BMI Optimization: Referral for Total Knee or Hip Arthroplasty

Elizabeth Combs DNP FNP Student

Idaho State University

Doctor of Nursing Practice

DNP Project Chair: Susan Tavernier PhD, APRN-CNS AOCN

DNP Project Members: Melody Weaver PhD, APRN, FNP-BC

Tanner Mitton MSPA, PA-C

Date of Submission: April 27, 2022

Table of Contents

Abstract

Background: Incremental increase in body mass index (BMI) above 30 kg/m,^{2} increases risk for total perioperative complications for total hip and knee arthroplasties. It is generally accepted that patients who are obese or morbidly obese should undergo a weight loss plan prior to undergoing orthopedic surgery. Primary care providers are in position to refer patients to orthopedic surgeons concurrently with a physical therapist and a dietitian to get patients started on BMI optimization.

Objective: To review referral practices of primary care providers to dietitians and physical therapists for BMI optimization in patients with knee or hip osteoarthritis.

Methods: New patients for two providers at Idaho Sports and Spine were given an optional questionnaire asking whether their visit was regarding knee or hip osteoarthritis and whether they were referred to a physical therapist and a dietitian for BMI optimization if appropriate. After six weeks, completed questionnaires were gathered and educational fliers were mailed to primary care providers within a 25 mile radius of Idaho Sports and Spine. Six weeks later, the same optional questionnaires were distributed to new patients at Idaho Sports and Spine. The last six weeks' questionnaires were collected and compared to the first set of questionnaires.

Results: The first set of questionnaires suggested that more patients had been referred to physical therapists (66%) than to dietitians (11%).

Conclusion:

Introduction and Background

Obesity, as defined as having a body mass index (BMI) of greater than or equal to 30 kg/m^2, has been steadily increasing and has almost tripled worldwide in the last 46 years (World Health Organization {WHO}, 2021). Obesity can cause many adverse health disorders involving the cardiovascular system, endocrine system, musculoskeletal system, and has even been indicated to be involved in the development of some cancers (WHO, 2021). Osteoarthritis is one of the major adverse musculoskeletal health effects of obesity (WHO, 2021). Total hip and knee arthroplasties are surgical procedures that can be done to treat degenerative musculoskeletal disease, like osteoarthritis of the hips and knees, in the end stages of the disease (Abdulla et al., 2020).

End stage osteoarthritis can develop faster in people who are obese (Abdulla et al., 2020). This phenomenon shows a risk for younger people who are obese to develop end stage osteoarthritis of the hips and knees (DeMik et al., 2018). However, obesity itself is considered an independent risk factor for surgical complications. In a retrospective review of 161,785 patients who had undergone either total hip or total knee arthroplasty, obese (BMI $\geq$30 kg/m^2) and morbidly obese (BMI $\geq$ 40 kg/m^2) patients were found to have higher rates of total complications than those who were not obese (DeMik et al., 2018). Wound complications, such as deep infection, superficial wound infection, organ space surgical site infection, and wound dehiscence, reflected a tendency to increase with incremental BMI category increases above 30 kg/m^2 (DeMik et al., 2018). Mortality rates, pneumonia, unplanned intubation, deep venous thrombosis, pulmonary embolism, renal insufficiency, acute renal failure, urinary tract infection, stroke, peripheral nerve injury, myocardial infarction, blood transfusions, and sepsis were also increased

in patients who underwent total hip and knee arthroplasties who had greater BMIs (DeMik et al., 2018).

Another study examined the risks of developing peri-prosthetic joint infection with a high BMI. After reviewing records of 18,173 patients who underwent primary total hip or primary total knee arthroplasties, it was determined that the risk of peri-prosthetic joint infection 90 days postoperatively in obese and morbidly obese people was equivalent to random chance (Shohat et al., 2018). However, other risks in obese and morbidly obese people remain a consideration, and results such as these make creating a consensus very difficult on appropriate BMI cutoff or threshold among orthopedic surgeons.

Anesthesia predictions of complications are also noted to be high in people who are obese. The American Society of Anesthesiologists (ASA, 2020) have a classification system that helps predict perioperative risks in people undergoing surgery. The classification system ranges from ASA I, a normal healthy patient, and ASA VI, a patient who has been declared brain-dead (ASA, 2020). The ASA classifies people who have a BMI between 30 kg/m^2 and 40 kg/m^2 as an ASA II, and those with a BMI of greater than 40 kg/m^2 as an ASA III (ASA, 2020). Patients who are obese are also more likely to have comorbidities such as type 2 diabetes and obstructive sleep apnea (American Academy of Orthopaedic Surgeons {AAOS}, n.d.). Additional comorbidities increase the ASA risk classification for patients (ASA, 2020). This reflects how perioperative risks to patients undergoing surgery increase with BMI increase.

Bariatric surgery for weight loss is an option for BMI optimization for the treatment of osteoarthritis and for BMI optimization prior to orthopedic surgery. However, bone demineralization was found to be increased after patients underwent bariatric surgery (Zhang et

al., 2017). Risk for falls and fracture up to two years after bariatric surgery was also found to be increased (Zhang et al., 2017). Postmenopausal women are particularly at risk for fracture due to increased bone resorption after bariatric surgery (Schafer et al., 2018). While bariatric surgery is considered one of the most effective treatments for weight loss and BMI optimization prior to orthopedic surgery referral, more conservative and less invasive options should be considered first (Zhang et al., 2017).

Problem Statement

People who have end stage osteoarthritis of the hip or knee can have difficulty maintaining mobility, and therefore, function. Weight loss prior to hip or knee surgery to treat osteoarthritis may prove difficult if mobility is impaired due to increased pain and decreased range of motion from the disease. However, perioperative risks for people who are obese, both during surgery and after surgery, are increased (AAOS, n.d.). Physical therapists, or physical therapists, and dietitians are specially trained to help patients lose weight and optimize activity, which may help with pain and mobility issues. With the help of physical therapists and dietitians, risks can be mitigated, and BMI can be optimized, prior to consideration of an invasive procedure that carries so much risk for people who are obese or morbidly obese (AAOS, n.d.). Diet and exercise plans are non-invasive treatments to help optimize BMIs that can be effectively and safely provided by dietitians and physical therapists (Seward et al., 2020). Referral to a dietitian and a physical therapist, at the same time that orthopedic surgery referral is done, can help expedite a collaborative approach to care for osteoarthritis of the hip or knee for patients who are obese and morbidly obese.

Project Purpose

The purpose of this project is to influence the referral practices of primary care providers for patients with hip and/or knee osteoarthritis who have a BMI of $\geq$ 35 kg/m^2 in the Chubbuck and Pocatello, Idaho areas. Encouraging referral practices that support a collaborative approach to care for this patient population may help with a timelier optimization of patients' BMIs for those who elect to undergo total joint arthroplasty. Optimization of BMI will help decrease perioperative risks for complications for those who elect to undergo total joint arthroplasty.

Discussion

The risks that surgery poses in patients who are obese or morbidly obese is higher than that of people who are not obese or morbidly obese. Weight loss can help reduce the risks of surgery and anesthesia for patients who are seeking total joint arthroplasty for the treatment of knee or hip osteoarthritis. A collaborative approach to weight loss is more effective than the approach of one health care provider alone. An early collaborative approach to weight loss may be achieved if primary care providers are encouraged to refer patients to dietitians and physical therapists concurrently with orthopedic surgery referral.

Clinical Question

Will the distribution of an educational pamphlet on the evidence supporting BMI optimization and accompanying resource list increase the frequency of primary care providers' referrals of obese or morbidly obese patients who have hip or knee osteoarthritis to dietitians and physical therapists six weeks post educational pamphlet distribution?

P: Obese or morbidly obese patients (BMI > 35 kg/m^2) who have hip or knee osteoarthritis who are seen at the Idaho Sports and Spine Clinic in Pocatello, Idaho.

I: Educational pamphlet outlining evidence supporting BMI optimization with accompanying list of dietitian and physical therapists in the Chubbuck/Pocatello, Idaho area.

C: Dietitian and physical therapy referrals during a six week time period prior to the educational pamphlet distribution at the Idaho Sports and Spine clinic.

O: Increase in percentage of dietitian and physical therapy referrals six weeks post educational pamphlet distribution.

T: The project started November 1, 2021 and ended April 8, 2022.

Literature Review

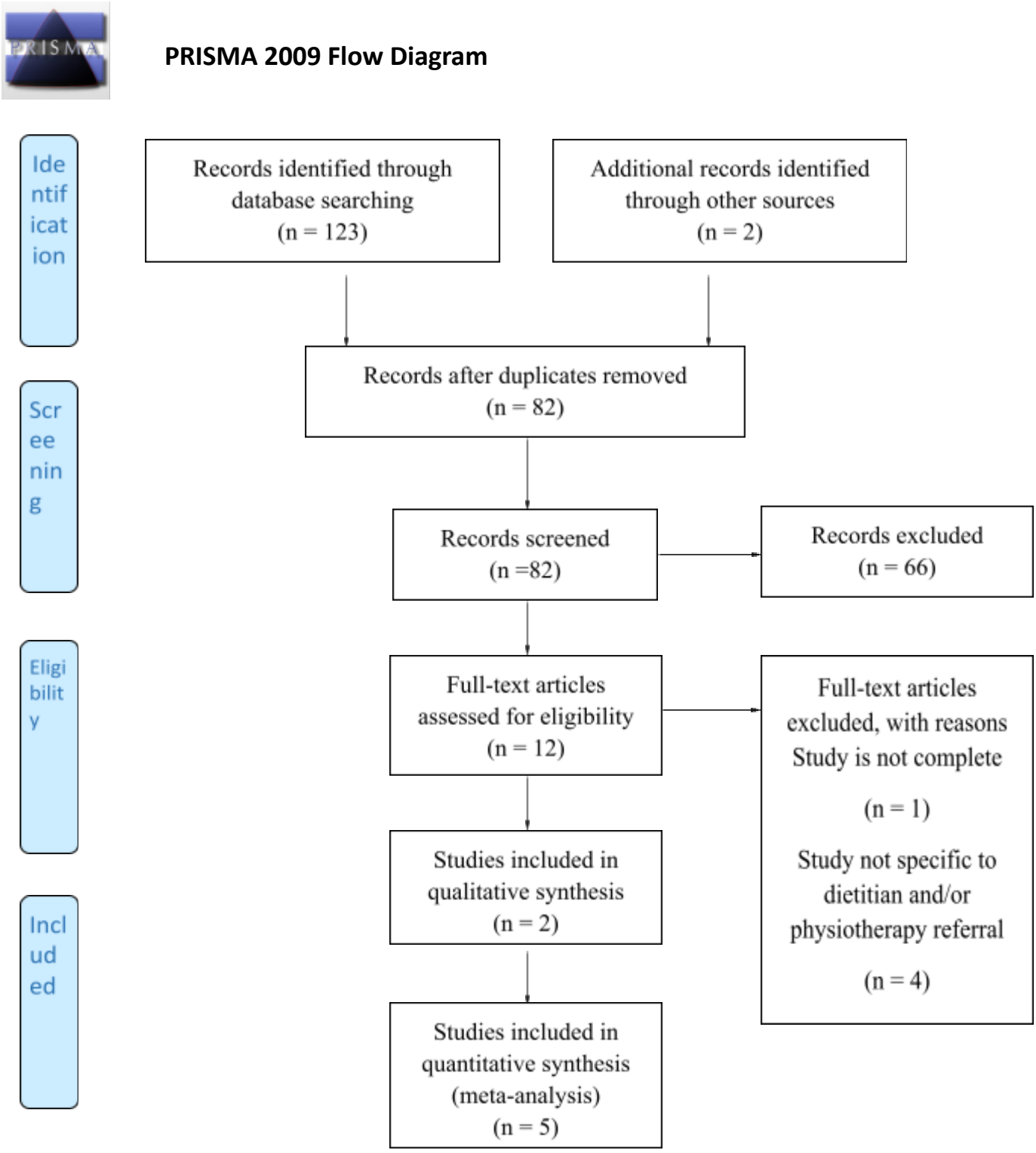
Search Strategy

A search was done in Idaho State University Library's One Search database. The key words used for the search were "bmi dietitian referral knee arthroplasty." The search was refined by "Full Text, Scholarly (Peer Reviewed) Journals, English language, united states, and published since 2017." One hundred and twenty-three articles resulted, and eighty-six articles were reviewed after duplicates were removed. Eighty-six titles were reviewed, fourteen abstracts were reviewed, ten full articles were reviewed, and six articles were ultimately selected. One of the six articles selected is currently an ongoing study, and was therefore not included.

Two additional articles were selected from the references used in the ongoing study "Weight loss before total joint arthroplasty using a remote dietitian and mobile app: Study protocol for a multicenter randomized, controlled trial" (Seward et al., 2020). Both articles were peer reviewed, were written in the English language, and were published in 2019.

Databases are *MEDLINE Complete, Academic Search Complete*, *Complementary Index*, *Science Citation Index,* and *CINAHL Complete.*

Figure 1


PRISMA 2009 Flow Diagram
Identification
Screening
Eligibility
Included
Records identified through database searching (n = 123)
Additional records identified through other sources (n = 2)
Records after duplicates removed (n = 82)
Records screened (n =82)
Records excluded (n = 66)
Full-text articles assessed for eligibility (n = 12)
Full-text articles excluded, with reasons
Study is not complete (n = 1)
Study not specific to dietitian and/or physiotherapy referral (n = 4)
Studies included in qualitative synthesis (n = 2)
Studies included in quantitative synthesis (meta-analysis) (n = 5)

Primary Care

Primary care is the optimal setting for patients to be provided or referred to preventative services (Sastre & Van Horn, 2021). Referrals to dietitians by primary care providers is considered beneficial to populations in need of dietary guidance, because dietitians are specifically trained to help modify patients' dietary behaviors (Mitchell et al., 2017). Referrals to lifestyle management programs by primary care providers can improve patients' general and musculoskeletal health, can help them lose weight, and can also help with cost and risk reduction, which in turn helps patients prepare for safe surgery (Law et al., 2018). Collaborative care with other healthcare providers, such as physical therapists and dietitians, has been associated with both weight reduction and improved musculoskeletal function for patients suffering with osteoarthritis of the hips and knees (Dabare et al., 2017; Teoh et al., 2017). However, variable settings and referral considerations can be complex, and referral rates by primary care providers to other healthcare providers like physical therapists and dietitians, can be adversely affected (Law et al., 2018). There is also a paucity in the data regarding nutritional counseling and protocol to help patients reach satisfactory weight loss for risk reduction (Lingamfelter et al., 2019). This indicates a benefit in taking a multidisciplinary approach to weight loss in obese and morbidly obese patients seeking total knee or hip arthroplasty (Lingamfelter et al., 2019).

Weight Loss

In one study, 43% of patients who underwent dietary counseling by a dietitian, lost weight and achieved their goal BMI of 40 kg/m^2 or less (Lingamfelter et al., 2019). In another study, patients had an average of 2.8 kg/m^2 drop in BMI score after undergoing a diet and

exercise program (Losina et al., 2019). In a systematic review, 18 out of 26 studies suggested positive clinical indicators and anthropometric changes with dietary interventions provided by dietitians (Mitchell et al., 2017). However, diet and exercise interventions vary by provider and settings in most of these studies, and therefore, substantial differences in nutritional and exercise practices may exist (Mitchell et al., 2017).

At least a 10% weight loss in patients who were obese or morbidly obese is considered optimal in reducing disability for patients with knee and hip osteoarthritis (Losina et al., 2019). A 20-pound preoperative weight loss is considered optimal in morbidly obese patients to decrease incidence of increased hospital length of stay and lower odds of being discharged to a facility (Keeney et al., 2019). While weight loss has shown to benefit patients considering knee or hip arthroplasty, no specific amount of weight loss has been identified as being clinically important to physical functioning prior to orthopedic surgery (Keeney et al., 2019).

Comorbidities

Comorbidities often occur in conjunction with morbid obesity and can increase risks for surgery (Dabare et al., 2017; Keeney et al., 2019; Losina et al., 2019; Mitchell et al., 2017). Glycemic control in diabetic patients has consistently shown to be improved in studies that focus specifically on dietetic management and glycemic control (Mitchell et al., 2017).

Weight Loss and Pain

Weight loss, diet, and exercise are effective treatment for knee and hip osteoarthritic pain (Law et al., 2018; Losina et al., 2019; Teoh et al., 2017). One study highlights conservative management, including diet and exercise therapy, effectively treats osteoarthritic hip and knee pain and can extend time to surgical intervention, even in obese patients with radiographic

changes that reflect significant disease (Dabare et al., 2017). In this study, a specific level of pain and function did not reflect whether operative intervention or conservative management was superior to the other; this was determined on a case-by-case basis (Dabare et al., 2017).

A multidisciplinary approach for BMI optimization has not only been correlated with weight loss, but has also been correlated with decreasing patients' pain (Teoh et al., 2017). After participation in the multidisciplinary weight loss program, patients' willingness to undergo orthopedic surgery was decreased due to the efficacy of weight loss on reducing pain and increasing function (Teoh et al., 2017). Conservative management through a multidisciplinary diet and exercise program was shown to be effective even in patients with end stages of osteoarthritis (Dabare et al., 2017). Patients with hip osteoarthritis, however, present with more significant pain and symptoms than patients with knee osteoarthritis, and usually need surgical intervention sooner than those with knee osteoarthritis (Dabare et al., 2017). Therefore, a shorter duration for conservative management for patients with hip osteoarthritis should be considered (Dabare et al., 2017).

Barriers

Insurance coverage plays a role in the decision for primary care providers to refer patients to dietitians or physical therapists for diet and exercise counseling. In one study, some insurances covered dietitian visits on a limited basis, whereas other insurances did not offer insurance coverage for dietitian visits (Lingamfelter et al., 2019). Insurance coverage was consistently perceived as one of the greatest barriers for referrals to dietitians in one study (Sastre & Van Horn, 2021). In some cases, dietitians and/or physical therapists are part of the multidisciplinary team in the office, and therefore, referral and insurance coverage may be variable to the

individual setting (Sastre & Van Horn, 2021). Insurance coverage may play a role as a barrier, however, cost-effectiveness of a multidisciplinary approach to knee and hip osteoarthritis treatment proved beneficial and reduced patients' desire to undergo total joint arthroplasty in one study (Losina et al., 2019; Teoh et al., 2017). Cost was also reduced when patients had a reduced length of stay after losing 20 pounds or more prior to undergoing total joint arthroplasty (Keeney et al., 2019). Providers are often aware of the fact, however, that patients will have to pay out-of-pocket for dietetic visits when insurance does not cover dietitian services (Law et al., 2018).

Vagueness of referral criteria and the subjectivity of individual patient presentations also presents barriers for providers in referring patients to dietitians and physical therapists (Law et al., 2018). While some providers base their decision on a patient's specific BMI, other providers may base their decision on a patient's level of pain and dysfunction caused by osteoarthritis (Law et al., 2018). Standardization of the referral process and optimization of the multidisciplinary team has yet to be determined, and contributes to the complexity of the referral process (Dabare et al., 2017).

Discussion

A multidisciplinary approach to BMI optimization for patients with knee and or hip osteoarthritis prior to orthopedic surgery referral is necessary to mitigate risks associated with surgery for obese and morbidly obese patients. While there are barriers to consider, BMI optimization will help improve surgical outcomes, and reduce costs associated with morbidity and suboptimal surgical outcomes. Improving knowledge and reducing barriers for primary care providers to help facilitate BMI optimization prior to referral for total joint arthroplasty in obese

and morbidly obese patients with knee and/or hip osteoarthritis will benefit patients in not only pain and function, but in their overall health.

Theoretical Framework

Exchange theory in the referral process identifies many considerations that the provider undertakes prior to patient referral (Shortell & Anderson, 1971). Not only do providers have to consider cost of treatment for their patients, they have to consider quality of care that can be provided through the referral process (Shortell & Anderson, 1971). Different variables that are relevant to patients' needs can make decisions regarding optimal referral complex, however, the rewards for appropriate referral may outweigh the costs associated with not referring patients to other healthcare providers (Shortell & Anderson, 1971). These associated rewards and costs affect both the providers as well as the patients in most cases.

The transactional approach implied by Exchange Theory benefits consulting physicians' networking style to referrals, however, networking style approaches to healthcare can be affected and guided by programs such as pay-for-performance type Medicare programs (Reschovsky & Rich, 2018). Policy and market forces are major barriers for effective referrals, therefore, information exchange on insurance coverage and conservative care are important for primary care both in prestige as well as in income (Reschovsky & Rich, 2018).

Methods

This project uses a cross-sectional approach using an anonymous patient survey to determine if the percentage of patients who are referred to a dietitian and/or physical therapist increases after the intervention.

Idaho Sports and Spine is an orthopedic clinic in Pocatello, Idaho with multiple providers who specialize in different areas of orthopedics. New patients who presented to the clinic to see two providers who specialize in knees, hips, and shoulders were provided questionnaires pertaining to knee and hip osteoarthritis (Appendix C) between the dates of November 1, 2021 and January 14, 2022. The intervention of mailing education flyers (Appendix D) to primary care providers was implemented on January 14, 2022. There was a six week waiting period to allow for primary care providers to receive and read the questionnaires as well as allow time of referral to time of appointment. On February 28, 2022, the second set of questionnaires (Appendix C) were distributed to new patients who presented to the clinic to see the two providers as before. Six weeks later, on April 8, 2022, the second set of questionnaires were collected. The results of the first set of questionnaires and the results of the second set of questionnaires were compared at the completion of the project.

Participants

New patients referred to two providers at Idaho Sports and Spine who specialize in knee, hip, and shoulder pathologies were given an anonymous questionnaire asking if their visit was pertaining to possible knee or hip osteoarthritis. In July through September of 2021, there were three new hip patients, and 14 new knee patients (a total of 17 patients) with a BMI >30 kg/m^2. The pre-intervention time period was a 6 week time period, and the post-intervention time period was a 6 week time period. Thus, it was anticipated that there would be 8.5 eligible patients in the pre- and 8.5 eligible patients in the post-intervention group. The pre-intervention group returned 9 questionnaires, the post intervention group returned _____ questionnaires.

A search in DocSpot.com resulted in a total of 217 primary care providers who practice within a 25-mile radius of the Pocatello Idaho area. One hundred sixty four primary care providers were in Pocatello, Idaho; 14 primary care providers were in Chubbuck, Idaho; 30 primary care providers were in Blackfoot, Idaho; and 9 primary care providers were in American Falls, Idaho. Primary care providers in these areas can potentially refer obese and morbidly obese patients with knee and/or hip osteoarthritis to the Idaho Sports and Spine clinic for total joint arthroplasty. Educational pamphlets regarding BMI optimization for patients with knee and/or hip osteoarthritis (Appendix D) through referral to a physical therapist and dietitian concurrently with orthopedic referral were sent to the 217 primary care providers by postal mail. A list of physical therapists and dietitians within a 25 mile radius of Pocatello (Appendix D) were also sent along with the education flyers to the 217 primary care providers.

Setting and Tools

The project took place at the Idaho Sports and Spine clinic in Pocatello, Idaho. The questionnaire (Appendix C) is anonymous and designed to ascertain if the patient's visit is concerning knee or hip osteoarthritis and to ascertain if the patient was referred to a dietitian and/or physical therapist by his/her referring primary care provider. A DocSpot.com search was done to find primary care providers within a 25 mile radius of the clinic. The intervention of sending an educational flier to primary care providers was sent by regular postal mail. The second set of data collection was done at Idaho Sports and Spine using the same questionnaire as the first set of data collection.

Intervention and Data Collection

The intervention is an educational flier (Appendix D) reviewing evidence supporting the positive patient care outcomes of optimizing BMI prior to knee or hip arthroplasty surgery. A list of dietitians and physical therapists was included to ease the burden of finding qualified clinicians for referral. The pamphlets were mailed to all primary care providers who were potentially referring patients to the Idaho Sports and Spine. Contact information for the clinic and project lead person, should the primary care providers have questions, was included on the pamphlet.

Data collected via anonymous surveys were distributed to eligible patients and collected by staff who collect new patient paperwork for Dr. Ford and Tanner Mitton at the clinic. The paper/pencil survey responses were entered into an Excel spreadsheet, which identified each participant as in the pre- or post-intervention group.

Analysis and Interpretation

Data from the patient surveys were entered into an excel spreadsheet. Descriptive statistics were used to compare the number of eligible patients, the number of eligible patients who completed the survey, percentage of patients who were referred to a dietitian and percentage referred to a physical therapist. The total values for each survey time were compared descriptively. Comparison was also done by using the non-parametric Fisher's exact test.

Ethical Considerations

The project was reviewed and considered exempt status by the Idaho State University Review Board. Staff at Idaho Sports and Spine reviewed elements of the project, and in conjunction with the Idaho State University Review Board, approved the project.

Results

Group 1 consisted of a total of 9 participants who responded to the pre educational pamphlet questionnaire. Forty four percent of participants in group 1 reported that their visit was concerning knee or hip pain possibly caused by arthritis (please see Chart 1 - Group 1). Over 66 percent responded that their primary care provider discussed physical therapy referral (please see Chart 2 - Group 1) and over 11 percent responded that their primary care provider discussed dietitian referral to help aid in the treatment of hip or knee pain (please see Chart 3 - Group 1).

Group one answered that time and scheduling issues was a barrier to seeing a physical therapist more frequently than they did for seeing a dietitian. Cost and insurance considerations was the most frequently reported barrier to seeing a dietitian in Group 1 (please see Chart 4 - Group 1).

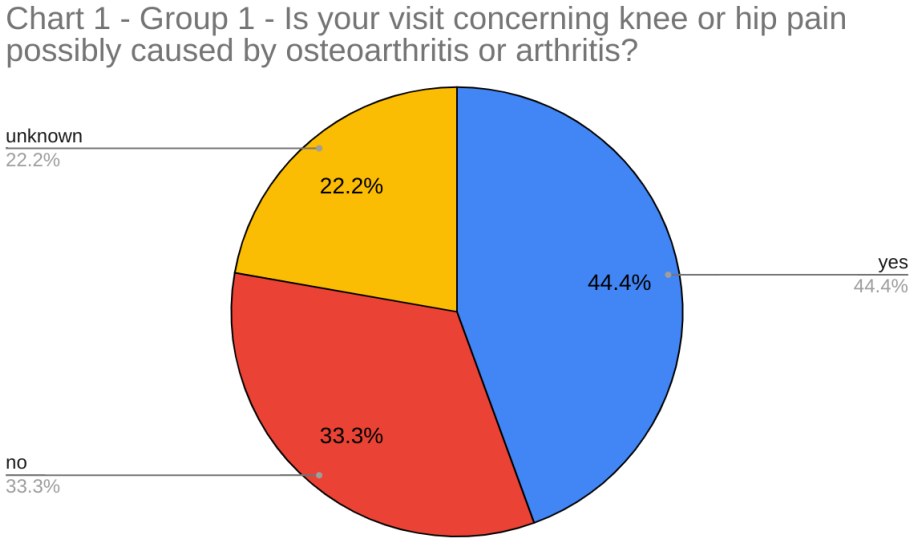


Chart 2 - Group 1 - Did primary care discuss physical therapy referral for knee or hip pain?

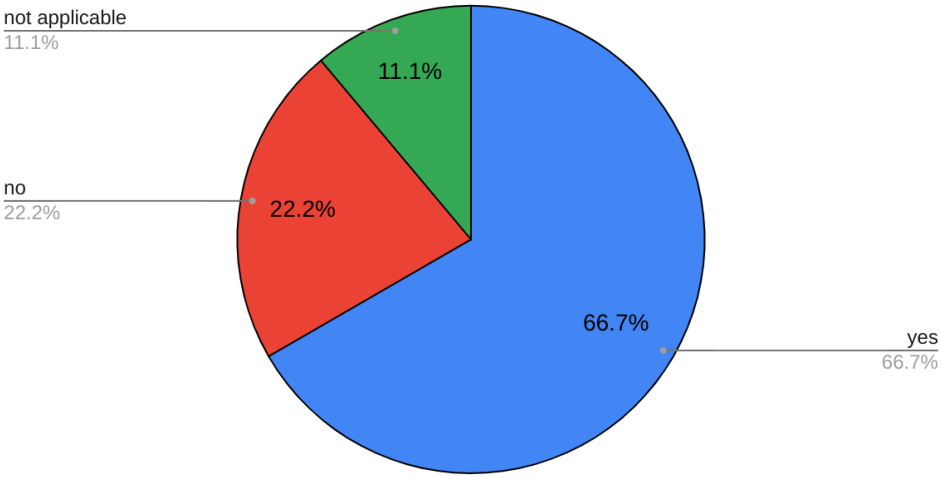
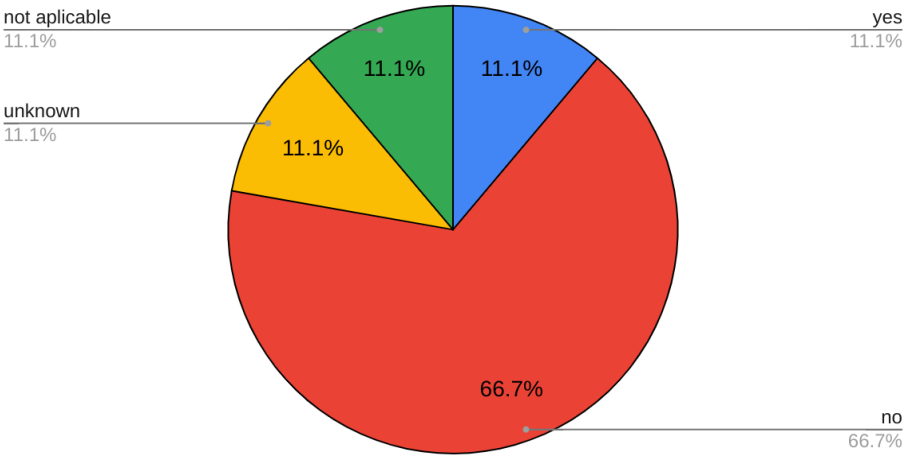
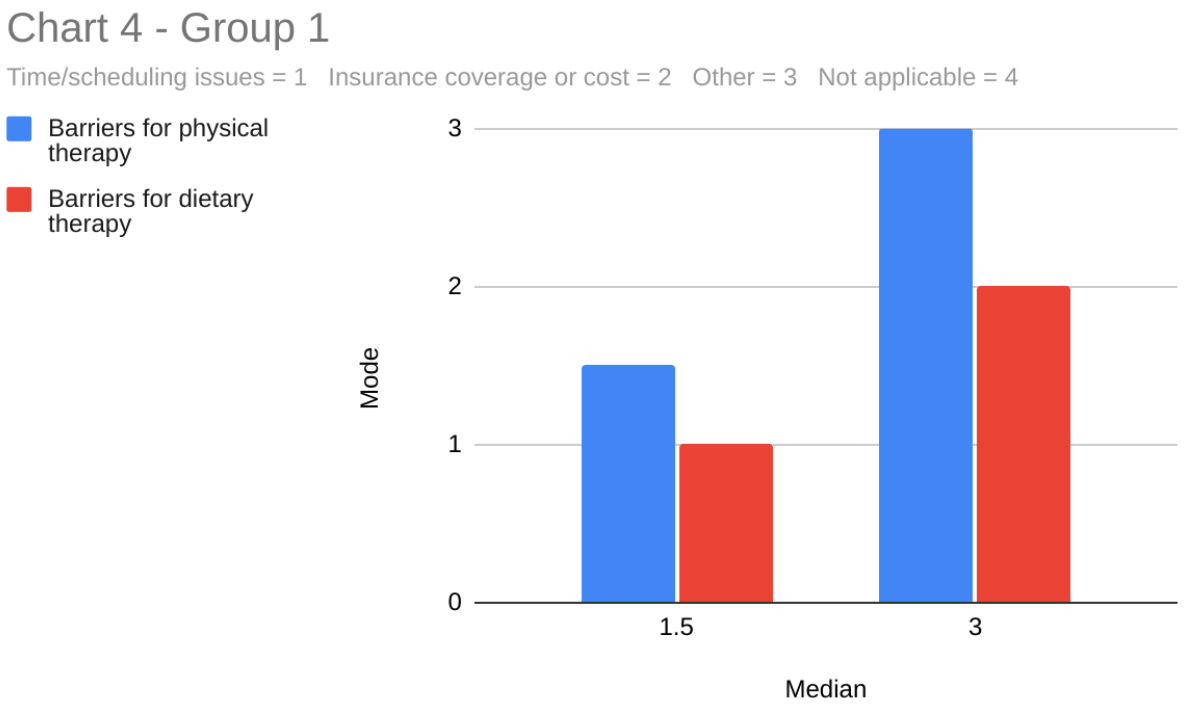


Chart 3 - Group 1 -Did primary care discuss dietitian referral for knee or hip pain?





Interpretation

Limitations

To limit burden for workflow and to allow questionnaires to be completely anonymous, questionnaires were distributed to all new patients for the two specialty providers. A query done by means of manual chart review, which was supervised by Tanner Mitton, between July and September of 2021 to estimate the amount of new patients seen by the two providers who had a BMI >35 kg/m2 and who were presenting for the treatment of knee or hip osteoarthritis. Despite efforts to estimate the number of patients with increased BMI and with knee or hip osteoarthritis in a defined period of time, the unknown BMI of the participants who completed the surveys is

still a limitation. While the questionnaires did ascertain if a referral was appropriate within the question of referral, known BMI would have been beneficial.

Time period of six weeks distribution of the first set of questionnaires and six weeks distribution for the second set of questionnaires is also a limitation to this study. Longer time periods for the pre- and post- educational pamphlet distribution would have provided larger sample sizes.

Elective surgery during the COVID-19 pandemic may have also affected the number of patients who were seeking surgical treatment for knee or hip osteoarthritis. However, after an initial drop in patients undergoing elective surgery in the United States between March and April of 2020, it appeared that elective surgery rates rose back up to pre-pandemic levels in the fall and winter of 2020 (Mattingly et al., 2021). While this project was completed in the fall and winter 2021 and spring of 2022, during the COVID Omicron variant surge, it is perhaps too early to ascertain a thorough picture of the effects the Omicron variant had on elective surgery trends.

Discussion

Funding

There was no funding for this project.

References

Abdulla, I., Mahdavi, S., Khong, H., Gill, R., Powell, J., Johnston, K. D. & Sharma, R. (2020). Does body mass index affect the rate of adverse outcomes in total hip and knee arthroplasty? A retrospective review of a total joint replacement database. *Canadian Journal of Surgery. Journal Canadien de Chirurgie, 63*(2), E142-E149. https://doi.org/10.1503/cjs.006719

American Academy of Orthopaedic Surgeons. (n.d.). Obesity, weight loss, and joint replacement surgery. https://orthoinfo.aaos.org/en/treatment/weight-loss-and-joint-replacement-surgery/

American Society of Anesthesiologists. (2020). ASA physical status classification system. https://www.asahq.org/standards-and-guidelines/asa-physical-status-classification-system

Dabare, C., Le Marshall, K., Leung, A., Page, C. J., Choong, P. F., & Lim, K. K. (2017). Differences in presentation, progression and rates of arthroplasty between hip and knee osteoarthritis: Observations from an osteoarthritis cohort study-a clear role for conservative management. *International Journal of Rheumatic Diseases*, *20*(10), 1350–1360. https://doi.org/10.1111/1756-185X.13083

DeMik, D. E., Bedard, N. A., Dowdle, S. B., Elkins, J. M., Brown, T. S., Gao, Y., & Callaghan, J. J. (2018). Complications and obesity in arthroplasty – A hip is not a knee. *The Journal of Arthroplasty, 2*(33), 3281-3287. https://doi.org/10.1016/jarth.2018.02.073

Keeney, B. J., Austin, D. C., & Jevsevar, D. S. (2019). Preoperative weight loss for morbidly obese patients undergoing total knee arthroplasty: Determining the necessary

amount. *The Journal of Bone and Joint Surgery*, *101*(16), 1440–1450. https://doi.org/10.2106/JBJS.18.01136

Law, R., Nafees, S., Hiscock, J., Wynne, C., & Williams, N. H. (2019). A lifestyle management programme focused on exercise, diet and physiotherapy support for patients with hip or knee osteoarthritis and a body mass index over 35: A qualitative study. *Musculoskeletal Care*, *17*(1), 145–151. https://doi-org/10.1002/msc.1382

Lingamfelter, M., Orozco, F. R., Beck, C. N., Harrer, M. F., Post, Z. D., Ong, A. C., & Ponzio, D. Y. (2020). Nutritional counseling program for morbidly obese patients enables weight optimization for safe total joint arthroplasty. *Orthopedics*, *43*(4), e316–e322.

Losina, E., Smith, K. C., Paltiel, A. D., Collins, J. E., Suter, L. G., Hunter, D. J., Katz, J. N., & Messier, S. P. (2019). Cost-effectiveness of diet and exercise for overweight and obese patients with knee osteoarthritis. *Arthritis Care & Research*, *71*(7), 855–864. https://doi.org/10.1002/acr.23716

Mattingly, A. S., Rose, L., Eddington, H. S., Trickey, A.W., Cullen, M. R., Morris, A. M., Wren, S. M. (2021). Trends in US surgical procedures and health care system response to policies curtailing elective surgical operations during the COVID-19 pandemic. *JAMA Netw Open, 1;4*(12):e2138038. https://doi.org/10.1001/jamanetworkopen.2021.38038.

Mitchell, L. J., Ball, L. E., Ross, L. J., Barnes, K. A., & Williams, L. T. (2017). Effectiveness of dietetic consultations in primary health care: A systematic review of randomized controlled trials. *Journal of the Academy of Nutrition and Dietetics*, *117*(12), 1941–1962. https://doi.org/10.1016/j.jand.2017.06.364

Morey, V. M., Song, Y. D., Whang, J. S., Kang, Y. G., & Kim, T. K. (2016). Can serum albumin level and total lymphocyte count be surrogates for malnutrition to predict wound complications after total knee arthroplasty? *Journal of Arthroplasty*, *31*(6), 1317–1321. https://doi.org/10.1016/j.arth.2015.12.004

Reschovsky, J. D., & Rich, E. C. (2018). Evolving Delivery System and Market Factors and Their Influence on Physician Networks and Patient Care. *JAMA Internal Medicine*, *178*(1), 73–74. https://doi.org/10.1001/jamainternmed.2017.6626

Sastre, L. R., & Van Horn, L. T. (2021). Family medicine physicians' report strong support, barriers and preferences for Registered Dietitian Nutritionist care in the primary care setting. *Family Practice*, *38*(1), 25–31. https://doi.org/10.1093/fampra/cmaa099

Seward, M. W., Antonelli, B. J., Giunta, N., Iorio, R., Fitz, W., Lange, J. K., Shah, V. M., & Chen, A. F. (2020). Weight loss before total joint arthroplasty using a remote dietitian and mobile app: Study protocol for a multicenter randomized, controlled trial. *Journal of Orthopaedic Surgery and Research*, *15*(1), 531. https://doi.org/10.1186/s13018-020-02059-w

Shohat, N., Fleischman, A., Tarabichi, M., Tan, T. L. & Parvizi, J. (2018). Weighing in on body mass index and infection after total joint arthroplasty: Is there evidence for a body mass index threshold? *Clinical Orthopaedics and Related Research, 476*(2), 1964-1969. https://doi.org/10.1007/s11999.0000000000000141

Shortell, S. M. & Anderson, O. W. (1971). The physician referral process: A theoretical perspective. *Health Services Research, 6*(1), 39-48. *PubMed*. https://www.ncbi.nlm.gov/pmc/articles/PMC1067309/

Teoh, L. S. G., Eyles, J. P., Makovey, J., Williams, M., Kwoh, C. K., & Hunter, D. J. (2017). Observational study of the impact of an individualized multidisciplinary chronic care program for hip and knee osteoarthritis treatment on willingness for surgery. *International Journal of Rheumatic Diseases*, *20*(10), 1383–1392. https://doi.org/10.1111/1756-185X.12950

World Health Organization (WHO). (2021). Home/Newsroom/Fact sheets/Detail/Obesity and overweight. https://www.who.int/news-room/fact-sheets/detail/obesity-and-overweight

Appendix A

Citi Training Certificates

COLLABORATIVE INSTITUTIONAL TRAINING INITIATIVE (CITI PROGRAM)

COMPLETION REPORT - PART 1 OF 2
COURSEWORK REQUIREMENTS*

* NOTE: Scores on this Requirements Report reflect quiz completions at the time all requirements for the course were met. See list below for details. See separate Transcript Report for more recent quiz scores, including those on optional (supplemental) course elements.

- **Name:** Elizabeth Combs (ID: 8314398)
- **Institution Affiliation:** Idaho State University (ID: 1264)
- **Institution Email:** dahleltz@isu.edu
- **Institution Unit:** Student
- **Phone:** 208-705-4630

- **Curriculum Group:** Social and Behavioral Responsible Conduct of Research
- **Course Learner Group:** Same as Curriculum Group
- **Stage:** Stage 1 - RCR
- **Description:** This course is for investigators, staff and students with an interest or focus in Social and Behavioral research. This course contains text, embedded case studies AND quizzes.

- **Record ID:** 33558512
- **Completion Date:** 30-Sep-2019
- **Expiration Date:** 29-Sep-2023
- **Minimum Passing:** 80
- **Reported Score*:** 100

REQUIRED AND ELECTIVE MODULES ONLY	DATE COMPLETED	SCORE
Authorship (RCR-Basic) (ID: 16597)	30-Sep-2019	5/5 (100%)
Collaborative Research (RCR-Basic) (ID: 16598)	30-Sep-2019	5/5 (100%)
Conflicts of Interest (RCR-Basic) (ID: 16599)	30-Sep-2019	5/5 (100%)
Data Management (RCR-Basic) (ID: 16600)	30-Sep-2019	5/5 (100%)
Mentoring (RCR-Basic) (ID: 16602)	30-Sep-2019	5/5 (100%)
Peer Review (RCR-Basic) (ID: 16603)	30-Sep-2019	5/5 (100%)
Research Misconduct (RCR-Basic) (ID: 16604)	30-Sep-2019	5/5 (100%)
Using Animal Subjects in Research (RCR-Basic) (ID: 13301)	30-Sep-2019	5/5 (100%)
Research Involving Human Subjects (RCR-Basic) (ID: 13566)	30-Sep-2019	5/5 (100%)

For this Report to be valid, the learner identified above must have had a valid affiliation with the CITI Program subscribing institution identified above or have been a paid Independent Learner.

Verify at: www.citiprogram.org/verify/?kf93e954c-8750-445f-b610-d80f865199e5-33558512

Collaborative Institutional Training Initiative (CITI Program)
Email: support@citiprogram.org
Phone: 888-529-5929
Web: https://www.citiprogram.org

COLLABORATIVE INSTITUTIONAL TRAINING INITIATIVE (CITI PROGRAM)

COMPLETION REPORT - PART 1 OF 2
COURSEWORK REQUIREMENTS*

* NOTE: Scores on this Requirements Report reflect quiz completions at the time all requirements for the course were met. See list below for details. See separate Transcript Report for more recent quiz scores, including those on optional (supplemental) course elements.

- **Name:** Elizabeth Combs (ID: 8314398)
- **Institution Affiliation:** Idaho State University (ID: 1264)
- **Institution Email:** dahlellz@isu.edu
- **Institution Unit:** Student
- **Phone:** 208-705-4630

- **Curriculum Group:** CITI Health Information Privacy and Security (HIPS)
- **Course Learner Group:** CITI Health Information Privacy and Security (HIPS) for Students and Instructors
- **Stage:** Stage 1 - Basic Course

- **Record ID:** 37096753
- **Completion Date:** 18-Aug-2020
- **Expiration Date:** 18-Aug-2021
- **Minimum Passing:** 80
- **Reported Score*:** 100

REQUIRED AND ELECTIVE MODULES ONLY	DATE COMPLETED	SCORE
Health Privacy Issues for Students and Instructors (ID: 1420)	18-Aug-2020	5/5 (100%)
Idaho State University (ID: 12693)	18-Aug-2020	No Quiz
Basics of Health Privacy (ID: 1417)	18-Aug-2020	5/5 (100%)

For this Report to be valid, the learner identified above must have had a valid affiliation with the CITI Program subscribing institution identified above or have been a paid Independent Learner.

Verify at: www.citiprogram.org/verify/?ka26a9f18-565f-4cfd-9d27-526de9505808-37096753

Collaborative Institutional Training Initiative (CITI Program)
Email: support@citiprogram.org
Phone: 888-529-5929
Web: https://www.citiprogram.org

COLLABORATIVE INSTITUTIONAL TRAINING INITIATIVE (CITI PROGRAM)

COMPLETION REPORT - PART 1 OF 2
COURSEWORK REQUIREMENTS*

* NOTE: Scores on this Requirements Report reflect quiz completions at the time all requirements for the course were met. See list below for details. See separate Transcript Report for more recent quiz scores, including those on optional (supplemental) course elements.

- **Name:** Elizabeth Combs (ID: 8314398)
- **Institution Affiliation:** Idaho State University (ID: 1264)
- **Institution Email:** dahlellz@isu.edu
- **Institution Unit:** Student
- **Phone:** 208-705-4630

- **Curriculum Group:** CITI Health Information Privacy and Security (HIPS)
- **Course Learner Group:** CITI Health Information Privacy and Security (HIPS) for Students and Instructors
- **Stage:** Stage 1 - Basic Course

- **Record ID:** 37096753
- **Completion Date:** 18-Aug-2020
- **Expiration Date:** 18-Aug-2021
- **Minimum Passing:** 80
- **Reported Score*:** 100

REQUIRED AND ELECTIVE MODULES ONLY	DATE COMPLETED	SCORE
Health Privacy Issues for Students and Instructors (ID: 1420)	18-Aug-2020	5/5 (100%)
Idaho State University (ID: 12693)	18-Aug-2020	No Quiz
Basics of Health Privacy (ID: 1417)	18-Aug-2020	5/5 (100%)

For this Report to be valid, the learner identified above must have had a valid affiliation with the CITI Program subscribing institution identified above or have been a paid Independent Learner.

Verify at: www.citiprogram.org/verify/?ka26a9f18-565f-4cfd-9d27-528de9505808-37096753

Collaborative Institutional Training Initiative (CITI Program)
Email: support@citiprogram.org
Phone: 888-529-5929
Web: https://www.citiprogram.org

COLLABORATIVE INSTITUTIONAL TRAINING INITIATIVE (CITI PROGRAM)

COMPLETION REPORT - PART 1 OF 2
COURSEWORK REQUIREMENTS*

* NOTE: Scores on this Requirements Report reflect quiz completions at the time all requirements for the course were met. See list below for details. See separate Transcript Report for more recent quiz scores, including those on optional (supplemental) course elements.

- **Name:** Elizabeth Combs (ID: 8314398)
- **Institution Affiliation:** Idaho State University (ID: 1264)
- **Institution Email:** dahlellz@isu.edu
- **Institution Unit:** Student
- **Phone:** 208-705-4630

- **Curriculum Group:** CITI Health Information Privacy and Security (HIPS)
- **Course Learner Group:** CITI Health Information Privacy and Security (HIPS) for Students and Instructors
- **Stage:** Stage 1 - Basic Course

- **Record ID:** 37096753
- **Completion Date:** 18-Aug-2020
- **Expiration Date:** 18-Aug-2021
- **Minimum Passing:** 80
- **Reported Score*:** 100

REQUIRED AND ELECTIVE MODULES ONLY	DATE COMPLETED	SCORE
Health Privacy Issues for Students and Instructors (ID: 1420)	18-Aug-2020	5/5 (100%)
Idaho State University (ID: 12693)	18-Aug-2020	No Quiz
Basics of Health Privacy (ID: 1417)	18-Aug-2020	5/5 (100%)

For this Report to be valid, the learner identified above must have had a valid affiliation with the CITI Program subscribing institution identified above or have been a paid Independent Learner.

Verify at: www.citiprogram.org/verify/?ka26a9f18-565f-4cfd-9d27-528de9505808-37096753

Collaborative Institutional Training Initiative (CITI Program)
Email: support@citiprogram.org
Phone: 888-529-5929
Web: https://www.citiprogram.org

Appendix B

Idaho State University

921 S 8th Ave

Pocatello, ID 83209

To whom it may concern,

This letter is to confirm that Idaho Sports & Spine is allowing Elizabeth Combs DNP FNP student to do her project in accordance with Idaho State University's Nursing Program at their facility.

There will be no monetary compensation by any party. Elizabeth Combs DNP FNP student will abide by all rules and considerations of both Idaho Sports & Spine and Idaho State University. The project will begin in October of 2021 and will finish by May of 2022. Extensions and changes will be done in agreement with all parties. The project will not include any identifying patient information in any way and the content of the project will follow all HIPPA and IRB considerations and rules.

Thank you,

Idaho Sports & Spine

Appendix C

Pre Educational Pamphlet Questionnaire

Idaho State University

Filling out this questionnaire is optional. It is an invitation to take part in a project that is being conducted by Elizabeth Combs DNP FNP student at Idaho State University. All information in this questionnaire is for data collection purposes only. No private information will be collected or retained. This questionnaire will not be retained in your personal chart.

This project is not a part of your medical care and declining to participate will not affect your treatment or your relationships with any medical providers in any way. Completion of this questionnaire should take no longer than 5 minutes. There will be no follow up as there is no private information attached to this questionnaire. Questionnaires will not be kept with any private information, but will be kept separately in a secure area where there will be no way to connect questionnaires with any private information.

This project is being conducted to assess primary care providers referral behavior for body mass index optimization for people with knee or hip osteoarthritis. No private information will be attached to this form. Again, completion of this questionnaire is optional.

If you have questions about this study/project, contact information is:
Elizabeth Combs DNP FNP student, 208-705-4630 or elizabethcombs@isu.edu
Idaho State University's Human Subjects Committee, humsubj@isu.edu
ISU's HSC Coordinator, Tom Bailey, 208-282-2179

1. Is your visit today concerning knee or hip pain possibly caused by osteoarthritis or arthritis?
   a. Yes
   b. No
   c. Unknown
   d. Not applicable
2. If applicable, did your primary care provider discuss a referral or treatment with a physical therapist for aid in treatment of knee or hip pain caused by arthritis?
   a. Yes
   b. No
   c. Unknown
   d. Not applicable
3. If applicable, did your primary care provider discuss a referral or treatment with a dietitian or nutritionist for aid in treatment of knee or hip pain caused by arthritis?
   a. Yes
   b. No
   c. Unknown
   d. Not applicable
4. What are the barriers that would prevent you from seeing a physical therapist?
   a. Time/scheduling issues
   b. Insurance coverage or cost
   c. Other
   d. Not applicable.
5. What are the barriers that would prevent you from seeing a dietitian or nutritionist?
   a. Time/scheduling issues
   b. Insurance coverage or cost
   c. Other
   d. Not applicable.

Thank you so much for your time and help!

Appendix D
Educational Pamphlet

Help Us Get Started - BMI Optimization

Through the supervision of a primary care provider, ACA dietitians can provide weight loss counseling for obese patients. ICD-10 code 97802 for the first dietitian visit and 97803 can be used for subsequent visits and are covered by Medicare.

Obese and morbidly obese patients are at higher risk for developing hip and knee osteoarthritis at a younger age than patients who are not obese

BMI optimization should be considered in patients with osteoarthritis of the hip or knee who have a BMI of >35 kg/m2

In morbidly obese patients, a preoperative weight loss of approximately 20 pounds was associated with a decrease length of stay at a hospital post total joint replacement surgery

- Keeney, B. J., Austin, D. C. & Jevsevar, D. S. (2019). Preoperative Weight Loss for Morbidly Obese Patients Undergoing Total Knee Arthroplasty: Determining the Necessary Amount. *The Journal of Bone and Joint Surgery. American Volume, 101*(16), 1440-1450. https://doi.org/10.2106/JBJS.18.001136

Research has shown that patients can be successful in losing weight through a collaborative approach that includes dietitians

- Lingamfelter, M., Orozco, F. R., Beck, C. N., Harrer, M. F., Post, Z. D., Ong, A. C., & Ponzio, D. Y. (2020). Nutritional counseling program for morbidly obese patients enables weight optimization for safe total joint arthroplasty. *Orthopedics, 43*(4), e316-e322
- Mitchell, L. J., Ball, L. E., Ross, L. J., Barnes, K. A., & Williams, L. T. (2017). Effectiveness of Dietetic Consultations in Primary Health Care: A Systematic Review of Randomized Controlled Trials.

Local dietitians may also have more insight to insurance coverage for their services

- Sastre, L. R., & Van Horn, L. T. (2021). Family medicine physicians' report strong support, barriers and preferences for Registered Dietitian Nutritionist care in the primary care setting. *Family Practice, 38*(1), 25-31. https://doi.org/10.1093/fampra/cmaa099

Dietitians and physiotherapists can help in weight loss, and referrals to a dietitian and physiotherapy will help get the ball rolling for weight loss in patients who may need surgical treatment for their knee or hip osteoarthritis

This flyer is sent to you by Liz Combs DNP FNP Student (208-705-4630) with Idaho State University.

Thank you to Idaho Sports and Spine for your assistance!

Talk to your local dietitians and physiotherapists for treatment options they can provide

Local Dietitians and Physical Therapists
Pocatello, Chubbuck, Blackfoot, and American Falls
Dietitians and weight loss management programs Pocatello and surrounding area:

- **Karen Donaldson MS, RD, LD**
  - **Excel Weight Loss Solutions**
  - **845 West Center #208, Pocatello, ID 83204**
  - **208-406-1084**
  - **excelweightloss@gmail.com**
- **Krista Diekemper, RD, LD**
  - **Portneuf Weight Management Institute**
  - **777 Hospital Way Office Bldg, Ste 201, Pocatello, ID 83201**
  - **208-239-2620**
- **Inner Connected Wellness**
  - **330 South 4th Ave., Pocatello, ID 83201**
  - **208-244-4175**
  - **carol@innerconnectedwellness.com**

Physical therapists and physical therapy clinics in Pocatello and surrounding area:

- **Superior Physical Therapy Spine & Sports – 2 locations in Pocatello**
  - **1800 Flandro Drive, Suite 190**
    - **or**
  - **128 Vista Drive**
  - **208-233-2248**
- **High Desert Physical Therapy**
  - **820 West Chubbuck Rd, Chubbuck, ID 83202**
  - **208-240-6017**
  - **tonyahdpt@gmail.com**
- **Wright Physical Therapy**
  - **131 N. Oak St., Blackfoot, ID 83221**
  - **208-684-2444**
- **Richard T. Sutton**
  - **592 Gifford Ave, American Falls, ID 83211**
  - **208-226-2476**

Appendix E
Post Educational Pamphlet Questionnaire

Idaho State University

Filling out this questionnaire is optional. It is an invitation to take part in a project that is being conducted by Elizabeth Combs DNP FNP student at Idaho State University. All information in this questionnaire is for data collection purposes only. No private information will be collected or retained. This questionnaire will not be retained in your personal chart.

This project is not a part of your medical care and declining to participate will not affect your treatment or your relationships with any medical providers in any way. Completion of this questionnaire should take no longer than 5 minutes. There will be no follow up as there is no private information attached to this questionnaire. Questionnaires will not be kept with any private information, but will be kept separately in a secure area where there will be no way to connect questionnaires with any private information.

This project is being conducted to assess primary care providers referral behavior for body mass index optimization for people with knee or hip osteoarthritis. No private information will be attached to this form. Again, completion of this questionnaire is optional.

If you have questions about this study/project, contact information is:

Elizabeth Combs DNP FNP student, 208-705-4630 or elizabethcombs@isu.edu
Idaho State University's Human Subjects Committee, humsubj@isu.edu
ISU's HSC Coordinator, Tom Bailey, 208-282-2179

1. Is your visit today concerning knee or hip pain possibly caused by osteoarthritis or arthritis?
   a. Yes
   b. No
   c. Unknown
   d. Not applicable
2. If applicable, did your primary care provider discuss a referral or treatment with a physical therapist for aid in treatment of knee or hip pain caused by arthritis?
   a. Yes
   b. No
   c. Unknown
   d. Not applicable
3. If applicable, did your primary care provider discuss a referral or treatment with a dietitian or nutritionist for aid in treatment of knee or hip pain caused by arthritis?
   a. Yes
   b. No
   c. Unknown
   d. Not applicable
4. What are the barriers that would prevent you from seeing a physical therapist?
   a. Time/scheduling issues
   b. Insurance coverage or cost
   c. Other
   d. Not applicable.

   Please describe_____
5. What are the barriers that would prevent you from seeing a dietitian or nutritionist?
   a. Time/scheduling issues
   b. Insurance coverage or cost
   c. Other
   d. Not applicable.

   Please describe_____

Thank you so much for your time and help!