, content and layout of the surveys, in-person presentation as opposed to an online, asynchronous presentation, and whether or not the intervention was useful in improving knowledge. These questions also used a five-point Likert scale. The values of questions 13-18 were averaged to produce an overall satisfaction outcome measurement. The mean, min, and max of the overall satisfaction with the intervention was '4.4,' '4,' and '5' respectively. These results are summarized in Table 2.

TABLE 2. *Post-test results.*

	Mean	**Min**	**Max**
Knowledge* (Out of 8)	7.6	7	8
Self-Rated Knowledge (Out of 5)	3.4	3	4
Comfortability with Prescribing Exercise (Out of 5)	3.6	3	5
Need for Exercise Prescription (Out of 5)	4.6	4	5
Feasibility of Prescribing Exercise (Out of 5)	4.2	3	5
Satisfaction with Educational Intervention** (Out of 5)	4.4	4	5

*Knowledge values are calculated based on the total number of correct answers of questions 1-8 on the post-test.
**Satisfaction values are calculated based the average values of questions 13-18 on the post-test.

Free Text Responses

Also, as part of the post-test, there was area to allow for free text responses. Out of five, only one participant gave a free text response. The response stated, "I already prescribe exercise, but I learned some specifics here that I will use. Thanks!"

Comparison

To complete the data analysis of this QI project, a comparison of the common outcome measurements of the pre-test and post-test was performed. A comparison of means, max, and min values can be seen in Figure 5, Figure 6, and Figure 7 respectively. The difference between the post-test and pre-test mean, max, and min values for the various outcome measurements are as follows: knowledge (mean 1.4, min 2, max 1), self-reported knowledge (mean 0.6, min 1, max 1), comfortability (mean 0.8, min 1, max 1), need for exercise prescription (mean 0, min 0, max 0), and feasibility (mean 0.6, min 2, max 0).

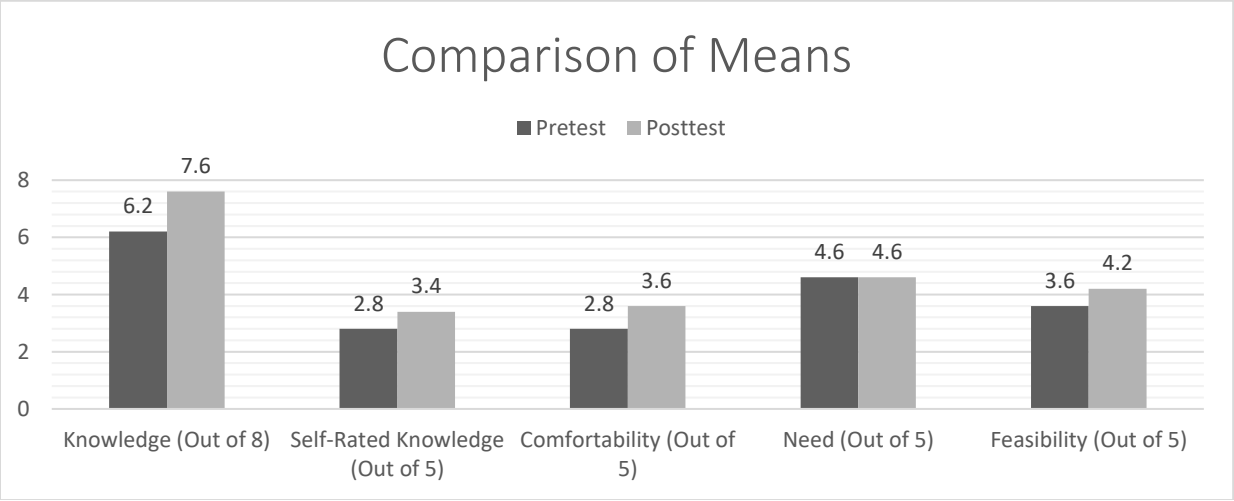

FIGURE 5. Comparisons pre-test and post-test means in different outcome measurements.

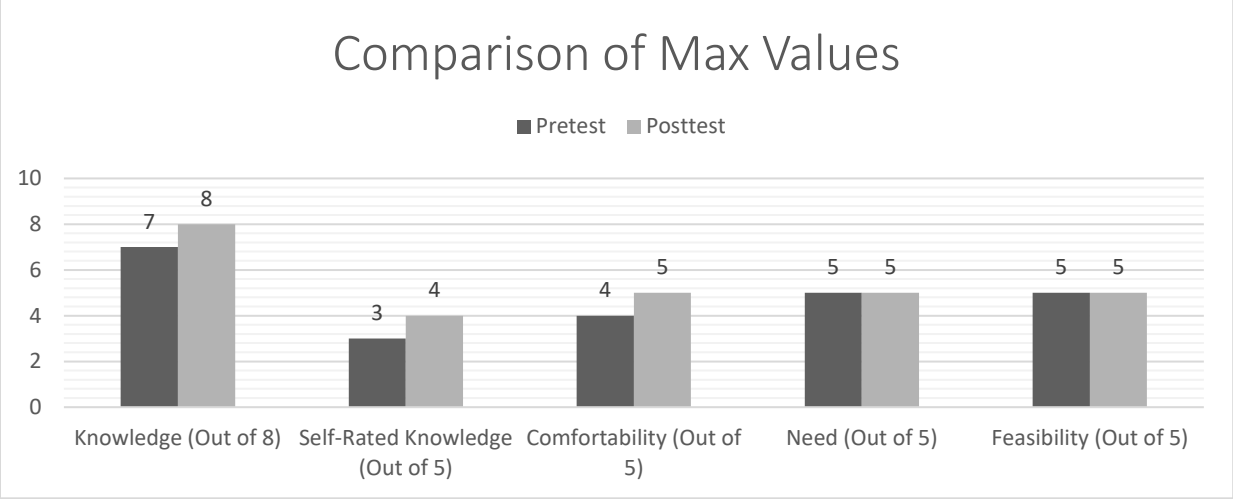

FIGURE 6. Comparisons pre-test and post-test max values in different outcome measurements.

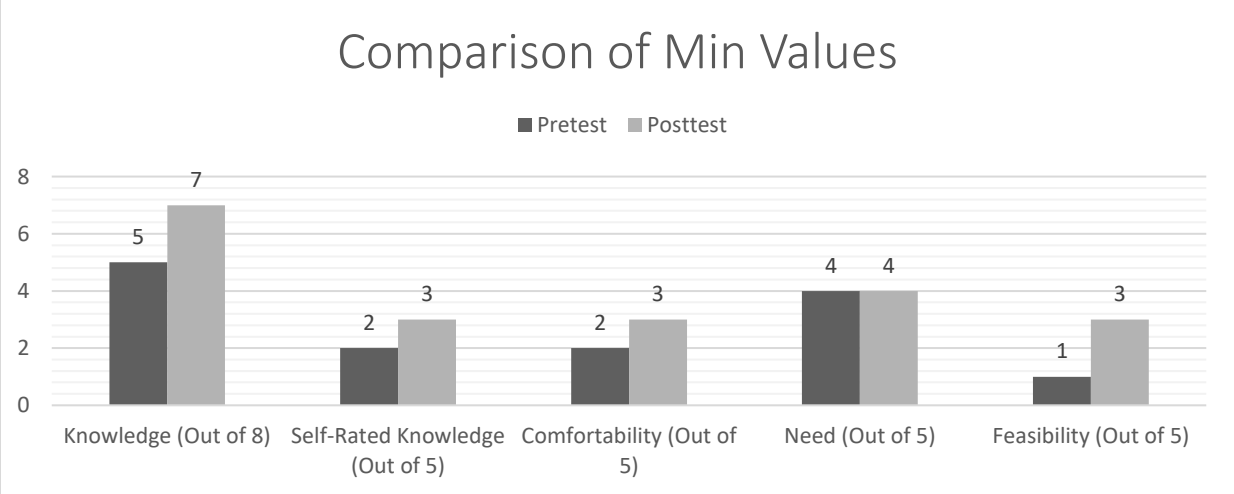

FIGURE 7. Comparisons pre-test and post-test min values in different outcome measurements.

The differences from the pre-test to the post-test were all positive. These differences represent the following percent improvements in mean, min, and max values in the following outcome measurements: knowledge (mean 22.58%, min 40%, max 14.29%), self-reported knowledge (mean 21.43%, min 50%, max 33.33%), comfortability (mean 28.57%, min 50%, max 25%), need for exercise prescription (mean 0%, min 0%, max 0%), and feasibility (mean 16.67%, min 200%, max 0%). These percentage increases are organized in Table 3.

TABLE 3. *Percentage of improvement.*

	Mean (%)	Min (%)	Max (%)
Knowledge*	22.58	40	14.29
Self-Rated Knowledge	21.43	50	33.33
Comfortability with Prescribing Exercise	28.57	50	25
Need for Exercise Prescription	0	0	0
Feasibility of Prescribing Exercise	16.67	200	0

*Knowledge values are calculated based on the total number of correct answers of questions 4-11 on the pre-test and 1-8 on the post-test.

DISCUSSION

As stated previously, the purpose of this QI project was to improve provider knowledge on exercise recommendations and on how to write exercise prescriptions, increase provider's intent and feasibility for prescribing exercise, and evaluate satisfaction with the content and delivery of the educational intervention at a primary care clinic. Therefore, an educational PowerPoint on exercise prescription for overweight and obese adults and an exercise prescription template were presented to five primary care providers during a medical staff meeting. Each participant filled out a pre-test and post-test, and the results of these surveys and the QI project are discussed below.

Participants and Variables

Participants

Physicians, physician assistants, and nurse practitioners were all represented in this QI project. However, out of the five participants, the majority of them were physicians (n=3). Furthermore, three out of the five participants had been practicing in their current role for more than 15 years. The other two participants had been practicing for 6-10 years. This demonstrates that the sample used in this project should have a strong base of clinical knowledge. Additionally, more than one age group was represented in this project's sample; three aged 36-50

years old, and two aged 51-65 years old. Along with the different professional titles and years of experience, this too adds diversity to this project's sample.

Knowledge

Knowledge was assessed on both the pre-test and post-test. The results can be observed above in the results section. Remarkably, after the educational intervention there was an increase of 1.4 in the average number of correct answers representing a 22.58% increase. Furthermore, all participants improved from the pre-test to the post-test. On the pre-test, the lowest number of correct answers out of '8' was '5,' but on the post-test, this value increased to '7.' These increases in values confirm that an in-person, educational PowerPoint presentation is effective in increasing provider knowledge on exercise prescription for overweight and obese adults.

Self-rated Knowledge

Likewise, self-rated knowledge also improved after the educational intervention was carried out. The average self-rated knowledge reported on the pre-test was '2.8' out of '5' which correlates to a self-rated knowledge of somewhere between *novice* and *some experience*. Interestingly, the average self-rated knowledge on the post-test was '3.4' which represents a 21.43% increase. Since the average values for self-rated knowledge improved in addition to real knowledge, which is discussed above, this suggests that the intervention used in this project is not only effective at increasing real knowledge of exercise recommendations and prescriptions, but it also makes the providers feel more confident and knowledgeable.

Comfortability

Yet another area of improvement was seen in self-rated comfortability with prescribing exercise. The average reported pre-test score was '2.8' out of '5' while the post-test score was

‘3.8’ representing a self-rated comfortability that went from *neutral* towards becoming *very comfortable* on the five-point Likert-scale provided on the surveys. This correlates with a 28.57% increase in the average self-rated comfortability. This suggests that this QI project is also effective at improving providers’ comfortability with exercise prescription and recommendations for overweight and obese adults.

Need

Surprisingly, one outcome measurement that did not improve on the post-test was a sense of the need for exercise prescription for overweight and obese adults. Interestingly, unlike the other outcome measures, all values were either a ‘4’ or ‘5’ on a five-point Likert-scale. This suggests that all of the participants felt either *very strongly* or somewhere between *neutral* and *very strongly* regardless of the educational intervention presented during this QI project. This consensus may be due to possible sample bias with only providers who have interest in the subject matter attending the meeting, or it is possible that actions may be lagging behind their beliefs due to unknown barriers.

However, either way, it is interesting that even though all of the providers *agree strongly* that there is a need for prescribing exercise to the patient population of interest, their pre-test self-rated knowledge was relatively low. Additionally, even though participants felt strongly about the need for exercise prescription, the average self-reported exercise prescription habits were a 3.8 on a five-point Likert-scale. The strong belief that there is a need amongst all participants is starkly juxtaposed to a minimum self-reported use of exercise prescription, discussed below, of ‘2’ on a five-point Likert-scale which suggests that that participant utilized exercise prescription for overweight and obese adult patients somewhere between *never* and

sometimes. This brings to question, if there is consensus that there is a need, then shouldn't exercise prescriptions be furnished to all overweight and obese adult patients? Further research may be needed to determine barriers that are preventing the use of exercise prescription.

Feasibility

Another outcome measure that was addressed in both the pre-test and post-test was whether or not the use of exercise prescriptions is feasible in the participant's current practice. Like knowledge and comfortability, improvements were seen in the feasibility of using exercise prescriptions for overweight and obese adults after the educational intervention was presented. The average post-test five-point Likert-scale score was '4.2' (which is a 0.6 of a point increase representing a 16.67% improvement). However, more impressively, one participant rated the feasibility of using exercise prescriptions on the pre-test as a one which correlates to an answer of *absolutely not*. This min value greatly improved in the post-test with the lowest five-point Likert-scale score being '3' which correlates to an answer of *it's possible*. These results suggest that the educational intervention and prescription handout presented in this QI project can be useful in helping convince primary care providers that exercise prescriptions are not only needed for overweight and obese adult patients, but their use is feasible in their current practice.

Current Prescription Habits

Unlike the previous outcome measures discussed, current exercise prescription habits were only addressed in the pre-test. The average five-point Likert-scale score was 3.8 which correlates to a score of somewhere between the use of exercise prescription habits *sometimes* and *every time*. For this particular outcome measure, the range of scores was great with the minimum being '2,' which is in-between *never* and *sometimes*, and '5,' which is *every time*. This result is

not surprising alone as individual practice habits often vary from provider to provider, but as discussed above, when juxtaposed to the self-reported need for exercise prescription, the fact that all of the providers are not using exercise prescriptions for overweight and obese adults is surprising. The consensus about the need for exercise prescriptions is clear. However, as demonstrated by this outcome measure, actual use of exercise prescriptions for overweight and obese adults may be lacking in some practices.

Satisfaction

The final outcome measure addressed in this QI project is satisfaction with the educational intervention and exercise prescription template. This outcome measure was assessed in just the post-test through six different five-point Likert-scale questions. The average score of was '4.4' with a minimum score of '4' and maximum score of '5.' These values suggest that the overall satisfaction with the layout and presentation of the educational presentation and exercise prescription template was high. Furthermore, for this sample population, these values suggest that an in-person format is preferred over an online, asynchronous presentation. Since satisfaction with the intervention was high, limited changes should be made in future implementation.

Free Text Responses

As for the free text responses, only one was provided, which was positive. This comment was surprising in the fact that even though the participant who left the comment has been actively using exercise prescriptions in their current practice, they were still able to take away new information on exercise recommendations and prescription that they can implement in their practice. This suggests that this QI project may even be useful in provider populations that

already have some clinical experience with exercise prescriptions in addition to those who have relatively little experience.

Comparison with Current Literature

Interestingly, the results of this QI project align well with previous literature on the effectiveness of continuing education given to primary care providers on improving knowledge and other attributes with relation to exercise prescription. Like other studies, which are noted in the background and synthesis of evidence sections of this paper, this QI project found that a brief educational intervention was successful in improving actual knowledge and self-rated knowledge (Nguyen et al., 2010; Dreisbach et al., 2011).

This QI project also addressed self-reported exercise prescription habits, comfortability with exercise prescription and guidelines, feasibility of using exercise prescription in their current practice, the self-rated need for exercise prescription for overweight and obese adults, and the satisfaction with an in-person PowerPoint presentation versus an asynchronous, online presentation. Many of these issues are not well addressed in current literature making this QI project important as it helps fill in gaps of knowledge in the literature. However, when compared with the limited research that was found, which is briefly discussed in the background section of this paper, this QI project aligns nicely. The following findings in this QI project were also found in other literature: there is a general lack of confidence and knowledge with exercise prescription and recommendations and provider education can improve attitudes, skills, and confidence with exercise prescription (O'Brien et al., 2017; Hootman et al., 2018; Bauer et al., 2010, Marinopoulos et al., 2007; Jones et al., 2013; Joyce & O'Tuathaigh, 2014).

Strengths and Limitations

This QI project had many strengths. First of all, it was tailored to the education and QI practices that have already taken place at the organization where this project was implemented. This organization has already began working with their primary care providers on exercise counseling and prescription creating good buy-in from the participants and management. However, much of their education prior to this QI project focused on community resources. This project helped fill their gaps of knowledge by providing more specifics on how to prescribe exercise to overweight and obese adult patients. Secondly, this QI project was presented at a medical staff meeting where the participants already had an obligation to be there. This is a strength of this project as it allowed the providers to participate without taking more time out of their busy schedules, as well as demonstrated clinic commitment to professional development and improving patient care.

Unfortunately, even though all primary care providers were invited via email, there was good buy-in from the primary care providers at the organization, and it was presented at a time that was convenient to them, the sample size was relatively small. It is difficult to know why the sample size was small as it may be multifactorial. Further research would be needed to understand the barriers that prevented other primary care providers from attending. Furthermore, this QI project was limited to only focusing on exercise prescriptions for otherwise healthy, overweight and obese adults. This included patients who are greater than or equal to 18 years old and have a BMI of 25kg/m^2 to 40kg/m^2, but it excluded patients who have comorbid conditions that may inhibit full participation in physical activity such as morbid obesity, severe heart disease, severe joint malfunction, lung disease, and kidney failure.

Conclusion

Overall, the most important finding of this QI project is that the brief educational intervention and exercise prescription template presented was found satisfactory and improved provider's actual knowledge, self-rated knowledge, comfortability, and feasibility of utilizing exercise prescription for overweight and obese adult patients seen in primary care.

Recommendations

Therefore, since this QI project was relatively successful, another round of the PDSA cycle is recommended. Within this PDSA cycle, the organization should: (1) expand the presentation's reach by offering it to other outpatient settings that care for overweight and obese adults, (2) invite providers with a multifaceted approach using email, handouts, and posters, (3) perform a retrospective study looking at charts for documentation of providing an exercise prescription, assessing post-intervention knowledge retention, and assessing the actual use of exercise prescriptions by counting the number of prescription used, and (4) place the exercise prescription templates provided during this QI project in every exam room for easy access. In order to carry out these recommendations, there will need to be a champion. This champion will most likely be the head of QI at this healthcare organization which is the DON. However, the DON may want to consider appointing an expert on exercise such as a physical therapist or exercise specialist to present the presentation to the other specialties. The QI project champion will also need to acquire a team to help develop PQRST cycles and retrospective studies.

Concluding Remarks

In conclusion, the overweight and obesity epidemic is a major health concern, and it is only projected to get worse (Hruby & Hu, 2016). Unfortunately, evidence suggests that the

management of this condition is lacking. Even though weight loss and obesity management are well documented benefits of physical activity and exercise, less than half of obese adults seen by their healthcare provider in a 12-month span are counseled about physical activity, and there is general lack of knowledge about physical activity and its prescription among health care providers (ODPHP, 2018a; Barnes & Schoenborn, 2012; Hootman et al., 2018; Bauer et al., 2010).

In order to address these issues at an organizational level, this QI project included a brief educational intervention and an exercise prescription template given to primary care providers on exercise prescription for otherwise healthy, overweight and obese adults at a local healthcare organization in a mostly rural, northwestern part of the United States. Not only was the implementation and layout of the presentation and template used in this project found satisfactory, but this project also improved actual knowledge, self-rated knowledge, comfortability, and feasibility of utilizing exercise prescription. Addressing exercise prescription in this healthcare institution is the first step in addressing the local, state, and national overweight and obesity epidemics.

APPENDIX A:

PRE-TEST

Pre-Test

1. What age group are you in?
    a. 20-35 years old
    b. 36-50 years old
    c. 51-65 years old
    d. >65 years old
    e. Do not wish to answer

2. How many years have you been practicing as a healthcare provider?
    a. <1 year
    b. 1-5 years
    c. 6-10 years
    d. 11-15 years
    e. >15 years

3. What most accurately describes your current job title?
    a. Nurse Practitioner
    b. Physician Assistant
    c. Physician

4. How many minutes of moderate-intensity, aerobic activity is currently recommended by the Office of Disease Prevention and Health Promotion (ODPHP) guidelines?
    a. 200 minutes/week
    b. 150 minutes/week
    c. 300 minutes/week
    d. 250 minutes/week

5. According to the ODPHP guidelines, how much vigorous-intensity, aerobic activity is needed to produce similar health benefits of moderate-intensity aerobic activity?
    a. It takes half as much of vigorous activity to produce similar health benefits
    b. It takes the same amount of vigorous activity to produce similar health benefits
    c. It takes one-third as much of vigorous activity to produce similar health benefits

d. It takes one-quarter as much of vigorous activity to produce similar health benefits

6. According to the ODPHP guidelines, how many days of resistance exercise should be performed per week?
    a. 1 day/week
    b. 3 days/week
    c. This is not addressed in the current guidelines
    d. 2 days/week

7. What three aspects should be included in all **aerobic** exercise prescriptions?
    a. Intensity, repetitions, and frequency
    b. Intensity, duration, and frequency
    c. Repetitions, sets, and frequency
    d. Aerobic exercise prescriptions should only address duration

8. What three aspects should be included in all **resistance** exercise prescriptions?
    a. Resistance exercise prescriptions should only address duration
    b. Intensity, duration, and frequency
    c. Repetitions, duration, and frequency
    d. Intensity, frequency, and repetitions/sets

9. What is/are the most important factor(s) in improving physical activity tolerance and maximizing its benefits?
    a. Overload
    b. Progression
    c. Specificity
    d. All of the above

10. Which of the following is an example of a moderate-intensity aerobic activity?
    a. Brisk walking
    b. Swimming laps
    c. Hiking uphill with a heavy backpack
    d. Jogging

11. Which of the following is an example of a vigorous-intensity aerobic activity?

    a. Jogging/Running
    b. Water Aerobics
    c. General gardening
    d. Bicycling less than 10 mph

12. How would you rate your knowledge on current physical activity guidelines?

1	2	3	4	5
Novice		Some Experience		Expert

13. How comfortable are you prescribing exercise to overweight and obese adults?

1	2	3	4	5
Very Uncomfortable		Neutral		Very Comfortable

14. With regards to overweight and obese adults, how frequently do you prescribe exercise?

1	2	3	4	5
Never		Sometimes		Every time

15. How do you feel about the need to prescribe exercise for overweight and obese adults?

1	2	3	4	5
Very Poorly		Neutral		Very Strongly

16. Is prescribing exercise to overweight and obese adults feasible in your current practice?

1	2	3	4	5
Absolutely Not		It’s Possible		Absolutely

APPENDIX B:

POST-TEST

Post-Test

1. How many minutes of moderate-intensity, aerobic activity is currently recommended by the Office of Disease Prevention and Health Promotion (ODPHP) guidelines?
    a. 200 minutes/week
    b. 150 minutes/week
    c. 300 minutes/week
    d. 250 minutes/week

2. According to the ODPHP guidelines, how much vigorous-intensity, aerobic activity is needed to produce similar health benefits of moderate-intensity aerobic activity?
    a. It takes half as much of vigorous activity to produce similar health benefits
    b. It takes the same amount of vigorous activity to produce similar health benefits
    c. It takes one-third as much of vigorous activity to produce similar health benefits
    d. It takes one-quarter as much of vigorous activity to produce similar health benefits

3. According to the ODPHP guidelines, how many days of resistance exercise should be performed per week?
    a. 1 day/week
    b. 3 days/week
    c. This is not addressed in the current guidelines
    d. 2 days/week

4. What three aspects should be included in all **aerobic** exercise prescriptions?
    a. Intensity, repetitions, and frequency
    b. Intensity, duration, and frequency
    c. Repetitions, sets, and frequency
    d. Aerobic exercise prescriptions should only address duration

5. What three aspects should be included in all **resistance** exercise prescriptions?
    a. Resistance exercise prescriptions should only address duration
    b. Intensity, duration, and frequency
    c. Repetitions, duration, and frequency

d. Intensity, frequency, and repetitions/sets

6. What is/are the most important factor(s) in improving physical activity tolerance and maximizing its benefits?
    a. Overload
    b. Progression
    c. Specificity
    d. All of the above

7. Which of the following is an example of a moderate-intensity aerobic activity?
    a. Brisk walking
    b. Swimming laps
    c. Hiking uphill with a heavy backpack
    d. Jogging

8. Which of the following is an example of a vigorous-intensity aerobic activity?
    a. Jogging/Running
    b. Water Aerobics
    c. General gardening
    d. Bicycling less than 10 mph

9. How would you rate your knowledge on current physical activity guidelines?

1	2	3	4	5
Novice		Some Experience		Expert

10. How comfortable are you prescribing exercise to overweight and obese adults?

1	2	3	4	5
Very Uncomfortable		Neutral		Very Comfortable

11. How do you feel about the need to prescribe exercise for overweight and obese adults?

1	2	3	4	5
Very Poorly		Neutral		Very Strongly

12. Is prescribing exercise to overweight and obese adults feasible in your current practice?

1	2	3	4	5
Absolutely Not		It's Possible		Absolutely

13. How satisfied were you with the contents and information in the presentation?

1	2	3	4	5
Very Unsatisfied		Neutral		Very Satisfied

14. How satisfied were you with the PowerPoint layout and how it was presented?

1	2	3	4	5
Very Unsatisfied		Neutral		Very Satisfied

15. How satisfied were you with the length of the presentation?

1	2	3	4	5
Very Unsatisfied		Neutral		Very Satisfied

16. How satisfied were you with the format and content of this survey?

1	2	3	4	5
Very Unsatisfied		Neutral		Very Satisfied

17. Do you agree or disagree with the following statement: “An in-person presentation of this PowerPoint is superior to an online, asynchronous format?”

1	2	3	4	5
Strongly Disagree		Neutral		Strongly Agree

18. Do you agree or disagree with the following statement: “This presentation was useful in improving my knowledge on exercise guidelines and prescription?”

1	2	3	4	5
Strongly Disagree		Neutral		Strongly Agree

Comments/Suggestions:

_____

_____

_____

_____

_____

_____

APPENDIX C:

DISCLOSURE FORM

DISCLOSURE FORM

Introduction
My name is Eric Sievers from the University of Arizona. I am a doctorate of nursing practice student in a family nurse practitioner program. To meet the requirements of my doctorate of nursing practice degree, I am required to perform a quality improvement project.

Purpose of Project
The purpose of this project is threefold: (1) improve provider knowledge on exercise recommendations and on how to write exercise prescriptions, (2) increase provider's intent and feasibility for prescribing exercise, and (3) evaluate satisfaction with the content and delivery of this educational intervention. The goal is to increase compliance with evidence-based recommendations regarding exercise to improve the health status of clinic patients, including decreasing risks associated with overweight and obesity.

Why are you being asked to participate?
You are being invited to participate in this project since you are healthcare providers that provide care for overweight and obese adults. I would like to determine if a brief educational presentation on exercise and its prescription can improve your comfortability and knowledge on this subject matter.

Description of the project:
This project entails a survey given just prior to a brief presentation and another survey given immediately after the presentation. In these surveys, there will be minimal demographic questions, a few multiple-choice questions to assess knowledge, and a few rating scale questions to assess self-perceived knowledge and comfortability. Additionally, the survey given after the presentation will assess satisfaction with this project. All data will be summarized and reported back to the clinic making sure no personal identifying information is shared.

As for the presentation, it will take 10-15 minutes and will discuss the benefits of exercise, current recommendations, and how to prescribe it. Furthermore, an exercise prescription template will be given to you to aid your future practice of prescribing exercise.
The results of this project will:

1. Help us better understand the knowledge gaps associated with exercise prescription in primary care.
2. Help us determine if a brief educational intervention can improve knowledge and comfortability.
3. Help refine the brief educational intervention so it can be more effective with future use.

Are there any risks?
The risks of participating in this project are minimal. The survey is completely anonymous and only a summary of the findings will be shared. Furthermore, this project is being reviewed by the University of Arizona Institutional Review Board and the Great Falls Clinic to be sure participants are protected.

What are the benefits?
The benefits of the study will be to improve primary care provider knowledge and comfortability with exercise prescriptions. Additionally, this project may also indirectly improve patient care and outcomes by improving the management of obesity.

The study is voluntary
By completing the surveys, you are agreeing to participate in this quality improvement project. However, you may decide not to participate or stop participating at any time.

Questions
If you have any questions or concerns, please contact Eric Sievers, BSN, DNP-FNP student by email at esievers@email.arizona.edu.

APPENDIX D:

LETTER OF SUPPORT

April 10, 2018

University of Arizona
Human Subjects Protection Program
1615 E. Helena St.
P.O. Box 245137
Tucson, AZ 85724

Dear Human Subjects Protection Program Members:

This is to certify that Eric Sievers, BSN, DNP-FNP Student has permission to perform a quality improvement project entitled "Improving Primary Care Providers' Knowledge and Intent to Prescribe Exercise for Overweight and Obese Adults." For this project, Mr. Sievers has permission to conduct an assessment of primary care providers' intent to prescribe and knowledge on exercise and to implement a brief educational presentation about exercise and exercise prescriptions at Great Falls Clinic for partial fulfillment of the requirements for the Doctorate of Nursing Practice degree at the University of Arizona College of Nursing.

For this project, Mr. Sievers has been granted full, unrestricted access to the clinical site and medical staff meetings from May 2018 to May 2019. This project will be physically conducted at the Great Falls Clinic located at 1400 29th St. South, Great Falls, MT 59405. However, healthcare providers from other primary care sites in Great Falls, MT may be included.

I understand that Mr. Sievers will be conducting this project with IRB approval from the University of Arizona.

Sincerely,

Lori Henderson, DON
Director of Nursing

APPENDIX E:

INVITATION AND DISCLOSURE EMAIL

Invitation and Disclosure Email

*Email will be sent by the DON to all primary care providers at Great Falls Clinic, Great Falls, MT.

Hello All!

YOU ARE ALL INVITED!!!

At this month's medical staff meeting, there will be a brief quality improvement project with a PowerPoint on prescribing exercise to otherwise healthy overweight and obese adults in a primary care setting. Additionally, there will be brief pre- and post-surveys. In total, the project will take 20-30 minutes and will be presented by Eric Sievers, a DNP-FNP student through the University of Arizona. So, please, join us in supporting Eric; there is a lot of great information to learn here! If you have any questions, please feel free to contact me or email Eric Sievers at esievers@email.arizona.edu

I look forward to seeing you all there!

Lori Henderson, DON
Director of Nursing

*The disclosure form will be attached to this email in PDF form.

APPENDIX F:

DETAILED POWERPOINT OUTLINE

Detailed PowerPoint Outline

Slide 1
- Title and Introduction

Slide 2
- Overview and Objectives of the PowerPoint

Slide 3
- Definition of aerobic and resistance exercise

Slide 4
- Define moderate and vigorous intensity aerobic activity
- List examples of moderate and vigorous intensity aerobic exercise

Slide 5
- Benefits of physical activity and supporting literature

Slide 6
- Benefits of physical activity and supporting literature

Slide 7
- Benefits of exercise prescription and supporting literature

Slide 8
- How to perform squat and pushup with physical demonstration from presenter

Slide 9
- How to perform row and deadlift with physical demonstration from presenter

Slide 10
- How to perform shoulder press with physical demonstration from presenter

Slide 11
- List common household items and community resources that can be used for physical activity

Slide 12
- Current aerobic exercise recommendations

Slide 13
- Current resistance exercise recommendations

Slide 14
- Description on what needs to be included in an exercise prescription
- Introduce exercise prescription template

Slide 15
- Description on what needs to be included in an exercise prescription
- Guide participants in filling out exercise prescription template

Slide 16
- Description on what needs to be included in an exercise prescription
- Guide participants in filling out exercise prescription template

Slide 17
- Description on what needs to be included in an exercise prescription
- Guide participants in filling out exercise prescription template

Slide 18

- Conclusion

Slide 19

- References

APPENDIX G:

SYNTHESIS OF EVIDENCE RESULTS

Evidence Appraisal Table

Reference	Research Question/ Objective	Study Design and Intervention	Sample and Setting	Methods for Data Collection and Data Analysis	Findings
Balachandran, A., Krawczyk, S., Potiaumpai, M., & Signorile, J. (2014). High-speed circuit training vs hypertrophy training to improve physical function in sarcopenic obese adults: A randomized controlled trial. *Experimental Gerontology, 60*, 64-71. doi:10.1016/j.exger.2014.09.016	Is high-speed circuit training more effective than conventional strength/hypertrophy training in improving neuromuscular performance, body composition and IADL function in sarcopenic obese individuals?	**Design:** 15-week randomized, controlled, single-blind study **Intervention:** 15 weeks, twice a week full body workouts using either strength training (SH) or high-speed circuit (HSC) training	**Sample:** 21 sarcopenic obese adults aged 60 yrs. or older **Setting:** Controlled environment at a workout facility	Pre- and post-test data were collected by blinded personnel through measurement of a Short Physical Performance Battery (SPPB); peak power in chest and leg press, body fat percentage, physical function performance test scores, dynamometer measurements, and ratings of perceived exertion (RPE) were also collected. ANCOVA used for statistical analysis.	HSC was found to be superior to SH in improved SPPB showing a moderate effect. (1.1, 95% CI (−.1 to 2.4), p = .08, Hedge g = 0.6, 95% CI (−0.4, 1.6)). Improvement in lower body power (95% CI (2, 315); p = .01) and RPE (95% CI (−2.9, −0.12); p = .04) also was greater in HSC. There was no significant difference in peak power in the upper body, strength in lower and upper body, physical function performance test scores, and body fat percentage.
Berggren, E., Orrevall, Y., Olin, A., Strang, P., Szulkin, R., & Törnkvist, L. (2016). Evaluation of a continuing educational intervention for primary health care professionals about nutritional care of patients at home. *The Journal of Nutrition, Health, & Aging, 20*(4), 428-438. doi:10.1007/s12603-015-0596-7	Is a continuing educational intervention given to primary health care professionals' effective in improving familiarity with information important to nutritional care during a palliative phase, collaboration, and their level of knowledge about nutritional care?	**Design:** Observational cohort study **Intervention:** A web-based program which entails factual knowledge, a practical clinical based exercise, and a case seminar	**Sample:** 140 nurses and general practitioners working in home health **Setting:** 10 primary care facilities in Sweden	Data was collected via a computer-based pre and post-test composed of 14 familiarity statements, 4 collaboration statements, and 14 level of knowledge questions. Wilcoxon signed-rank test to compare intergroup pre- and post-test results, and a Wilcoxon rank-sum test was used to compare the intervention and control group.	In the intra-group analyses, significant improvement occurred in 28 out of 32 questions in the intervention group and only 4 out of 32 questions in the control group. The inter-group analyses showed significant effects in 20 of the 32 questions with improvements in all of the familiarity and collaboration questions but only 2 of the knowledge questions. The intervention effect was between 2.5 and 12.0 for these tests.
Dombrowski, S., Knittle, K., Avenell, A., Araújo-Soares, V., & Sniehotta, F. (2014). Long term maintenance of	To systematically review, determine effectiveness of, and describe interventions used for weight loss	**Design:** Systematic review with meta-analysis **Intervention:** N/A	**Sample:** Randomized trials published through January	Potential studies were screened independently and data were extracted. An inverse variance method and a random effects	Diet and physical activity behavioral interventions resulted in a -1.56kg weight loss at 12 months (95%

Reference	Research Question/ Objective	Study Design and Intervention	Sample and Setting	Methods for Data Collection and Data Analysis	Findings
weight loss with non-surgical interventions in obese adults: Systematic review and meta-analyses of randomized controlled trials. *BMJ, 348*(g2646). https://doi.org/10.1136/bmj.g2646	maintenance interventions for obese adults.		2014 involving weight loss maintenance interventions for obese adults and having long-term follow-up; 45 trials involving 7788 individuals were included **Setting:** N/A	model was used for the meta-analysis to determine the effect of the interventions. Results are mean differences in weight change, with 95% confidence intervals. m	confidence interval −2.27 to −0.86 kg; 25 comparisons, 2949 participants). Pharmacotherapy with orlistat combined with behavioral interventions resulted in a −1.80 kg weight loss at 12 months (−2.54 to −1.06; eight comparisons, 1738 participants), but all orlistat studies gastrointestinal events in the experimental groups. A dose of 120 mg of orlistat three times a day was found to produce greater weight loss maintenance (−2.34 kg, −3.03 to −1.65) compared to doses of 60 mg and 30 mg at the same frequency (−0.70 kg, 95% confidence interval −1.92 to 0.52) (p=0.02).
Dreisbach, S., Devine, S., Fitch, J., Anderson, T., Lee, T., Rietmeijer, C., & Corbett, K. Can experiential-didactic training improve clinical STD practices? *Sexually Transmitted Diseases, 38*(6), 516-521. doi:10.1097/OLQ.0b013e3182045306	To assesses the effectiveness of a 3-day experiential and didactic training intervention in increasing provider knowledge, skills, and ability to anticipate and overcome barriers to implementation	**Design:** Observational cohort study **Intervention:** A standardized 3-day educational course created by the Denver STD/human immunodeficiency virus (HIV) Prevention Training Center	**Sample:** 110 direct care clinicians **Setting:** Direct care facilities in 10 different states	Knowledge and skills were measured before, immediately after, and 6 months after the using a pre- and post-test survey with knowledge questions and self-reported clinical skill. Self-reported practice patterns were assessed before training and after 6 months. Data on barriers were collected at 6 months post-training. Paired *t* tests were used to compare post-test means and a nonparametric Wilcoxon rank sign was used to analyze 12 matching responses.	An increase in knowledge was seen immediately post-training ($p < 0.001$) and at 6-month follow-up ($p = 0.002$). Self-reported mean skill levels also remained improved compared to pre-test levels ($p < 0.05$). Self-reported practice patterns improved for 23 of 35 practices at 6-month follow-up ($p < 0.05$). Barriers to implementation that were found include: inadequate time (52.9%), facilities/equipment (51.5%), and staffing (47.1%).

Reference	Research Question/ Objective	Study Design and Intervention	Sample and Setting	Methods for Data Collection and Data Analysis	Findings
Drenowatz, C., Hand, G., Sagner, M., Shook, R., Burgess, .S., & Blair, S. (2015). The prospective association between different types of exercise and body composition. *Medicine Science in Sports and Exercise, 47*(12) 2535-2541. doi:10.1249/MSS.0000000000000701	To examine the effect of different exercise types on various anthropometric measures	**Design:** Observational cohort study **Intervention:** General physical activity including sports, cycling, running, swimming, aerobics/group exercise, upper body resistance exercise, lower body resistance exercise and other forms of structured physical activity	**Sample:** 348 healthy weight, overweight, and obese young adults without chronic conditions **Setting:** Community-based	Participants were from an ongoing observational study which had data over a 12-month period. Participants self-reported time and frequency of types of physical activity (aerobic, strength training, or other physical activity) every 3 months. Anthropometric measures were collected every 3 months for 1 year. Fat mass (FM) and lean mass (LM) were measured via dual x-ray absorptiometry. Body fat percentage (BF) helped differentiate normal fat, over fat, and obese participants.	93% of participants reported at least some physical activity during the observation period. After adjusting for variables, total exercise and specific types of exercise did not affect BMI. However, resistance exercise improved lean mass ($p<0.01$) and fat mass ($p<0.01$), while aerobic exercise improved fat mass ($p<0.01$). In normal fat individuals, all exercise types improved lean mass ($p<0.04$). In overfat and obese participants, an improvement in fat mass was seen with resistance exercise ($p\leq0.02$) but not with aerobic exercise ($p\geq0.09$).
Grandes, G., Sanchez, A., Montoya, I., Ortega Sanchez-Pinilla, R., Torcal, J. (2011). Two-year longitudinal analysis of a cluster randomized trial of physical activity promotion by general practitioners. *PLoS One, 6*(3), doi:10.1371/journal.pone.0018363	To determine the effectiveness of a physical activity promotion program carried out by general practitioners with inactive patients in primary care.	**Design:** Longitudinal analysis of a cluster randomized clinical trial (24-month follow-up) **Intervention:** Physical activity advice given to a systematic sample of patients and exercise prescriptions given to 30% of this sample	**Sample:** 3691 adults who were found to not meet physical activity guidelines **Setting:** 11 primary care clinics in Spain	General providers gave physical activity advice based on education that they received in an earlier study to the intervention group. Prescriptions were given to 30% of the participants who had an additional appointment. The control group was given standard advice. Primary outcome measure was self-reported physical activity at baseline to 6 months, 12 months, and 24 months. Secondary outcomes included: cardiorespiratory fitness and quality of life. Linear model analysis and post hoc power calculation was used.	In the intervention group, physical activity trends improved over the whole 24-month follow-up ($p<0.01$). The greatest improvement in the control group was seen at 6-months with 5.3% more of the patients meeting minimum recommendations [95% CI: 2.1% to 8.8%] NNT=19), but this improvement was lost at 12 and 24 months. There were no differences in secondary outcomes. An improvement in meeting minimum physical activity was also observed at 24 months in the group that received a prescription

Reference	Research Question/ Objective	Study Design and Intervention	Sample and Setting	Methods for Data Collection and Data Analysis	Findings
					(adjusted difference 10.2%, 95% CI 1.5% to 19.4%).
Grandes, G., Sanchez, A., Sanchez-Pinilla, R., Torcal, J., Montoya, I., Lizarraga, K., & Serra, J. (2009). Effectiveness of physical activity advice and prescription by physicians in routine primary care: A cluster randomized trial. *Archives of Internal Medicine, 169*(7), 694-701. doi:10.1001/archinternmed.2009.23	To determine the effectiveness of the PEPAF (Experimental Program for Physical Activity Promotion") implemented by physicians in primary care clinics	**Design:** A cluster randomized clinical trial **Intervention:** Physical activity advice given to a systematic sample of patients and exercise prescriptions given to 30% of this sample	**Sample:** 56 Spanish family physicians and 4317 physically inactive patients **Setting:** 11 primary care clinics in Spain	General providers gave physical activity advice based on education that they received in an earlier study to the intervention group. Prescriptions were given to 30% of the participants who had an additional appointment. The main outcome measure was a change in physical activity which was measured by a 7-Day Physical Activity Recall administered by blinded nurses. Secondary outcomes included: cardiorespiratory fitness and quality of life. Linear model analysis and post hoc power calculation was used.	Participants receiving the improved physical activity counseling saw greater improvement in physical activity at 6 months (adjusted difference, 18 min/wk [95% confidence interval, 6-31 min/wk]; metabolic equivalent tasks x hours per week, 1.3 [95% CI, 0.4-2.2]). 3.9% more of the intervention group met minimum physical activity recommendations (1.2%-6.9%; number needed to treat, 26). There were no differences in secondary outcomes. The effect of intervention was greater in participants >50 years old ($p <$ or $= .01$) and in those who received a prescription ($p <$ $.001$).
Heinrich, K., Patel, P., O'Neal, J., & Heinrich, B. (2014). High-intensity compared to moderate-intensity training for exercise initiation, enjoyment, adherence, and intentions: An intervention study. *BMC Public Health, 14*(789). doi:10.1186/1471-2458-14-789	To determine effects of high-intensity functional training (HIFT) as compared to moderate-intensity aerobic and resistance training (ART) on exercise initiation, enjoyment, adherence, and intentions	**Design: S**tratified randomized intervention study **Intervention:** Three training sessions per week for 8 weeks. The ART group completed 50 minutes of moderate aerobic exercise every session and full-body resistance	**Sample:** 23 physically inactive, obese adults **Setting:** At a gym proctored by trained athletic personnel	A pre-test post-test design was used. Questionnaires were composed of questions asking about the reasons for exercise initiation (baseline), exercise enjoyment, and exercise intentions (post-test). Daily workout times were recorded. Body composition was determined by dual-energy x-ray. Qualitative data were analyzed using NVivo, and quantitative data were summarized by chi-square analysis and *t* tests.	Intrinsic reasons were the most common reasons for exercise initiation. Out of the 23 participants, 18 adhered (ART = 9, 81.8%; HIFT = 9, 75%). Those who dropped out had less exercise enjoyment (HIFT;$p = .012$ and ART;$p =$ $.009$). However, enjoyment improved at post-test for the ART group ($p = .005$). More HIFT participants planned to continue exercise compared to the ART participants ($p =$

Reference	Research Question/ Objective	Study Design and Intervention	Sample and Setting	Methods for Data Collection and Data Analysis	Findings
		training on 2 sessions per week. The HIFT group completed 60 minutes of CrossFit™.			.002). No changes in BMI or body composition were found, and workouts were shorter for HIFT than ART ($p < .001$).
Jefferis, B., Parsons, T., Sartini, C., Ash, S., Lennon, L., … Whincup, P. (2016). Does duration of physical activity bouts matter for adiposity and metabolic syndrome? A cross-sectional study of older British men. *The International Journal of Behavioral Nutrition and Physical Activity, 13*(36). doi:10.1186/s12966-016-0361-2	To determine the effect of moderate-vigorous activity, light physical activity, or sedentary behavior, especially in bouts equal to or >10 minutes have on metabolic syndrome and adiposity	**Design:** Cross-sectional design **Intervention:** Wearing an accelerometer on hip measuring physical activity	**Sample:** 1078 men aged 71-91 years old **Setting:** Community based intervention and data collection with recruitment occurring in primary care clinics	Nurses collected anthropometric data including: weight, height, bio-impedance, and blood pressure pre- and post-test. An accelerometer was worn for 7 days by participants with at least three consecutive days having no breaks of 90 or more minutes. Linear and logistic models were used to assess association between different physical activity and anthropometric measures.	Participants spent an average of 612 minutes being sedentary (SD 83), 202 minutes of light physical activity (SD 64), and 42 minutes of moderate-vigorous physical activity (SD 33). Every 30 min/day of sedentary behavior increased BMI by 0.32 Kg/m2 but moderate-vigorous activity decreased BMI by −0.72 Kg/m2. There was no difference in levels of physical activity in waist circumference, fat mass index, fasting insulin and metabolic syndrome.
Keating, S., Hackett, D., Parker, H., O'Connor, H., Gerofi, J., … Johnson, N. (2015). Effect of aerobic exercise training dose on liver fat and visceral adiposity. *Journal of Hepatology, 63*(1), 174-182. doi:10.1016/j.jhep.2015.02.022	To examined the efficacy of commonly prescribed exercise doses for reducing liver fat and VAT.	**Design:** Randomized placebo-controlled design **Intervention:**Eight 8 weeks of either: low to moderate intensity, high volume aerobic exercise, high intensity, low volume aerobic exercise, or low to moderate intensity,	**Sample:** 48 inactive and overweight/obese adults **Setting:** Community with hospital-based testing	Anthropometric measures and both liver fat and VAT were measured pre- and post-test. Randomization of the participants occurred after initial data collection into either one of the three exercise groups or a placebo group that performed stretching, self-massage, and a fit ball program. Normal diets and habits were maintained. ANCOVA and a LSD post hoc test were used to analyze the data. Pearson correlation coefficients were used	During the study, there were no serious adverse events, and improvements in liver fat was seen in the all groups except for the placebo ($p = 0.04$). The same was true for visceral adiposity ($p = 0.03$). The dose and intensity of exercise made no difference on liver fat and visceral adiposity ($p > 0.05$).

Reference	Research Question/ Objective	Study Design and Intervention	Sample and Setting	Methods for Data Collection and Data Analysis	Findings
		low volume aerobic exercise		to determine potential confounders.	
Moholdt, T., Wisløff, U., Lydersen, S., & Nauman, J. (2014). Current physical activity guidelines for health are insufficient to mitigate long-term weight gain: more data in the fitness versus fatness debate, *British Journal of Sports Medicine, 48*(20), 1489-1496. doi:10.1136/bjsports-2014-093416	To assess how physical activity affects long-term weight gain	**Design:** An observational prospective cohort study **Intervention:** Self-reported physical activity duration and intensity based on survey questions	**Sample:** Norwegian adults > or equal to 20 years old **Setting:** Norway; community	Weight and physical activity were measured in a previous study called the Nord-Trøndelag Health Study which occurred in 1984–1986, 1995–1997 and 2006–2008. Participants were stratified based on physical activity level compared to the current recommendations. Analysis of the data consisted of an adjusted mixed model regression analyses with the participant's weight as outcome.	Men who exercised for more than the recommendation for 33 years still gained weight, but only gained 5.6 kg vs. 9.1 kg for inactive men. The same is true with women with a weight gain of 3.8 kg vs. 9.5 kg. Physical activity above the recommendations resulted in 2.1 kg less weight gain over 11 years compared to inactive adults (95% CI 1.8 to 2.4), and women exceeding the recommendations gained 1.8 kg less than inactive women (CI 1.5 to 2.2). The odds ratios of gaining meaningful weight of ≥2.3 kg were 0.79 for men exceeding the recommendations (CI 0.69 to 0.91) and 0.70 for women exceeding the recommendations (CI 0.60 to 0.81).
Nguyen, B., Pham, J., Chew, R., McPhee, S., Stewart, S., & Doan, H. (2010). Effectiveness of continuing medical education in increasing colorectal cancer screening knowledge among Vietnamese American physicians. *Journal of Health Care for the Poor and*	To determine the effectiveness of two interactive CME's in increase knowledge of colorectal cancer and colorectal cancer screening among the Vietnamese American physicians.	**Design:** Quasi-experimental pre-test-post-test design **Intervention:** Two separate CME's during dinners using expert presenters and slide presentations	**Sample:** 42 Vietnamese American physicians in the first CME and 35 physicians in the follow-up CME **Setting:** Hosted by the Vietnamese Physician	Participants were recruited from the registry of the Vietnamese Physician Association of Northern California, and eligibility criteria included being a self-identified as a Vietnamese American health care provider. The pre-test consisted of 27 items with 5 items on knowledge of the colorectal cancer and burden in both the Vietnamese American	Upon analysis, correct responses increased significantly from the first and the second survey for 5 of the items on colorectal burden, and 4 of 11 items on screening and practice covered in the first presentation, and for 5 of 7 items on screening and practices covered in the second presentation.

Reference	Research Question/ Objective	Study Design and Intervention	Sample and Setting	Methods for Data Collection and Data Analysis	Findings
Underserved, 21(2), 568-581. doi:10.1353/hpu.0.0290			Association of Northern California in two Asian restaurants in the study area of Santa Clara County, California	and general U.S. populations, 11 items on screening guidelines and current practices, and finally, 11 items on risk factors. The second questionnaire consisted of 16 items with 7 items on screening guidelines and current practices and 9 vignettes to assess the physicians' clinical skill. The primary outcome was a change in knowledge, and McNemar's tests were used to determine if there was a significant change between tests.	
Nicklas, B., Chmelo, E., Delbono, O., Carr, J., Lyles, M., & Marsh, A. (2015). Effects of resistance training with and without caloric restriction on physical function and mobility in overweight and obese older adults: A randomized controlled trial. *The American Journal of Clinical Nutrition, 101*(5), 991-999. doi:10.3945/ajcn.114.105270	To determine the effects of adding caloric restriction for weight loss to resistance training on muscle and physical function responses in older overweight and obese adults	**Design:** Randomized Controlled Trial **Intervention:** Full body, progressive resistance training 3 days/week for 5 months with or without a weight loss intervention of caloric restriction	**Sample:** 126 older overweight and obese men and women **Setting:** Wake Forest University Clinical Research Center exercise facility and geriatric research facility	Participants recruited from Forsyth County, North Carolina. The participants meeting criteria were randomized into groups. Caloric restriction was monitored with a dietary log and triweekly meetings with a registered dietician, and trained personnel supervised exercise. Anthropometric measures were collected pre- and post-test using dual-energy x-ray and CT scans. Strength was testes using a dynameter and function with a timed 400-meter walk test. An ANCOVA test was used to analyze between groups and a *t* test was used to analyze differences in pre- and post-test.	Body mass decreased in the dual intervention group but not the resistance training alone group. Fat mass, fat %, and all thigh fat volumes improved in both groups, but the resistance training and caloric restriction group lost lean mass. Improvements in a body and thigh composition measures were seen in the dual intervention group except intermuscular adipose tissue. Knee strength, power, and quality and the 400 m gait speed increased similarly improved in both groups. Less fat participants saw a greater improvement in the 400-m walk and knee strength and power.

Reference	Research Question/ Objective	Study Design and Intervention	Sample and Setting	Methods for Data Collection and Data Analysis	Findings
Normandin, E., Chmelo, E., Lyles, M., Marsh, A., & Nicklas, B. (2017). Effect of resistance training and caloric restriction on the metabolic syndrome. *Medicine and Science in Sports Exercise, 49*(3), 413-419. doi:10.1249/MSS.0000000000001122	To determine the effect of adding caloric restriction to resistance training on metabolic syndrome in older overweight and obese adults	**Design:** Randomized Controlled Trial **Intervention:** Full body, progressive resistance training 3 days/week for five months with or without a weight loss intervention of caloric restriction	**Sample:** 126 older overweight and obese men and women **Setting:** Wake Forest University Clinical Research Center exercise facility and geriatric research facility	Participants recruited from Forsyth County, North Carolina. The participants meeting criteria were randomized into groups. Caloric restriction was monitored with a dietary log and triweekly meetings with a registered dietician, and trained personnel supervised exercise. Anthropometric measures were collected pre- and post-test using blood labs, dual-energy x-ray, and CT scans. An ANCOVA test was used to analyze between groups and Log values were used to analyze non-normally distributed data.	Body mass decreased in the dual intervention group by −5.67%, but it was unchanged with only resistance. The dual intervention group was superior to resistance training alone in reducing very low-density lipoprotein cholesterol (VLDL), triglycerides, and blood pressure (p=0.000 through 0.013). The resistance training group showed no difference in metabolic syndrome criteria, but in the dual intervention group saw a reduction in abdominal obesity, hypertension, the number of metabolic abnormalities, and the presence of metabolic syndrome.
Pellegrini, C., Song, J., Chang, R., Semanik, P., Lee, J., … Dunlop, D. (2016). Change in physical activity and sedentary time associated with 2-year weight loss in obese adults with osteoarthritis. *Journal of Physical Activity & Health, 13*(5), 461-466. doi:10.1123/jpah.2015-0404	How do changes in moderate-to-vigorous physical activity, light activity, and sedentary behavior relate to weight change over a 2-year period in obese adults with or that have an elevated risk for osteoarthritis of the knee?	**Design:** Observational Cohort Study **Intervention:** Data collected on weight, physical activity, and sedentary time at baseline and 2 years using accelerometers	**Sample:** 459 obese adults from the Osteoarthritis Initiative **Setting:** Community dwelling adults	Weight change was categorized as ≥ 10 lbs, 5.0 to 9.9 lbs, 4.9 to −4.9 lbs, −5.0 to −9.9 lbs, and ≤ −10 lbs. Data was collected using an accelerometer and borrowed from a sub-cohort of the Osteoarthritis Initiative. Linear regression analysis was used to compare data.	Across the weight categories, the 2-year change in activity levels ranged from −7.4 to 28.0 of sedentary minutes per day, 4.2 to −23.1 of light activity minutes per day, and 3.2 to −4.9 moderate-vigorous physical activity minutes per day. Greater weight loss was seen with an increase in moderate-vigorous physical activity ($p < 0.001$) and less sedentary behavior ($p = 0.01$).
Piccolo, B., Keim, N., Fiehn, O., Adams, S., Van Loan, M., & Newman, J. (2015). Habitual physical activity	To determine the effect of energy restriction in adults on variables such as the plasma metabolome,	**Design:** Secondary Analysis of a Randomized Control Trial	**Sample:** 71 overweight and obese young to middle-aged	Total energy requirements were calculated via formulations. Food was then weighed for each meal based on a caloric restricted diet,	Compared to low-responders to the diet, high-responders to the diet had greater improvement in body weight ($p < 0.01$), BMI

Reference	Research Question/ Objective	Study Design and Intervention	Sample and Setting	Methods for Data Collection and Data Analysis	Findings
and plasma metabolomic patterns distinguish individuals with low vs. high weight loss during controlled energy restriction. *The Journal of Nutrition, 145*(4). doi:10.3945/jn.114.201574	endocrine and inflammatory markers, clinical indices, body composition, diet, and physical activity	**Intervention:** A strictly monitored energy restricted diet for 12 weeks with physical activity being monitored by accelerometer	adult recruited from the Davis and Sacramento, California, communities **Setting:** Community-based	and compliance was maintained by returning the food containers and reweighing the leftovers. Physical activity was measured with an accelerometer. Partial least squares regression was used to identify weight-loss differences, and linear mixed models were used to identify differences in high vs low responders.	($p < 0.01$), and total fat ($p < 0.01$). Significant effects that were not caused by the intervention were the result of improved: respiratory exchange ratio ($p< 0.01$), moderate physical activity ($p = 0.02$), sedentary activity ($p= 0.02$), and plasma stearate ($p = 0.01$).
Ross, R., Hudson, R., Stotz, P., & Lam, M. (2015). Effects of exercise amount and intensity on abdominal obesity and glucose tolerance in obese adults: A randomized trial. *Annals of Internal Medicine, 162*(5), 325-334. doi:10.7326/M14-1189	To determine the effects of exercise dose and intensity on abdominal adiposity and glucose tolerance	**Design:** Randomized Control Trial **Intervention:** The control was no exercise with different intervention groups consisting of 5 days per week for 24 weeks of: low-amount, low-intensity exercise, high-amount, low-intensity exercise, or high-amount, high-intensity exercise	**Sample:** 300 abdominally obese adults. **Setting:** supervised exercise sessions in Kingston, Ontario, Canada.	Physical activity and Sedentary activity were measured by accelerometer. Primary outcomes were waist circumference and 2-hour glucose level, and secondary outcomes were cardiorespiratory fitness and measures of insulin action. Outcome measures were taken at baseline, 8, 16, and 24 weeks. Mixed models were used for statistical analysis.	Unsupervised physical activity and sedentary time did not change in any of the groups ($p > 0.33$). Waist circumference reduction was greater in all groups compared to the control ($p < 0.001$), but there was no statistical difference between groups ($p > 0.43$). 2-hour glucose level reductions were greater with high amounts, high intensity physical activity compared to the control group ($p = 0.027$), but the other two groups did not differ from the control ($p >0.159$). All groups had greater weight loss than the control group ($p < 0.001$), but yet again, there was no difference in weight loss between the intervention groups ($p > 0.182$).
Tomasone, J., Martin Ginis, K., Estabrooks, P., & Domenicucci, L. (2014). 'Changing minds':	To determine the effectiveness and short- and long-term maintenance of a "Changing Minds,	**Design:** Observational Cohort Study	**Sample:** 97 healthcare providers	Questionnaires covering the Theory of Planned Behavior constructs with regard to discussing physical activity were	Improved social cognition for discussing physical activity was seen post-intervention ($p <0.002$), but these increases

Reference	Research Question/ Objective	Study Design and Intervention	Sample and Setting	Methods for Data Collection and Data Analysis	Findings
Determining the effectiveness and key ingredients of an educational intervention to enhance healthcare professionals' intentions to prescribe physical activity to patients with physical disabilities. *Implementation Science: IS*, *9*(30). doi:10.1186/1748-5908-9-30	Changing Lives" seminar, and explore key variables that may determine changes in healthcare providers social cognitions	**Intervention:** "Changing Minds, Changing Lives" which is a seminar-mediated educational intervention for healthcare providers to improve their knowledge, strategies and resources needed to prescribe leisure-time physical activity to patients with disabilities	**Setting:** Healthcare institutions in five Canadian provinces	given pre-interventions, immediately post-intervention, 1-month follow-up, and 6-month follow-up. Repeated-measures ANOVAs and post-hoc *t* tests were used to analyze data, and hierarchical multiple regressions were used to predict intentions to prescribe.	were not seen at follow-ups. Perceived behavioral control was the strongest predictor of participants' intentions to prescribe after the intervention ($p < 0.001$). The number of seminars the presenter gave was the only negative predictor of post-seminar perceived behavioral control with a negative relationship ($p < 0.05$).

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