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Improving Glycemic Control for Post-Orthopedic Surgery Patients with Type 2 Diabetes

Allison Dale
Walden University

Walden University

College of Health Sciences

This is to certify that the doctoral study by

Allison Dale

has been found to be complete and satisfactory in all respects,
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Review Committee
Dr. Patricia Senk, Committee Chairperson, Nursing Faculty
Dr. Melissa Rouse, Committee Member, Nursing Faculty
Dr. Sue Bell, University Reviewer, Nursing Faculty

Chief Academic Officer and Provost
Sue Subocz, Ph.D.

Walden University
2020

Abstract

Improving Glycemic Control for Post-Orthopedic Surgery Patients

With Type 2 Diabetes

by

Allison Dale, APRN-CNP

MSN, Walden University 2016

BSN, Ohio University, 2014

Project Submitted in Partial Fulfillment

of the Requirements for the Degree of

Doctor of Nursing Practice

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Abstract

Type 2 diabetes is a population health problem and a leading cause of mortality in the United States. The complications and comorbidities associated with diabetes cause a financial and resource burden on the healthcare system and negative mental and physical health outcomes for the individuals living with the disease. The clinical practice problem addressed by this project was glycemic control following an orthopedic surgery requiring hospitalization. The project was informed by the chronic care model, which emphasizes the need for a whole system, interdisciplinary team approach to disease management and prevention of complications. To analyze the practice problem and create an evidence-based clinical practice guideline to direct patient care, a literature review was completed. Literature was reviewed and graded using the Oxford Centre for Evidence-Based Medicine Levels of Evidence. Professional organizations' guidelines and scholarly publications were also reviewed in developing the guideline. Central themes from the literature review were translated into the clinical practice guideline and included the importance of long-term preoperative glycemic control, patients' skills for self-management, and mental health evaluation and support of patients. To ensure the appropriateness of the clinical practice guideline for translation into practice, the AGREE II tool was applied by the author in the guideline development and used by the project team in evaluation of the guideline for adoption. Improving postoperative glycemic control for patients living with type 2 diabetes supports social change by improving the patients' ability to contribute to society, decreasing the healthcare burden, and addressing the mental and physical health of patients.

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Dedication

I would like to dedicate this DNP project to all of the men, women, and children living life with diabetes. Though the diagnosis may be life changing, may we all live long, happy, and healthy lives.

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I would like to thank many individuals who have helped me complete the DNP program and project. First, I would like to thank my chairs, Dr. Patti Senk and Dr. Melissa Rouse, for all of the encouraging feedback and assistance throughout this journey. Next, to my mentor Dr. Tufail Ijaz for all of the encouragement throughout both my educational and career journey, thank you. I would also like to thank my family, especially my husband, children, and parents for assisting and being so patient when this project took me away from my familial responsibilities. Without all of you, this project would not have been possible.

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Section 1: Nature of the Project

Introduction

In the United States, as of 2015, 30.3 million people are affected by diabetes and an estimated 95% of these cases are classified as type 2 diabetes (American Diabetes Association [ADA], 2019a). Data show that individuals 65 years of age and older have the highest prevalence of this diagnosis (ADA, 2019a). However, childhood and young adults are receiving type 2 diabetes diagnoses at an alarmingly high rate due to obesity, poor lifestyle choices, and genetic factors (Dutta & Ghosh, 2019). In the United States, as of 2017, the annual cost of diabetes was an estimated $327 billion (ADA, 2019a). As of 2015, it was the seventh leading cause of death (ADA, 2019a). Public health officials estimate that type 2 diabetes diagnosis will continually rise at a faster rate, leading to financial burdens that will bankrupt insurance companies and healthcare institutions (Maa, 2017).

Type 2 diabetes is a chronic disease with known pathophysiologic and metabolic changes that contribute to hyperglycemia (Hurtado & Vella, 2019). The pathophysiologic changes are referred to as the "ominous octet," as first described by Dr. Ralph DeFranzo, an esteemed endocrinologist hoping to identify the defects contributing to type 2 diabetes in order to improve treatment (DeFranzo, Elder, & Abdul-Ghani, 2013). The ominous octet identifies the following body malfunctions: (a) inadequate release of the hormone glucagon-like peptide 1 (GLP-1) from the gut, (b) poor release of insulin from the beta cells in the pancreas, (c) too much glucagon release from the alpha cells of the pancreas, (d) insulin resistance and the inability of sugar to enter muscle cells, (e) the liver's

production of excess sugar in response to glucagon production and insulin resistance, (f) lack of GLP-1 response by the brain and appetite dysregulation, (g) the insulin resistant state of fat cells, and (h) excessive reabsorption of sugar from the kidneys returning to the bloodstream (DeFranzo et al., 2013). These malfunctions contribute to hyperglycemia and a type 2 diabetes diagnosis.

Many complications and comorbidities are associated with a type 2 diabetes diagnosis. Type 2 diabetes is known to cause both microvascular and macrovascular conditions (Hayfron-Benjamin et al., 2019). Microvascular complications include retinopathy which contributes to blindness, neuropathy which contributes to amputations, and nephropathy which contributes to chronic kidney disease (Hayfron-Benjamin et al., 2019). Macrovascular complications include coronary artery disease, increased risk of myocardial infarction (MI), peripheral vascular disease, and increased risk of cerebrovascular accident (Hayfron-Benjamin et al., 2019). Common comorbidities associated with a type 2 diabetes diagnosis include obesity, hypertension, and hyperlipidemia (Nowakowska et al., 2019). Researchers have also shown correlations between type 2 diabetes, decreased cognitive functioning, and dementia (Simo, Ciudin, Sino-Servat, & Hernandez, 2017).

Type 2 diabetes has also been associated with poor quality of life and increased rates of depression (Gómez-Pimienta et al., 2019). Individuals with a type 2 diabetes diagnosis are more likely to suffer from multiple medical conditions and have lower perceived quality of life (Gómez-Pimienta et al., 2018). Additionally, those living with

type 2 diabetes often face burnout as the disease requires a great amount of self-care and self-efficacy (Van Smoorenburg et al., 2019).

Type 2 diabetes management requires several pharmacologic and non-pharmacologic interventions (ADA, 2019b). In recent years, the cost of insulin, injectables, and oral anti-hyperglycemic agents have received much attention (Meng et al., 2017). The cost of these medications is currently not restricted and, depending on insurance coverage and other factors, these medications may be unaffordable for some patients (Meng et al., 2017). Both the American Association of Clinical Endocrinologists (AACE, 2019b) and ADA (2019b) guidelines illustrate the potential need for three or more medications for the appropriate management of type 2 diabetes. The financial burden also extends to the healthcare systems and health insurance companies (Maa, 2017).

Nonpharmacological interventions for the treatment of type 2 diabetes may include diet, exercise, nutrition therapy, diabetes education, nicotine cessation, stress relief, and mental health wellness services (ADA, 2019b). These interventions are important for the treatment of type 2 diabetes and barriers should be eliminated. Many people associate healthy eating with high-cost foods, therefore, creating a barrier to healthy eating (Rehm, Monsivais, & Drewnowki, 2015). Food deserts, areas where certain foods, including fresh fruits and vegetables are not available, compound the difficulty of improved dietary habits (Schupp, 2019). Exercise requires a lifestyle change and self-motivation. Many individuals with a type 2 diabetes diagnosis cite lack of

education and inability to motivate themselves to start an exercise regimen as barriers to beginning an exercise routine (Jalilian, et al., 2019). Poor exercise regimens may be associated with comorbidities, time limitations, cost, climate, and functional limitations (Korkiakangas et al., 2011). Stress relief and mental health in general are under discussed topics that may have an impact on glycemic control (Armani Kiam et al., 2018). Lack of mental health resources and stress management education reduce the ability of the person living with type 2 diabetes from using healthy coping mechanisms to help self-manage their disease (Armani Kiam et al., 2018). These barriers are especially to discuss and overcome prior to a surgical procedure.

When speaking of postoperative outcomes, glycemic control is of importance. Surgical risks, including prolonged healing time and increased length of stay, are substantially higher when the 90-day average glucose measured via hemoglobin A1C (HgbA1C) is above 8% (Underwood et al., 2014). For this reason, many surgeons will not perform nonemergent surgery on a patient with an A1C above 8%. Such a delay in surgery could lead to prolonged pain, prolonged time away from work, decreased functioning and mobility, decreased ability to perform activities of daily living, depression, and poor perceived quality of life (Paul & Issac, 2018). Uncontrolled diabetes leads to poor outcomes such as longer hospital stays, infection, evisceration or wound opening, the need for ventilation, admission to the intensive care unit, and mortality (Yong et al., 2018). These delays contribute to prolonged time away from work, delayed return to normal activities of daily life, increased depression, prolonged pain, prolonged

need for pain management therapies, and decreased perceived quality of life (Yong et al., 2018).

A Doctor of Nursing Practice (DNP) project calls for the standardization and utilization of a guideline to improve postoperative glycemic control in hospitalized patients living with type 2 diabetes following orthopedic surgery. Because type 2 diabetes affects a large percentage of the population, it is critical that healthcare providers are adequately equipped to assist in the management and prevention of postoperative complications related to glycemic control. From a social perspective, improving postoperative outcomes allows those with type 2 diabetes a faster return to work and normal functioning; it also limits the adverse effects on quality of life perception and depression (Paul & Issac, 2018). Nursing professionals need an improved knowledge base and a structured guideline to improve advocacy measures, teaching ability, and the care and treatment of patients living with type 2 diabetes.

Problem Statement

Type 2 diabetes is considered a problem of epidemic proportion and a large number of surgical patients have a diabetes diagnosis (ADA, 2019a). These patients are predisposed to altered glycemic control when undergoing a surgical procedure (Sudhakaran & Surami, 2015). Poor glycemic control is often found postoperatively because of preoperative changes in eating, medications and anesthesia agents, the withholding of insulin or alternate antihyperglycemic agents, as well as the metabolic changes and stress response of the patient undergoing the surgical procedure (Sudhakaran

& Surani, 2015). Hyperglycemia postoperatively contributes to an array of problems, including poor wound healing, higher rates of evisceration and infection, longer hospital stays, an increase in depression, and poorer perceptions of quality of life (Reategui et al., 2015). Patients often must postpone return to work and have limited ability to perform activities of daily living (Akiboye & Rayman, 2017). Hyperglycemia has been noted to continue for 8 months postoperatively if untreated or undermanaged (Akiboye & Rayman, 2017). Prolonged hyperglycemia contributes to both microvascular and macrovascular complications, including retinopathy, neuropathy, nephropathy, coronary artery disease, myocardial infarction, cerebrovascular accident, and peripheral vascular disease (Hayfron-Benjamin et al., 2019). In addition, hyperglycemia may worsen comorbidities and increase the risk of infection (Hayfron-Benjamin et al., 2019).

The problem of hyperglycemia following a surgical procedure is seen worldwide (Aklboye & Rayman, 2017). Delays in hyperglycemia treatment contribute to poor outcomes (Akiboye & Rayman, 2017). Glycemic management requires specialized education and an extensive time commitment from the entire healthcare team to ensure optimal outcomes (Sabione et al., 2018). For this reason, utilization of appropriate published guidelines that are evidence based, such as those established by the American Diabetes Association (2019), is critical. Therefore, the focus of the project was to synthesize the current research and guidelines issued by specialized organizations, including the ADA (2019b), into a practice guideline. The guideline outlines recommendations for glycemic control postoperatively in patients living with type 2

diabetes and who remain in the hospital after an orthopedic procedure. The aim of the DNP project was to analyze and appraise the research critically to ensure evidence-based practice methods are used and updated continually.

Purpose Statement

To enhance nursing practice, this project focused on the development of a clinical practice guideline that synthesized the recommendations and guidelines issued by reputable sources, which included, but were not limited to, the ADA (2019b), AACE (2019a), and the Endocrine Society (Umpierrez et al., 2012). The guideline should be used by all inpatient healthcare providers to ensure appropriate glycemic management of the patient with type 2 diabetes following an orthopedic surgical procedure requiring an inpatient stay. Nurses in particular should be aware of the evidence and guidelines to improve patient care and outcomes. Several evidence-based guidelines have been issued by reputable organizations, including the Endocrine Society (Umpierrez et al., 2012), ADA (2019b), and AACE (2019a). However, a synthesis and cohesive report of these guidelines would allow for improved application consistency (Patrik & Wyckoff, 2018). Additionally, continued review of research sources should be completed to ensure continued use of the most up-to-date, high-quality research (Breneman et al., 2015). The synthesis of the literature, recommendations, and guidelines will create a clear and concise guide that is evidence based and contains the highest quality research. A clinical practice guideline allows nurses to provide appropriate care and obtain knowledge on the

current best practice standards as well as to reduce the gaps and disharmony of care (Patrick & Wyckoff, 2018).

Nature of the Doctoral Project

Project completion required a robust literature review with great attention to research validity. The research, current guidelines, and literature will be analyzed extensively to ensure high quality research. The research findings were translated to fit the needs of the population: patients with type 2 diabetes postoperatively, who require an inpatient stay following an orthopedic procedure. A guideline was created by synthesizing the current guidelines as well as published literature, including specific details for postoperative patients. The synthesis allowed for creation of a clinical practice guideline that may be utilized within the clinical settings. This guideline is meant to be used by all nurses caring for the type 2 diabetic patient following an orthopedic surgery requiring an inpatient stay. It shall serve as a framework for glycemic management leading to improvements in perceived quality of life.

Significance

Type 2 diabetes is a significant problem in the United States, affecting nearly 30 million people with an estimated annual cost of $327 billion as of 2015 (ADA, 2019a). The comorbidities and complications associated with type 2 diabetes increase the financial burden associated with the diagnosis and the complications following an orthopedic surgery including longer hospital stays, delays from work, and infections (Paul & Isaac, 2018). Patients with type 2 diabetes, especially those following an

orthopedic surgery, confront many challenges that may decrease their perceptions of quality of life (Yong et al., 2018).

Walden University (2019) established a mission to ensure that doctoral projects are focused on social change that allows for improvements and maintainable progression for society and the professions. This social change is expected to come from evidence and research to ensure the highest quality improvements (Walden University, 2019). Based on the research, poor postoperative outcomes related to type 2 diabetes have a grave effect on the individual as well as the society (Akiboye & Rayman, 2017). Therefore, improvements in outcomes may have a positive benefit on society.

With this project, the profession of nursing will be afforded the opportunity to continue to grow and develop practice guidelines and ensure the appropriate use of evidence-based standards to ensure high-quality patient care. Ensuring that an established guideline can be translated into practice allows for continued development of the profession and positive societal impacts, including improvements in quality, evidence-based care. Guidelines are often lengthy and filled with specialty jargon that is difficult to read and understand (Guo et al., 2016). Providing a synthesis of the guidelines established by the ADA (2019b) will improve nurses' ability to use the guideline. Therefore, nurses will be able to carry out the guideline and improve the care they provide to patients, and thus promote better patient outcomes.

Summary

Type 2 diabetes is a disease millions of Americans are currently living with. The potential postoperative complications of those living with type 2 diabetes are severe and could lead to decreased quality of life, depression, debility, and mortality. The established guidelines offered by the ADA, AACE, and Endocrine Society offer recommendations to decrease the risk of postoperative complications. However, many patients continue to suffer from an array of postoperative complications. Guidelines can be difficult to interpret into practice for a variety of reasons. Producing a clear synthesis of the current guidelines will contribute to an improved use of the guidelines and thus contribute to improved patient care, improved glycemic control, decreased risk of complications, and improvements in perceived quality of life. A clinical practice guideline may be best created utilizing a model or framework. The guideline is relevant to the local area and the nursing profession. The student and project team are necessary to ensure clinical practice guideline development and project completion.

Section 2: Background and Context

Introduction

Type 2 diabetes is a chronic, progressive disease that may lead to a multitude of complications and alter a patient's ability to function (Hurtado & Vella, 2019). Therefore, adequate treatment is imperative (Akiboye & Rayman, 2017). A professional guideline for diabetes management across the lifespan and continuum of care is published by the ADA with annual updates (2019b). The publication includes guidance on management of diabetes during hospitalization (ADA, 2019b). Though diabetes requires a great deal of self-management, during times of surgery and hospitalization, the responsibility for glycemic control includes the healthcare team (Akiboye & Rayman, 2017). Therefore, it is essential to have an established guideline for use in these circumstances and to ensure that nurses are educated about the guidelines and recommendations so that they can advocate for optimal glycemic control (Akiboye & Rayman, 2017). In this section, I discuss the model that guided the development of the clinical practice guideline, the development of a clinical practice guideline, its relevance to nursing practice, the local background and context, and the role of the DNP student.

Model

Concepts are simple words or phrases that act as building blocks and are commonly used in the nursing profession to strategize, theorize, and analyze (McEwen & Wills, 2019). To further evaluate glycemic management following an orthopedic surgical procedure, glycemic management may be seen as a concept. Researchers and scholars are

able to analyze specific components of glycemic management and explore each component exclusively and thoroughly. Within the concept of glycemic management, postoperatively, nurses consider hypoglycemia and hyperglycemia as concepts, as well as barriers to management. Many other concepts and factors may be dissected to analyze the situation (Yong et al., 2018).

Models serve as frameworks or guides to address health concerns (McEwen & Wills, 2019). Many models are used in the management of type 2 diabetes (Crowe, Jones, Stone, & Coe, 2019). Crowe et al. (2019) offer research showing the improved efficacy of nurse-led models for the improvement of glycemic control when compared to physician-led models. The chronic care model (CCM) depicts the need for a whole system, interdisciplinary team approach for the management of disease and prevention of complications (Zuccaro, 2015). Type 2 diabetes is a complex, chronic, and progressive disease requiring the expertise of the individual living with it (Yadmaa, Samoilova, & Koshevets, 2018). Self-management, as well as the ability to adapt and alter self-management techniques for alternate situations, are imperative for successful disease management (Yadmaa, Samoilova, & Koshevets, 2018). The model concepts and tenets allow the application of the CCM in guideline development.

Grover and Joshi (2014) wrote that the CCM includes consideration of the community, the health system, the person living with diabetes, and the ever-changing circumstances of life to ensure adequate care and prevention of complications and ailments. The concepts that guide the care model include the individual, self-

management, self-efficacy, community, expert, and interdisciplinary care team. The CCM focuses on entire entities, communities, healthcare systems, technological advances, and the changing times as these changes are known to affect the way in which care is delivered and diseases are self-managed. Additionally, the National Committee for Quality Assurance recognized the importance of the whole system and whole-body approach to ensure appropriate diabetes management. As diabetes management requires the person living with the disease, the community, the healthcare system, a network of medical and healthcare professionals, a wealth of education, and change adaptation skills, the CCM is a model that is essential to disease management at any stage of life and with any healthcare challenge, including postoperatively (Grover & Joshi, 2014).

The CCM may be used to assist with clinical practice guideline development as proposed in this project. To create a guideline for post-orthopedic procedure glycemic control, all stakeholders must be considered. The guideline must consider the effects of the guideline on the patient, nurses, the hospital, and the community as a whole because poor glycemic control and poor patient outcomes affect not only the patient, but also their family, friends, healthcare providers, healthcare system, and entire community (Funnell, 2006; Paul & Issac, 2018). As guideline review and synthesis progresses, those affected will be kept at the forefront to ensure the guideline may positively impact patients throughout the continuum of care and society as a whole.

Relevance to Nursing Practice

Diabetes is a disease that has reached epidemic proportion in the United States and according to the World Health Organization (WHO, 2016) incidence rates have quadrupled since 1980. In the United States, as of 2015, 30.3 million individuals were living with type 2 diabetes (CDC, 2017b). Of the 30.3 million people living with diabetes, 7.2 million are undiagnosed and unaware of their diagnosis (ADA, 2019a). These individuals are of varying ethnicities, ages, socioeconomic classes, and areas of residence (CDC, 2017b). Of the United States population, 9.4% are living with diabetes (CDC, 2017b). Of the individuals living with diabetes, 90% to 95% or approximately 28,785,000 people have a type 2 diabetes diagnosis (WHO, 2019). Comparative data presented by the CDC (2017a) shows an increase incidence over time in the United States. The incidence rate of type 2 diabetes in adults was 2.62% in 1985, 3.30% in 1995, 5.61% in 2005, and 7.4% in 2015. The largest incidence rate increase has been noted within the past decade and this trend is expected to continue. Above and beyond those diagnosed with or living with diabetes without awareness, 84.1 million people, 33.9% of adults living in the United States have prediabetes (CDC, 2017b).

CDC (2017b) data shows disparities are noted with type 2 diabetes. Age is a known health disparity in terms of type 2 diabetes. Prevalence of a diabetes diagnosis is highest in persons over the age of 45. The 2015 data provided by the CDC (2017b) showed 10.9 diabetes diagnoses per 1,000 individuals in the 45 to 64 age group. The second largest prevalence rate is seen among persons in the 65 and older age range with a

rate of 9.1 diabetes diagnoses per 1,000 individuals. Although many reports suggest a higher incidence of young adults with a type 2 diabetes diagnosis, the 18–44 age group has a prevalence rate of 3.1 diagnoses per 1,000 individuals. Women and men do not have statistically significant differences in prevalence. The prevalence rate for women is 6.8 per 1,000 individuals and the prevalence rate for men is 6.7 per 1,000 individuals. Disparities are also noted in educational backgrounds with higher prevalence rates of diabetes among those individuals having lower levels of educational attainment. The diabetes prevalence rate for individuals without a high school diploma is 12.6%, for individuals with a high school diploma the rate is 9.3%, and for individuals with a college degree the rate is 7.2%.

Disparities in ethnicity and residence are also noted. The CDC documented the prevalence rate of male American Indians and Alaskan Natives as 14.9% and of female American Indians and Alaskan Natives as 15.3%, which is the highest rate of all ethnicities. The Black, non-Hispanic prevalence rate is 12.2% for men and 13.2% for women, and the Hispanic prevalence rates for men is 12.6% and 11.7% for women. The prevalence rates for the Asian ethnicity is 9% for men and 7.3% for women. The White, non-Hispanic ethnicity has the lowest prevalence rate, 8.1% for men and 6.8% for women. Additionally, the CDC documented disparities in the United States based on residence and reported the highest prevalence rates are seen in the Appalachian areas and Southern United States.

The prevalence, increasing incidence, and epidemic proportion complicate disease management and directly affect the societal impact as well as the significance of the problem on the nursing profession. The complications and comorbidities associated with type 2 diabetes further contribute to the problem significance. A number of diseases and health ailments are associated with diabetes which include but are not limited to hypertensive disorders, cardiac disorders including the risk for cerebrovascular accident, myocardial infarction, cardiovascular disease, dyslipidemia, and hypertension, and obesity (Hayfron-Benjamin et al., 2019). Many comorbidities and complications arise for microvascular and macrovascular changes caused by hyperglycemia, which include diabetic retinopathy, nephropathy, neuropathy, blindness, infections, amputations, kidney disease, pregnancy complications, silent MIs, and cardiac death (Hayfron-Benjamin et al., 2019). Heart disease is the number one killer of patients living with diabetes (Healthy People 2020, 2011). Per Healthy People 2020 (2011), diabetes is considered the leading cause of blindness, lower limb amputations, and renal failure. Type 2 diabetes and the complications and comorbidities associated with the condition have contributed to the financial burden of the illness as well. It is estimated that diabetes and diabetes related illness cost $245 billion annually in the United States.

It is also important to discuss the personal and social impact of type 2 diabetes. Yadmaa, Samoilova, and Koshevets (2018) offered the direct correlation between a type 2 diabetes diagnosis and psychological maladaptation related to the required behavioral changes, burden of illness, and financial challenges of the disease. The international

Diabetes Attitudes, Wellness, and Needs (DAWN) Study was conducted in 13 countries to evaluate the perceptions, desires, and needs of both individuals living with diabetes and individuals providing care to those living with diabetes (Funnell, 2006). The study published by Funnell (2006) had numerous participants which included 2,705 physicians, both specialists and generalists, 1,122 nurses working in various specialty and general areas, 5,104 patients living with type 1 diabetes, and 5,104 patients living with type 2 diabetes. All participants were interviewed in some form to identify perceptions on self-management ability, disease stressors, difficulties with treatment regimen, and medical-patient relationship barriers.

The outcomes of the DAWN study published by Funnell (2006) were insightful and offered a great opportunity for improvement and change. In terms of self-management, 16.2% of individuals in the study living with type 2 diabetes admitted to full compliance with dietary and exercise recommendations and other self-care behaviors. Physician responses estimated 2.9% self-management compliance rates among their patients living with type 2 diabetes. Of the patients surveyed living with diabetes, 85.2% admitted to high levels of disease distress at diagnosis and 41% of patients living with diabetes admitted to continued distress 15 years after diagnosis. The study also showed that only 10% of patients whom had experienced disease distress were evaluated or treated for the distress. Nurses in the study perceived higher rates of disease-related distress and were more likely to make the association between the distress and poor glycemic outcomes when compared to physicians. The study also found that physicians in

the United States were the least likely to refer patients to mental health services for disease distress. Likewise, physicians expressed their lack of knowledge regarding the psychological distress caused by outcomes and noted the relationship between psychological distress and poor patient outcomes.

The DAWN study as published by Funnell (2006) explored perceptions of healthcare providers and potential barriers to glycemic control. The study showed that the patients with more complications self-reported poor relationships with healthcare providers and lack of access to resources. Most patients in the study reported they saw two or fewer healthcare professionals for diabetes management, meaning that few patients were appropriately referred to receive recommended vision screenings, education, primary care services, and specialty services. Additionally, nearly half of providers self-reported restricting medication use and insulin initiation as long as possible despite guidelines and recommendations. Overall, the DAWN study showed major barriers to the improvement of glycemic control in patients living with diabetes. Patients living with diabetes face many psychological barriers and are likely to suffer from disease distress that is not appropriately addressed or managed in many cases. The interdisciplinary team is not used effectively to ensure patients living with diabetes are appropriately monitored and prevention services are obtained. Perhaps most importantly, providers recognized the need to have a better understanding on the psychological effects of diabetes as they saw the relationship between distress and poor glycemic outcomes.

The DAWN2 study was conducted in 2011, published by Joensen et al. (2017) and evaluated patients living with diabetes, healthcare providers, and caregivers or family members of the patients living with type 2 diabetes. Study participants came from 17 countries and 15,000 individuals living with type 1 and type 2 diabetes collectively were surveyed. Many of the results were quite similar to the DAWN study and indicated that 13.8% of people living with diabetes had a concordant depression diagnosis and 44.6% reported disease distress. Self-reported opinions on quality of life showed 12.2% of study participants living with diabetes rated their quality of life as very poor or poor. Less than half of the surveyed participants reported attainment of diabetes education. DAWN2 assessed the concerns of family members as well and found 35.3% of family members felt the diagnosis of diabetes was a burden, 61.3% of family members had continual fears of hypoglycemia, and 44.6% of family members felt distress and psychological changes because of their family members diabetes diagnosis. Like in the original DAWN study, healthcare professionals reported the need for improved diabetes education, the improvement in self-management capability, yet lacked the ability to assist with psychological distress or education. The DAWN2 study reiterated the high rate of disease distress, the negative glycemic outcomes related to diabetes distress, and the need for improvement in education as well as psychological management of distress.

Nurses play a unique role within the healthcare system and are often tasked with changing healthcare for the better. Often, nurses work directly with patients and are able to ascertain information, assess needs, educate, and offer care assistance (Stuij, Elling, &

Abma, 2019). These opportunities grant the nurse a unique perspective different from other healthcare professionals. Nurses have the ability to form a patient-nurse relationship built on trust and mutual respect, which allows the nurse the ability to further explore with the patient holistic health needs (Stuij et al., 2019). The nurse-patient relationship also allows for increases in patient confidence in their abilities to manage their own health (Davis, Johnson, McClory, & Warneck, 2019).

Nurses implement evidence-based practice to create guidelines, enforce standards, and elicit positive change and improved healthcare outcomes (Teodorowski, Cable, Kilburn, & Kennedy, 2019). These tasks are accomplished with application of several foundations of nursing practice, including advocacy, quality care, and education as established by the American Nurses Association (ANA, 2015). Research suggests that nurses are able to more effectively improve patient outcomes and elicit positive social change when their knowledge base is robust (Jones et al., 2018). As such, nurses educated on the recommendations and guidelines in the treatment of postoperative glycemic control have the ability to positively impact patient outcomes (Stuij et al., 2019). Nurses play an integral role in the improvement of diabetes management throughout the continuum of life (Stuij et al., 2019).

Additionally, nurses play an important role in the education of the patient (Jones et al., 2018). Data from multiple studies suggest the importance of diabetes specific patient education to improve the outcomes and glycemic control of patients living with diabetes (Tan et al., 2019). Lower rates of disease knowledge result in more

complications and poorer glycemic control (Tan et al., 2019). A nurse with disease specific knowledge has the ability to educate a patient living with diabetes on the disease (Jones et al., 2018). Per Jiang et al. (2017) psychological evaluation and continued support is also required to ensure best outcomes in patients living with diabetes. Nurses have a critical role in ensuring psychological well-being and assessments to ensure patients are able to care for themselves. To ensure complete evaluation, nurses must also assess barriers to care and adequate glycemic control. An individualized, multidisciplinary approach is the only method to ensure adequate glycemic control in people living with type 2 diabetes (Tan et al., 2019).

Local Background and Context

Rates of diabetes vary throughout the 50 states in the country, and the state of Ohio has one of the highest rates of diabetes (CDC, 2017b; Ohio Department of Health, 2017). Though an estimated 9.4% the United States population has diabetes, the rate in Ohio was 12.7% as of 2017 (CDC, 2017b; ADA, 2017). As of 2017, 1,279,000 Ohioans are living with diabetes and an estimated 67,000 more individuals are diagnosed yearly (ADA, 2017). In the state of Ohio as of 2015, diabetes was listed as the cause of death for 3,500 individuals and was noted as the 7th leading cause of death (Ohio Department of Health, 2017).

Along with an increased prevalence of diabetes in Ohio, expenses related to diabetes are also elevated. Data published by the ADA (2017) shows that a person living with diabetes spends an estimated 2.3 times more on healthcare related expenses when

compared to individuals living without diabetes. As of 2017, the direct healthcare expenditure related to diabetes was $9 billion in Ohio. Additionally, an estimated $3.4 billion were spent on disability and time away from work related to diabetes in Ohio in 2017. Overall costs related to a diabetes diagnosis in the state of Ohio in 2017 were $12.4 billion.

The pathophysiology of type 2 diabetes, antihyperglycemic agents, and the co-morbidity of obesity play a role in bone health and contribute to the need for orthopedic surgeries and procedures (Sundararaghavan, Mazur, Evan, Liu, & Ebraheim, 2017). Sundaraghavan et al. (2017) wrote patients living with type 2 diabetes have increased bone mineral density related to decreased bone turnover and hyperinsulinemia. Decreased bone turnover is identified as low type 1 cross-linked C-telopeptide and type 1 cross-linked N-telopeptde levels. Insulin like growth factor 1 (IGF-1) is a hormone that plays a role in bone health and bone mineral density. Hyperinsulinemia is a characteristic of type 2 diabetes and is thought to act as IGF-1 creating several problems with bone health. One known change is the result of the increased osteoblast action resulting in bone changes. A second change in bone health is the result of the increased storage and creation of adipose tissue noted in the bone marrow stem cell. This is the direct result of a single protein cascade that leads to the activation of subsequent proteins and receptors.

Obesity and type 2 diabetes are commonly correlated and obesity has been shown to effect bone health (Dutta & Ghosh, 2019; Sundararaghavan et al., 2017). Per Sundaraghavan et al. (2017) the relationship between obesity and bone change is related

to the increase in adipose tissues and hormones, particularly leptin. Leptin is a hormone that decreases the creation of osteoclasts and stimulates the production of osteoblasts. Adiponectin is another hormone associated with obesity and lower bone mineral density, however, patients with type 2 diabetes have low levels of adiponectin, therefore, higher levels of bone mineral density.

Several classes of antihyperglycemic agents effect bone health. Sundararaghavan et al (2017) discussed the biguanide class of medications, which includes metformin, has been shown to promote bone creation and bone health. The thiazolidinedione (TZD) class of medications, which includes rosiglitazone and pioglitazone, was found to cause an increase in fracture risk, aside from spinal fractures in women in the ACCORD study. The GLP-1 medication class was shown to promote bone health in one study and compromise bone health in another. The Dipeptidyl peptidase-4 (DPP-4) medication class has a neutral effect on bone health. Sodium–glucose co-transporter 2 (SGLT2) inhibitors work in the kidney causing a rise in phosphate and therefore elevated parathyroid hormone levels resulting in increased bone resorption and poor bone outcomes. Lastly, the sulfonylurea medication class may improve bone health or have neutral effects.

Overall, Sundararaghavan et al. (2017) found that patients living with diabetes have an increased fracture risk related to medication use, disease pathophysiology, co-morbidities, or other factors. Though patients living with type 2 diabetes have increased bone mineral density in some trabecular bone, bone mineral density is weaker in intracortical bone and the bones are more porous, which contributes to higher fracture

risk. Obesity and elevations in BMI may account for further negative bone change related to immobility, risk of accident or injury, and the potential for hormonal irregularities including testosterone levels. Studies have also shown a positive correlation between complications of diabetes including retinopathy, nephropathy, and neuropathy and risks of fractures, especially in the hip.

With the knowledge of the increased risk of bone fractures in patients living with type 2 diabetes, it is also important to consider the potential complications of poor health. Per Sundararaghavan et al (2017), patients living with type 2 diabetes have slower bone healing related to dysfunctions in production of growth hormones, collagen, failed cartilage transfer, and defective protein synthesis. In addition to poor bone health and poor bone healing, changes in the joint related to excess glucose and poor diabetes control, raises the risk of the need for surgical intervention for fracture or joint problems. Aside from poor bone and surgical healing, a primary concern is risk of infection. Researchers have found that patients living with type 2 diabetes are two to four times more likely to develop a postoperative infection when compared to individuals without a type 2 diabetes diagnosis.

Poor bone health, increased fracture risk, and increased likelihood of the need for surgical intervention to eliminate joint problems, adds to the difficulties of living life with type 2 diabetes (Sundararaghavan et al., 2017). Injuries to the bone and surgical interventions, especially when complicated by infections, lead to prolonged periods of time away from work, declines in the ability to complete everyday activities, and negative

psychological impacts including decreased perceptions of quality of life (Garg et al., 2016). Nursing professionals are charged with caring for and ensuring the best outcomes for patients (Jiang et al., 2017). When the patient is hospitalized following an orthopedic procedure, the nurse must address the mental, physical, and medical needs of the patient to return the patient to their previous health level (Jiang et al., 2017).

Role of the DNP Student

Completion of the DNP project requires complete emersion on behalf of the DNP student. To begin the project, identification of a healthcare problem that has a great societal impact is necessary. To determine the project focus, consideration to global, national, and local health is imperative. On the local level, type 2 diabetes has a high prevalence (Ohio Department of Health, 2017). With the recent addition of a healthcare system based orthopedic group, an increase in patients living with type 2 diabetes receiving orthopedic procedures and surgeries has been noted. Research showed the potential for poor outcomes in patients living with type 2 diabetes following surgical intervention within the acute care or hospital setting (Sundararaghavan et al., 2017). Therefore, the focus of the project surrounds guideline development to assist with the glycemic control of patients living with type 2 diabetes following orthopedic intervention requiring hospitalization.

The DNP project is meant to elicit exemplary nursing practice and scholarship (Root, Nunez, Velasquez, Malloch, & Porter-O'Grady, 2018). Projects should be rigorous, use high level evidence, focus on social change, and ensure increased

knowledge and assimilation of evidence to practice, which may lead to healthcare improvements (Root et al., 2018). The American Association of Colleges of Nurses (AACN, 2006) wrote of the standards for the DNP educated nurses. To complete this project, DNP essentials I, II, III, and VI were used (AACN, 2006). The essentials require the utilization of science and evidence, system changes and improvements, scholarship and evidence-based practice utilization, and the multidisciplinary approach to improve population health problems (AACN, 2006).

Through research, the importance of the nurse's role in glycemic control is noted (Jiang et al., 2017). Nurses play an integral role in the education and provision of self-management and coping skills for the patient, as well as direct psychological and physical healthcare needs (Jiang et al., 2017). With the understanding of the great impact nurses have on glycemic control as well as the published guidelines citing the guidelines and recommendations for euglycemia postoperatively, the development of a clinical practice guideline focusing on the nurse's role in the improvement of postoperative glycemic control is found to be necessary (Jiang et al., 2017; ADA, 2019b). My role in the development of the clinical practice guideline began with the identification of a problem and continued through literature search and review to determine a potential change implementation that would elicit positive social change and patient outcomes. Motivation for project completion included a family and personal history of diabetes and continued work in the endocrinology field. Personal and practice experience may lead to bias and to

avoid this bias, I based recommendations on high quality research articles and guidelines retrieved through a thorough search and analysis of the literature.

Role of the Project Team

I worked with several members of the University faculty, as well as mentors to successfully complete the DNP project. Walden University provided me with a project committee, which included a committee chair, committee member, and university research reviewer (Walden University, 2018). Additionally, the chief academic officer will play a role in the final approval of the project (Walden University, 2018). This review process ensures project rigor and focus on the goals of societal change and population health improvement (Root et al., 2018). The Appraisal of Guidelines for Researching & Evaluation (AGREE) II instrument was used by experts in the field to evaluate the appropriateness of the developed guideline. Following the project timeline and approval process, the team members had several opportunities to review the material and data supporting the clinical practice guideline (Walden University, 2018).

Because the multidisciplinary team approach is crucial to successful diabetes management, a team within the clinical location assisted in the creation of the final clinical practice guideline. I collaborated with the local endocrinologist, diabetes educators, nurses on the orthopedic unit, and members of the orthopedic team. This team approach allowed for collaborative and functional production of a clinical practice guideline that may be easily assimilated into practice. I ensured that the project information, progress, and goals were provided to the interdisciplinary team with time for

personal accounts and feedback to help guide the clinical practice guideline. Team members were updated with each submission of the project to Walden University to ensure the entire team was aware of the project status.

Summary

As the prevalence of type 2 diabetes increases, the social and healthcare impacts of poor control create a greater strain on society and the healthcare system (Maa, 2017). Identification of a specific problem, poor glycemic control following an orthopedic procedure requiring hospitalization, allowed for a focused analysis and potential resolution through developing a clinical practice guideline. To create an effective clinical practice guideline, reputable research must be used. Additionally, a team approach may ensure rigorous publication and a sound clinical practice guideline to ensure a powerful improvement in healthcare delivery and positive social change.

Section 3: Collection and Analysis of Evidence

Introduction

Type 2 diabetes is a chronic health condition with complications that may devastate the individual diagnosed with the disease (Hurtado & Vella, 2019). The high prevalence rate and poor control seen in the United States result in a negative effect on society overall (CDC, 2017b). Of special concern are postoperative wound healing (Underwood et al., 2014). The risks of poor glycemic control include evisceration, poor wound healing, infection, surgical failures, delay in return to normal functional ability, and mortality (Yong et al., 2018). Specifically, orthopedic procedures that require inpatient stays create a challenge for nurses and care providers who are attempting to reach optimal glycemic control for the patient living with type 2 diabetes postoperatively (Underwood et al., 2014).

The project will enhance nursing practice through the development of a practice guideline. The guideline, a synthesized version of current research and recommendations, may improve glycemic control in hospitalized patients following an orthopedic procedure. The guideline will allow nurses to educate patients, advocate for patients, and assist patients with self-management and self-efficacy to improve glycemic control (Akiboye & Rayman, 2017). Because living with type 2 diabetes requires a great deal of self-management, it is imperative that even within the hospital setting, nurses are ensuring the patients have an understanding of their role in the management of the disease when they are able to do so (Akiboye & Rayman, 2017). To achieve optimal

management, nurses and healthcare providers need to follow a standardized guideline that helps with glycemic control to prevent life-limiting or life-altering postoperative complications and ensure optimal patient outcomes (Akiboye & Rayman, 2017).

Locally, in the state of Ohio, the prevalence rate of diabetes was 12.7% as of 2017, compared to a national prevalence rate of 9.4%, which means that more people in Ohio are living with a diabetes diagnosis and that it is considerably more likely that they would require intensive glycemic management during a hospitalization than elsewhere (CDC, 2017b, Ohio Department of Health, 2017). It is estimated that in Ohio alone, $9 billion is spent annually on direct diabetes healthcare costs and $3.4 billion is spent on indirect costs associated with a diabetes diagnosis (ADA, 2017). In relation to orthopedic surgeries, researchers have also found correlations between some antihyperglycemic agents and poor bone health, thus increasing the potential need for a fracture repair surgery (Sundararaghavan et al., 2017). On the local level, a newly established orthopedic practice and unit within a healthcare system, along with limited access to endocrinology services and diabetes education, have complicated the way in which optimal postoperative glycemic control is achieved.

To further solidify the importance of this problem, I will restate the practice-focused question and relate the question to the DNP project goals. The research supporting the development and appropriateness of a clinical practice guideline will be discussed and analyzed. The location of the research and guidelines as well as a description of the research methodology and specific details on the obtainment of the

research will be stated. The project did not include any local or organizational data and I did not conduct any research studies individually. A summary of the approach will be detailed and reviewed in-depth.

Practice Focused Question

The project aim is to enhance nursing practice through creation of a clinical practice guideline to assist with the improved management of glycemic control following an orthopedic procedure requiring an inpatient stay in the person living with type 2 diabetes. The practice-focused question was developed using the PICO format as follows: What are the evidence-based practice recommendations for adults aged 18 years and older living with type 2 diabetes, for glycemic management following an orthopedic procedure requiring hospitalization? To answer this question, a thorough review of the research and evidence was required. A thorough analysis of the recommendations and outcomes allowed for further exploration of the impact a clinical practice guideline standardizing postoperative glycemic control and education following an orthopedic procedure would have on the improvement of glycemic control postoperatively. The operational definitions used for completion of this DNP project were as follows:

> *Clinical practice guideline:* A written work formulated through a research review and analysis process that results in an evidence-based set of patient-focused recommendations that may improve quality of care and patient outcomes (American Academy of Family Physicians, [AAFP], 2019).

Glycemic control: Within the hospital setting, glycemic targets of 100-180 or 100-140 if achievable without hypoglycemia equate to glycemic control (ADA, 2019b).

Postoperative: The period of time following a surgical or operative procedure (Mick & Guastella, 2013).

Sources of Evidence

Published recommendations and outcomes were used as sources of evidence to ensure the practice-focused question was answered as required for this project. The sources of evidence were in the form of peer reviewed journal articles, published organizational guidelines and recommendations, books, and organizational and public websites. The goal of this project was to enhance glycemic control following an orthopedic procedure for hospitalized patients. The developed clinical practice guideline will assist nurses as they advocate and care for these patients. To develop a thorough and evidence-based clinical practice guideline, a literature review and synthesis was required. A literature review is defined as an intense review and analysis of high-quality evidence and research that allows for synthesis of appropriate guidelines (Burgers, Brugman, & Boeynems, 2019).

To ensure the practice-focused question was addressed, a comprehensive and thorough literature review was completed. The literature review included synthesis and analysis of type 2 diabetes management techniques, research, and published guidelines from national organizations. The review focused on the published works of accredited

organizations, scholars and experts in the field, and high-quality research findings. The following databases were used to conduct the literature review: CINAHL, PubMed, Medline, Cochrane, and SAGE. The following search terms were used: *type 2 diabetes*, *postoperative*, *orthopedic surgery*, *glycemic control*, *self-management*, *self-efficacy*, *guidelines*, *standards*, *education*, *nursing*, *hospitalization*, *inpatient*, and *glucose*. The literature review included publications dated 2006 to 2020.

Several reputable organizations offer guidelines, recommendations, and research in diabetes management. The ADA (2019b) issues a yearly guideline that implicitly states recommendations for glycemic control for hospitalized patients. The ADA (2019b) also supports self-management education and the multidisciplinary team approach to improve glycemic control. The American Association of Diabetes Educators (AADE, 2019) supports diabetes self-management education and emphasizes the importance of glycemic control through the continuum of care. Additionally, AACE (2019a), and the Endocrine Society (Umpierrez et al., 2012) offer guidelines for the management of type 2 diabetes through the life span and both note the importance of the multidisciplinary team as well as education that improves self-efficacy. Lastly, as noted in the DAWN study, attention to the patients' perceived quality of life and the patients' ability to self-manage their type 2 diabetes is of the utmost importance (Funnell, 2006).

The aforementioned literature review, key terms, databases, and publication years allowed a thorough analysis and synthesis of the current literature. Collection of the most recent and robust literature allowed for creation of an appropriate and evidence-

based clinical practice guideline that will be used to optimize patient outcomes. As the goal of the project was to improve postoperative glycemic control, specifically in patients requiring an inpatient stay following an orthopedic surgery, it was important to evaluate glycemic control during hospitalization and glycemic control following other surgical procedures. This robust literature review of the highest quality evidence allowed me to produce a high-quality clinical practice guideline.

Analysis and Synthesis

A clinical practice guideline is a written work formulated through a research review and analysis process that results in an evidence-based set of patient-focused recommendations that may improve quality of care and patient outcomes (AAFP, 2019). Clinical practice guidelines should be composed of the highest quality, evidence-based research that has the positive potential to influence patient outcomes and elicit social change (AAFP, 2019). As a clinical practice guideline should include high quality research, it is important for the developer of the clinical practice guideline as well as the reader to understand the level and quality of evidence. A literature review includes the formal analysis of research quality and commonly, levels of evidence are used (Johns Hopkins Medicine, 2019).

The Oxford Centre for Evidence-Based Medicine Levels of Evidence (2011) literature assessment offers an effective way to categorize research by quality. The levels of evidence presented offer levels 1 through 5 based on the aim of the study, the study type, and the quality of study (Oxford Centre, 2011). This initial grade is then transposed

to a letter A through D with the highest quality research earning a level A grade (Oxford Centre, 2011). For example, research aimed at prevention conducted using an individual cohort study would receive a level 2b grade (Oxford Centre, 2011). An initial grade of 2b translates to a letter B grade (Oxford Centre, 2011). The guideline is complex and specific allowing for appropriate categorization of the research and the extrapolation of high-quality research (Oxford Centre, 2011). To keep the literature organized and the grading criteria easily accessible, a literature matrix was used (See Appendix A).

The AGREE II instrument, an in-depth tool to assist with the development of clinical practice guidelines, was applied to ensure the quality of the clinical practice guideline (Brouwers et al., 2010). The tool required utilization of 23 criteria levels and six areas of appraisal (Brouwers et al., 2010). The six domains include: (a scope, (b) stakeholder involvement, (c) rigor, (d) clarity, (e) applicability, and (f) editorial independence (Brouwers et al., 2010). Scores were based on completeness, quality, rigor, and overall cohesiveness and evidence-based research level of support for the clinical practice guideline (Brouwers et al., 2010).

This tool was used by the project team members and experts in the field. As a Walden University (2019) requirement, the AGREE II tool is used to analyze and approve final scholarly projects. Initially, the AGREE II criteria act as a guide for clinical practice guideline development. I self-evaluated the rough draft of the final project using the AGREE II checklist. After initial revisions, the AGREE II instrument was applied by the expert panel that included two endocrinologists, two endocrinology

nurses, a diabetes educator, a registered nurse working on the orthopedic unit, an orthopedic surgeon, and three registered nurses working in the endocrinology office. The expert panel evaluated and graded the clinical practice guideline. When the second revision, based on expert panel feedback was complete, the same group of experts provided with the final revision and the instrument again graded the guideline. The development of the clinical practice guideline was considered complete when a high score was achieved and no further revisions were necessary.

Institutional Review Board (IRB) approval was obtained (approval #02-25-20-0516844) to ensure the ethical requirements of the project were met. This approval required the completion of a document and acceptance of that document by the IRB following the completion of the project proposal oral defense. The ethical requirements for the project included institutional privacy, patient privacy, assurance of no data collection, and assurance that all partner organization or institution rules and regulations were upheld. With all matters concerning patient outcome and patients in general, confidentiality is of the utmost importance and must be considered a top priority (Oye, Dahl, Sorensen, & Glasdan, 209). This project did not collect or use patient data nor entail patient participation.

Additionally, the AACN (2006) DNP Essentials were used to help guide the scholarly project, the clinical practice guideline development, and the in-depth analysis and review of the current research and literature. The Essentials guide the scholarly practice of the DNP nurse by ensuring high quality evidence is translated into care

(AACN, 2006). My adherence to the essentials was evidenced by the creation and synthesis of a clinical practice guideline that was thoroughly assessed for quality and rigor. Additionally, the clinical practice guideline addressed several of the DNP Essentials including the importance of the doctorally prepared nurse to act as an integral member of the healthcare team, enhance the profession of nursing, and exhibit nurses' role in social change (AACN, 2006).

Summary

Type 2 diabetes is a problem of epidemic proportion that negatively affects the physical and mental health of millions of Americans (CDC, 2017b). Specifically, uncontrolled type 2 diabetes following an orthopedic surgery that requires hospitalization contributes to negative outcomes for patients and places a financial and resource burden on the healthcare system (Underwood et al., 2014). To improve patient outcomes, research, current guidelines, and organizational data may be synthesized into a clinical practice guideline that may inform nurses as they assist with advocacy and education to improve patient outcomes (AAFP, 2019). To ensure rigor and quality of the clinical practice guideline, it is vital to ensure the literature and the clinical practice guidelines are based on high quality research that show positive health benefits and patient outcomes (Brouwers et al., 2010). A complete analysis and synthesis of the literature along with use of tools and grading systems is required (Brouwers et al., 2010).

Section 4: Findings and Recommendations

Introduction

Type 2 diabetes is a problem of epidemic proportion that continues to grow (CDC, 2017b). In America, 30.3 million people were living with a diabetes diagnosis as of 2015 (ADA, 2019a). Type 2 diabetes is a chronic, progressive disease that may lead to a number of microvascular, macrovascular, and psychological complications (Hurtado & Vella, 2019). Diabetes-related distress has been associated with poor perceived quality of life and increased rates of depression (Garg et al., 2016). The treatment algorithm for the management of hyperglycemia requires lifestyle modifications, behavior change, and commonly, multiple medications (ADA, 2019b).

Additionally, for people living with diabetes who require an orthopedic procedure, hyperglycemia has many negative postoperative outcomes: evisceration, poor wound healing, increased infection rate, prolonged hospital stay, delayed return to normal activities, and mortality (Yong et al., 2018). Locally, in Ohio, the incidence rate of diabetes is 12.7%, which is higher than the national population incidence rate of 9.4% (CDC, 2017b; ADA, 2017). Poor glycemic control in general and postoperatively places a financial and resource burden on the healthcare system and contributes to negative societal effects noted by the financial healthcare burden (Maa, 2017).

Based on an understanding of the negative outcomes associated with type 2 diabetes, a practice-focused question was developed for this project: What are the evidence-based practice recommendations for adults, aged 18 years and older and living

with type 2 diabetes, for glycemic management following an orthopedic procedure that required hospitalization? Clinical practice guidelines are developed to improve clinical outcomes (AAFP, 2019). Several organizations have created clinical practice guidelines addressing glycemic control postoperatively and during hospitalization (ADA, 2019b; AACE, 2019a; Umppierrez et al., 2012). The purpose of this DNP project was to improve patient outcomes by synthesizing the current guidelines and recommendations into a concise practice guideline that addresses postoperative glycemic control following an orthopedic procedure requiring hospitalization.

To create the clinical practice guideline, many sources of evidence were reviewed. The following databases were used to obtain articles published between 2006 and 2020: CINAHL, PubMed, Medline, Cochrane, and SAGE. The following keywords were used: *type 2 diabetes*, *postoperative*, *orthopedic surgery*, *glycemic control*, *self-management*, *self-efficacy*, *guidelines*, *standards*, *education*, *nursing*, *hospitalization*, *inpatient*, and *glucose*. The literature was reviewed and analyzed according to the Oxford Centre for Evidence-based Medicine scale, Levels of Evidence to ensure high-quality evidence. Additionally, the AGREE II tool was applied to the draft guideline by experts in the field of diabetes management. The purpose of this section is to discuss the findings, implications, and recommendations; the contribution of the DNP project team; and study's strengths and limitations.

Findings and Implications

Multiple literary works were reviewed and critically analyzed for this project. The literature reviewed focused on several aspects of living with type 2 diabetes and type 2 diabetes management in general, as well as specifically pertaining to surgical operations. The literature review explored the effect of self-efficacy and self-management education on glycemic control (Azami et al., 2018; Jamiszewski, O'Brian, & Lipman, 2015). Funnell (2006) explored the psychological effect of living with diabetes. Lee et al., (2016) discussed the impact and negative outcomes associated with hyperglycemia postoperatively . Additionally, the professional guidelines as stated by the ADA (2019a), Endocrine Society (Umpierrez et al., 2012), and AACE (2019) were analyzed. The literature review was inclusive and thorough with the aim of building a practice guideline.

Akiboye and Rayman (2017) explored the current guidelines and recommendations for preoperative glycemic control and evaluated the effectiveness of current care. The researchers determined preoperative glycemic control as well as perioperative control has an impact on surgical outcomes (Akiboye & Rayman, 2017). To determine the specific impact of postoperative outcomes, more research and data collection would be required. However, the research findings are valuable and the evidence is strong.

Lee et al. (2016) completed a retrospective analysis of hyperglycemia postoperatively. Findings of prolonged hyperglycemia extending several months

postoperatively were established. The researchers reviewed 60 historical charts from the point of the operation through several months postoperatively. Though the researchers concluded the negative and prolonged effects of hyperglycemia persist for several months postoperatively, a larger participant group would be beneficial to provide more direction on how to prevent prolonged hyperglycemia postoperatively.

Several other studies suggested correlations of diabetes to poor surgical outcomes as well. Underwood et al. (2014) found postoperative complications were significantly higher in patients living with diabetes with an A1C of 8% or greater. Asida et al. (2013) also found more negative postoperative outcomes with poor glycemic control specifically. Penrose and Lee (2013) found that postoperative outcomes were directly correlated to preoperative glycemic control. The researchers recommended an intense analysis of preoperative glycemic control to decrease negative postoperative outcomes (Penorse & Lee, 2013). These combined findings suggest the need to assess preoperative, intraoperative, and postoperative glycemic control is important to ensure positive surgical outcomes.

Azami et al. (2018) published a study that included 142 participants to determine if nurse-led diabetes intervention groups would lead to improvements in diabetes control. The participants were divided into two groups and one group received the intervention, while the other group did not. The nurse-led intervention included self-management education, a survey of self-efficacy, and individualized care with frequent follow-up. The group of participants that received the nurse-led program had better outcomes as noted by

improvement in A1C, self-efficacy, and self-management skill. Though the outcomes were positive, the study should be explored on a larger scale with a longer follow-up window to ensure accuracy of the study findings.

The effect of care management and self-management education on glycemic control was explored by Janiszewski et al., 2015. Again, self-education and self-management skill were positively associated with improved glycemic control and self-efficacy. The study did have some flaws, which included a limited participant size and short follow-up time. While self-management is important, the technique of education delivery is also important according to the research of Van Smoorenburg, Hertrojis, Eliseen, and Melles (2019). The authors cited value in self-management education and ability for glycemic control, however, they emphasized the need for less structured and more individual education and care delivery.

Davis et al. (2019) cited the importance of nurse-led programs and shared medical appointments, which led to empowerment in patients living with type 2 diabetes and also contributed to increased self-management, self-efficacy, and glycemic control. Garg et al. (2016) found that patients receiving diabetes care and management services from nurse practitioners were more likely to reach glycemic targets. The researchers found 87% of study participants receiving intervention in the form of diabetes management from nurse practitioners met their glycemic targets. Research published by Stuij et al. (2019) suggested that nurse patient relationships were improved when the relationship was

cultivated out of a traditional clinic space. However, this research had few participants and scored low on the evidence scaling (Stuji et al., 2019).

Psychological distress has also been identified as an area that should be assessed when considering glycemic control (Armani Kian et al., 2018). The original DAWN study included a large group of participants (Funnell, 2006). The researchers were able to ascertain the connection between a diabetes diagnosis and disease distress (Funnell, 2006). Joensen et al. (2017) discussed the aforementioned DAWN 2 study. The researchers determined that patients living with diabetes faced a great deal of disease distress (). Not only were the patients living with diabetes afflicted with disease distress, caregivers and loved ones also felt disease burden and distress. Additional research conducted by Armani Kian et al. (2018) showed patients had improved glycemic control and perceptions of self when they were taught stress management skills and provided with emotional support.

Additionally, professional guidelines were reviewed to comprehensively assess the current practice standards for postoperative glycemic management. The ADA (2019b) Standards of Care offered guidance on management of diabetes during hospitalization and in the special circumstance of surgery. These guidelines were created after thorough conduct of research and exploration of findings by many experts in the field of diabetes management. The recommendations within the Standards of Care are analyzed based on strength of research. Additionally, the guidelines are updated yearly and more frequently if new research and data warrants an update ensuring currency and validity.

The ADA (2019b) offered an array of recommendations for glycemic management. The recommendations include medication and lifestyle interventions as well as self-management education. Specifically, the ADA recommends informal diabetes education to teach self-management skills. Additionally, the ADA offers guidelines on target glycemic control for patients during hospitalization and calls for moderate intensity control to prevent both hypoglycemia and hyperglycemia and improve patient outcomes.

The joint guideline of the ACE and AACE (2019) offers evidence-based recommendations for the management of glycemic control. The organizations joined together to create a treatment algorithm for type 2 diabetes in general. Additionally, a second algorithm offered instruction on the intensification of insulin regimens. This is of particular importance as insulin is the recommended treatment option for patients during times of hospitalization (ADA, 2019b). The guidelines are strong and backed by two nationally-recognized organizations depicting evidence-based findings and expert opinion (AACE, 2019).

Lastly, Umpierrez et al. (2012) detailed the recommendations of the Endocrine Society, another highly recognized organization. The Endocrine Society guideline depicts the need for preoperative glycemic control. The guideline also recommends intense management of glycemic control postoperatively to improve patient outcomes. The guideline coincides with the guidelines and recommendations of the ADA, ACE, and AACE as well.

The research and professional organization guidelines offered recommendations on the need for and way to achieve glycemic postoperatively. The research suggested the need for preoperative glycemic management to achieve postoperative glycemic control (Underwood et al., 2014). Additionally, the research was clear that insulin should be used as the treatment modality during hospitalization (ADA, 2019b). The guidelines also recognized the importance of eliminating hypoglycemia during hospitalization to prevent negative patient outcomes (ADA, 2019b). The guidelines and recommendations also stated the importance of the healthcare providers' knowledge of diabetes and diabetes management to achieve optimal glycemic goals and the need for the interdisciplinary team (Reategui et al., 2015). The complete recommendations from the literature review have been compiled into a clinical practice guideline (see Appendix B).

Several of the research studies did have some limitations. The work of Garg et al. (2016) was rated as a Level 3b when applying the Oxford Centre for Evidence-Based Levels of Medicine grading system. The publication of Sunj et al. (2019) scored a level 5 on the same grading system. These lower level research findings indicated lack of strength in the study and findings. One of the studies also had a limited sample size, which may discredit the findings (Lee et al., 2016). An additional limitation to the literature review process itself was the lack of orthopedic surgery specific research.

Overall, the research findings have implications for patients living with diabetes, healthcare providers, healthcare organizations, and society. From a patient perspective, translating the research findings into a clinical practice guideline that may be applied in

healthcare organizations may result in improved glycemic control and improved postoperative outcomes. Improved glycemic outcomes may results in a variety of improved patient outcomes including improved physical and mental health (Guo et al., 2016). The findings also allow for healthcare providers to gain knowledge on the treatment approaches that may improve glycemic control and patient outcomes. Knowledgeable healthcare providers have a greater ability to improve patient outcomes (Reategui et al., 2015).

Healthcare organizations on both a small and large scale could benefit from the findings and recommendations to improve postoperative glycemic control. Healthcare organizations are often graded on postoperative outcomes as well as hospital readmission rates, both of which may be improved with better glycemic control following an orthopedic surgery (Grover & Joshi, 2014). Additionally, glycemic control in the hospital is imperative to keep patients safe as the risks of hypoglycemia during the hospitalization continue after hospital discharge (ADA, 2019b). From a societal standpoint, due to the great number of Americans living with diabetes and the potential ill consequences of uncontrolled diabetes and postoperative outcomes associated with poor diabetes control, the societal implications of glycemic control are great (Maa, 2017). Patients living with type 2 diabetes have a greater ability to function within society and contribute adequately if they achieve glycemic control (Maa, 2017). If patients living with diabetes are cared for on both a physical and mental level, the rates of depression and distress may be significantly decreased (Maa, 2017).

Recommendations

The clinical practice guideline created for this project can be used by nurses to assist with postoperative glycemic control, specifically in patients living with type 2 diabetes following an orthopedic surgery requiring hospitalization. The purpose of a clinical practice guideline is to improve quality of care and care outcomes (Roof et al., 2018). Improving glycemic control and decreasing the negative outcomes and complications associated with diabetes postoperatively allow for improvements in care and quality (ADA, 2019b). Additionally, a clinical practice guideline affords all healthcare professionals the ability to gain knowledge and have a resource to guide the care of patients with complex conditions.

In order to create the clinical practice guideline, many steps needed to occur. Initially, a problem was identified. The problem was selected based on my professional experience and notation of a problem in achieving glycemic control postoperatively, specifically following orthopedic procedures. A thorough research review was required to (a) identify the effects of poor glycemic control postoperatively, and (b) determine evidence-based research and guidelines to assist with improved glycemic control postoperatively. The evidence then required reviewing, grading, and synthesis for translation into a clinical practice guideline.

The clinical practice guideline was created to (a) provide concise, evidence-based, and easily implementable information, (b) focus on improvement of the negative health consequences of type 2 diabetes postoperatively, (c) improve understanding of the

importance of preoperative glycemic control for postoperative glycemic control, (d) ensure self-management and self-efficacy are addressed during the care of the patient with type 2 diabetes, and (e) ensure appropriate and adequate assessment and management of patients' psychological distress. Although several guidelines existed to assist with glycemic management postoperatively, the guidelines were often lengthy and difficult to follow. The creation of one inclusive clinical practice guideline that could be used by those with and without prescriptive authority supports easy implementation and more diverse utilization.

Additionally, sharing the literature depicting the poor outcomes associated with impaired glycemic control postoperatively within the clinical practice guideline allowed for an easier understanding of the gravity of the problem. The research reviewed also substantially highlights the importance of preoperative glycemic control in order to achieve improved postoperative glycemic control and outcomes (ADA, 2019b). Although the aim of the clinical practice guideline development was specifically to improve postoperative glycemic control, preoperative glycemic control must be achieved to achieve postoperative glycemic control (ADA, 2019b).

The guideline also addressed self-management and self-efficacy as these are two important contributors to glycemic control (Van Smoorenburg et al., 2019). As diabetes is mainly self-managed, it is important to assess the patient's knowledge base, ability to self-manage, and self-efficacy behaviors (Van Smoorenburg et al., 2019). If the education level, self-management ability, and self-efficacy behaviors are not optimal, education and

advocacy is necessary to improve the patient's ability to manage diabetes successfully (Van Smoorenburg et al., 2019). Likewise, distress and depression are two common conditions seen in individuals living with diabetes (Armani Kian et al., 2008; Egede et al., 2016). Both distress and depression can prevent patients from achieving glycemic control (Armani Kian et al., 2008; Egede et al., 2016). The guideline addresses the need to screen patients for both diabetes distress and depression on a routine basis to ensure patients are psychologically capable of participating in disease management.

To fulfill the purpose of clinical practice guideline development, several sections of information, education, and recommendations were created (see Appendix B). The first section of the clinical practice guideline discusses preoperative glycemic control. Preoperative glycemic control is discussed in terms of (a) general diabetes management goals, (b) lifestyle modifications, (c) medications, (d) diabetes education, self-management, and self-efficacy, (e) psychological implications, and (f) the nurses' role. The second section of the clinical practice guideline depicts the necessary education and recommendations to achieve intraoperative glycemic control. The third and final section offers education and recommendations for postoperative glycemic control during a hospitalization. Recommendations throughout the clinical practice guideline were based on existing clinical practice guidelines, professional organization recommendations, and evidence-based research. The recommendations were graded using the Oxford Centre for Evidence-Based Medicine Levels of Evidence.

Preoperative glycemic control begins with a healthcare providers' general knowledge base of diabetes and expected glycemic control goals. Organizations including the ADA (2019b) and AACE (2019) offered recommendations for general diabetes control in the form of an A1C result. Preoperatively, it was recommended that the A1C value be as close to goal as possible and should not exceed an 8% (Underwood et al., 2014). The A1C goal is achievable through lifestyle modification, education, medication, and consideration of psychological factors (ADA, 2019b).

In terms of lifestyle modification, the ADA (2019b) recommended improved nutrition, increased physical activity, improved sleep habits, and decreased alcohol and tobacco intake to improve glycemic control. Pharmacologic management of hyperglycemia can be achieved using the joint ACE/AACE (2019) medication algorithm and insulin intensification guidelines. The algorithm and intensification guide are shared in their entirety in the clinical practice guideline. Although lifestyle changes and pharmacologic management of diabetes are crucial, continued management efforts will likely fail if the patient is not educated on self-management techniques and does not have a level of self-efficacy (Van Smoorenburg et al., 2019). Because of this, a portion of the guideline is dedicated to the current recommendations for diabetes self-management education. The current recommendations seek to ensure clinicians are educated on the usefulness of diabetes education, the availability of the program, and methods to evaluate patients for the need for additional self-management and disease education (AADE, 2019).

The initial section of the guideline discusses the need to evaluate the psychological impact of type 2 diabetes. As previously established, rates of diabetes distress are high in individuals living with diabetes (Funnell, 2006; Joensen et al., 2017). Diabetes distress can contribute to poor self-management skill and noncompliance (Armani Kian et al., 2008). Higher rates of depression are also seen in individuals living with diabetes (Egede et al., 2016). Depression has negative implications for glycemic control and health in general (Egede et al., 2016). The clinical practice guideline seeks to reiterate the high rates of distress and depression, the negative consequences of these psychological ailments, the importance of screening for these disorders on a routine basis, and the need for specialized care for distress and depression.

The nurse plays an integral role in assisting with the management of glycemic control (Stuij et al., 2019). The clinical practice guideline addressed the importance of the nurses' role and the ability of the nurse to advocate for, educate, and care for patients living with diabetes (Stuij et al., 2019). The role of the nurse should not be understated in terms of postoperative glycemic management. Lastly, the guideline depicts general recommendations preoperatively, which include cessation of certain antihyperglycemic control, continued glycemic control, and assessment of any metabolic abnormalities related to diabetes prior to the surgical procedure.

The second section of the clinical practice guideline discussed the recommendations for glycemic control intraoperatively. The ADA (2019b) recommends that glycemic control continue to be analyzed and assessed during the intraoperative

phase. Blood sugars should be kept between 100 and 180 during the surgical procedure. Treatment of both hypoglycemia and hyperglycemia should be initiated if blood sugars fall outside of the parameters using the ADA guidelines for the management of diabetes during hospitalization.

The third and final section of the clinical practice guideline discusses true postoperative glycemic control during a hospitalization, specifically targeting patients following an orthopedic surgery. Because conditions of the joints are negatively affected by high levels of sugar, it is imperative to continue to maintain adequate glycemic control during hospitalization postoperatively. High level recommendations include treatment of hyperglycemia with basal insulin as well as sliding scale or prandial insulin plus sliding scale insulin. Insulin therapy should be initiated with glucose levels greater than 180. Hypoglycemia protocols should be followed per facility protocol and basal insulin dosage should be decreased with hypoglycemia to prevent the recurrence of hypoglycemia. It is of the utmost importance to formulate a discharge plan that allows for glycemic control sustainability.

These recommendations are discussed in the clinical practice guideline as published in Appendix B. The clinical practice guideline was thoroughly analyzed for appropriateness using the AGREE II tool. The AGREE II tool is used to ensure quality clinical practice guideline development and implementation (Brouwers et al., 2010). The AGREE II tool requires the completion of a 23 section appraisal reviewing six important aspects of clinical practice guideline development (Brouwers et al., 2010). The six

domains focused on: (a) scope, (b) stakeholder involvement, (c) consistency, (d) clarity, (e) applicability, and (f) editorial independence (Brouwers et al., 2010). Evaluators may rank each section with a score of one to seven with a seven being the highest obtainable score. For the purpose of this project and clinical practice guideline development, the AGREE II tool was used to assess the clinical practice guideline by two endocrinologists, a diabetes educator, a registered nurse working on the orthopedic unit, an orthopedic surgeon, and three registered nurses working in the endocrinology office. The AGREE II results are presented below:

Table 1.
AGREE II Overall Guideline Assessment Question

AGREE II Team Member Overall Guideline Assessment Question 1. Rate the overall quality of this guideline	Rate	Total	Score
Appraiser 1	7	7	100%
Appraiser 2	7	7	100%
Appraiser 3	7	7	100%
Appraiser 4	7	7	100%
Appraiser 5	7	7	100%
Appraiser 6	7	7	100%
Appraiser 7	7	7	100%
Appraiser 8	7	7	100%
Total	56	56	100%

Note. AGREE II scoring ranges from 1 (lowest possible quality) through 7 (highest possible quality) With 8 appraisers, the maximum total score possible is 56 and the minimum total score possible is 8. The total score percentage was obtained by adding all individual scores and dividing by the total possible points. 56/56=1; 1 x 100 = 100%

Contributions of the Doctoral Project Team

The doctoral project team consisted of two endocrinologists, a diabetes educator, a registered nurse working on the orthopedic unit, an orthopedic surgeon, and three registered nurses working in the endocrinology office. The interdisciplinary team membership allowed for an enormous amount of knowledge from a nursing, diabetes educator, endocrinology, and orthopedic perspective. An interdisciplinary doctoral

project team was purposely selected to ensure all areas of expertise were given an opportunity to contribute their specialized knowledge. Members of the team assisted with the project by offering expert opinion, personal experience, and advice on reputable organizations and sources of evidence. This information and expert opinion was helpful for the data collection process. Additionally, upon completion of the clinical practice guideline, the doctoral team used the AGREE II tool to assist with evaluation of the validity and completeness of the clinical practice guideline. Completion of the AGREE II tool appraisal and the results confirmed the strength of the clinical practice guideline. The development of the clinical practice guideline was solely for the utilization of this project and no implementation plans exist.

Strengths and Limitations of the Project

The clinical practice guideline has several strengths. A major strength of the project is the robust research review completed to elicit the information entered into the clinical practice guideline. The research review and clinical practice guideline creation were completed with a review of more than one dozen organizational publications and evidence-based practice research articles. Many of the recommendations of the clinical practice guideline are strong and supported by numerous research findings. Additionally, the research was reviewed and graded using a recognized research grading tool, the Oxford Centre for Evidence-based Practice Levels of Evidence. Therefore, the research quality is easily interpretable and validity assessment may be completed.

The utilization of the interdisciplinary team for assessment of the clinical practice guideline is a major strength of the clinical practice guideline. As identified in the CCM (Zuccaro, 2015) and works by Grover and Joshi (2014), diabetes is a disease best treated by an interdisciplinary team. The team members most closely effected by and most likely to play a role in postoperative management would include an array of professionals from the orthopedic, endocrinology, and diabetes education team. Therefore, using the expert opinions of these clinicians as well as having the clinical practice guideline reviewed by these individuals allows for assurance that (a) the guideline coincides with the recommendations of the specialties, (b) the clinicians believe the clinical practice guideline is valid, (c) the clinical practice guideline may have validity for utilization, and (d) all specialties understand the problem and agree with a potential practice change.

Although the clinical practice guideline does offer several strengths, some limitations are noted as well. The first limitation is the limited research pertaining specifically to glycemic control postoperatively following an orthopedic procedure. A number of postoperative glycemic control research articles have been published, but few works were specifically tailored to orthopedic procedures. The findings of these research studies may have some differences if performed on a patient group following orthopedic surgeries. To combat this, I urge researchers to conduct studies specifically following patients living with diabetes requiring an orthopedic surgery. The second disadvantage to the clinical practice guideline is the simple fact that postoperative glycemic control is greatly affected by preoperative control (Underwood et al., 2014). Therefore, despite best

efforts to obtain glycemic control postoperatively, if an appropriate treatment algorithm is not implemented prior to the orthopedic surgical procedure, attainment of glycemic control following the procedure may not be possible. To lessen this disadvantage, education should be provided to all parties to ensure the importance of preoperative glycemic control is known.

Summary

Based on the identified diabetes epidemic and consequences of poor glycemic control both preoperatively and postoperatively, creation of a clinical practice guideline was warranted. The clinical practice guideline was created with knowledge of the importance of preoperative glycemic control to assist with management of postoperative outcomes and postoperative glycemic control. To ensure the clinical practice guideline was well-founded, high quality literature and organizational guidelines were used to create recommendations. Further, the doctoral project team, which included experts to review the draft clinical practice guideline, applied the AGREE II tool to solidify the validity of the recommendations. Clinician use of a synthesized clinical practice guideline may improve postoperative glycemic control and decrease the negative consequences of poor postoperative glycemic control, specifically following an orthopedic surgery requiring a hospitalization.

Section 5: Dissemination Plan

Introduction

The initial need for the clinical practice guideline development was based on the local finding of poor postoperative outcomes related to poor glycemic management postoperatively, specifically following orthopedic procedures. From there, I reviewed evidence-based research to determine the extent of complications related to poor postoperative glycemic control. From the literature, researchers found poor glycemic control led to postoperative complications, including extended hospital stays, increased risk of infection, delayed return to normal activities of daily living, and even mortality among others (Paul & Isaac, 2018). Additional research was compiled to analyze the degree of glycemic control needed to ensure a reduction of postoperative outcomes. Underwood et al. (2014) found patients had a decreased risk of postoperative complications if A1C was less than 8% prior to surgery and even better outcomes if the A1C was 6.5% or less. For this project, a decision was made to create a clinical practice guideline to assist with postoperative glycemic control following an orthopedic surgery requiring hospitalization.

As the problem identified was local, dissemination to the local organization is warranted. As the published research solidified the importance of preoperative and postoperative glycemic control, dissemination of the clinical practice guideline would target nursing professionals caring for the patient both preoperatively and postoperatively (Yong et al., 2018). Members of the care team would likely include nursing professionals

working in endocrinology, diabetes education, and orthopedics, and could be extended to the family practice environment. Postoperatively, the audience for this guideline would include surgical nurses, inpatient orthopedic nurses, and hospitalist nurses. The practice guideline could also be used by physicians and physicians' assistants.

Many stakeholders would be needed to disseminate the guideline and they are part of the DNP project team. They include members of the endocrinology, orthopedic, and diabetes education teams. These team members hold positions within the local healthcare system that afford them the ability and opportunity to meet with policy makers to disseminate the guideline into local policy. Generally, the local healthcare system would create a task force to review the need for the policy, the validity of the policy, and the ability to assimilate the policy into practice. After this is done, one person would be responsible for notifying all employees of policy changes and additions.

Analysis of Self

Creation of the clinical practice guideline and project completion required that I view myself in varying roles including as a practitioner, scholar, and project manager. The project has allowed me to grow in a variety of ways and did present some challenges. First, my role as a nurse practitioner allowed me the insight and knowledge of the noted problem with glycemic management postoperatively, specifically following an orthopedic procedure requiring a hospitalization. In my practice, I had seen firsthand the complications associated with poor glycemic control postoperatively. This afforded me the opportunity to identify a problem.

After problem identification, I was able to act as a scholar. My education and understanding of the field of research allowed me to identify a number of credible resources. These resources were the basis of the clinical practice guideline development. Prior to that, the resources helped me to understand and share the great impact poor glycemic control may have on the surgical patient living with type 2 diabetes. This research also allowed me to share the validity of the problem with my project team.

As project manager, I gained insight on how to work within a team. I gained perspective on leadership and team membership. Although many courses have taught me the importance of teamwork in healthcare whether the goal be working in an interdisciplinary team for patients or working in a team to offer policy creation or change, my professional career had not yet afforded me the opportunity to truly work as a team member with the purpose of changing a process within the healthcare system. Additionally, as I was the leader of this team, I was able to implement learned leadership behaviors and gain a better understanding of the necessary skills leaders must possess in order to work as a true team member.

Taking the leadership role was likely the biggest challenge for me. I am accustomed to working as a team and acting as a team member, however, prior to this project, I had not been identified as a team leader officially. The leadership role certainly comes with expectations and the need for very effective communication. For project completion, I worked with individuals in several specialties. Each specialty self-identified a different top goal. From an endocrine perspective, glycemic control is of the utmost

importance, from a diabetes education perspective ensuring the patient is educated and able to self-manage is imperative, and from an orthopedic perspective, ensuring the patient receives the necessary procedure to prevented a worsened problem is top priority. As a leader, I had to ensure all of these top priorities were placed at the forefront all while managing the best interest of the patient and the intent of the project. This project has allowed me to grow as a nurse practitioner, scholar, team member, and leader and these critical skills will allow me to improve my abilities to grow, learn, and lead throughout my career.

Summary

The intent of this project was to create a clinical practice guideline that could be easily implemented to improve glycemic control postoperatively, specifically following an orthopedic surgery. The created clinical practice guideline outlines the essential steps required to ensure postoperative glycemic control. As written, the clinical practice guideline is inclusive and allows providers and nurses the ability to advocate for their patients to ensure their physical, emotional, and educational needs are met. The clinical practice guideline serves the purpose of a clinical practice guideline and may assist with improvements of patient outcomes.

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Appendix A: Literature Review Matrix

Author/ Date	Theoretical/ Conceptual Framework	Research Question(s)/ Hypotheses	Methodology/Grade	Analysis & Results	Conclusions	Implications for Future research	Implications For practice
Azami, G., Soh, K. L., Sazlina, S. G., Salmiah, M. S., Aazami, S., Mozafari, M., & Taghinejad, H. 2018	Theoretical construct of self-efficacy by Bandura.	Primary hypothesis: a nurse-led diabetes self-management education program would lead to superior A1C results and improve lipids, blood pressure, weight, and ability to self-management, improve self-efficacy, quality of life, depression, and social support.	A two-arm parallel-group RCT. 142 adults with a type 2 diabetes diagnosis divided into two groups, one control group. Intervention was provided for 12 weeks with A1C as the primary outcome. Secondary outcomes of blood pressure, weight, lipids, self-management, self-efficacy, quality of life, depression and social support. Level 1B	Two-way ANOVA analysis of outcomes at both 12 and 24 weeks. The group receiving the intervention had noted improvements in A1C, blood pressure, weight, self-efficacy, and self-management skill.	The group receiving the intervention had noted improvements in A1C, blood pressure, weight, self-efficacy, and self-management skill. These improvements were noted over a 24 week period.	Continued research with a longer duration would be beneficial to confirm validity of long-term results.	Motivation, consideration to self-efficacy, and self-management are important to improving diabetes management and should be incorporated into practice.
Akiboye, F., & Rayman, G. 2017	Comparing current recommendations for postoperative glycemic control.	What recommendations for treating hyperglycemia reduces complications and improves These outcomes.	Systematic review. Level 2a	Perioperative glycemic control may help prevent postoperative complications as well as moderate intensity glycemic control	Continued guideline development and recommendation is needed to ensure adequate surgical outcomes from the population	More conclusive research should be completed and compiled to make successful guidelines.	Improved patient outcomes may follow improvements and creation of a clinical practice guideline.

				postoperatively .	living with diabetes.		
Janiszewski, D., O'Brian, C. A., & Lipman, R. D. 2015	To gain perspective and better understand the perceptions of the lived experience and the role of self-management in the individual living with diabetes.	Determine the perceived effect of diabetes self-management education using a team approach including a diabetes educator and nurse navigator.	Participants were divided into six groups with 37 individuals each. Education occurred at three different locations. The experiences and perceptions of the group members were ascertained and evaluated. Level 2C	The largest concern was ongoing care management and social support followed by lifestyle management, self-management and self-efficacy confidence.	The team approach with continued care management and diabetes self-management education were perceived to be helpful and important to care by the participants.	Ongoing care coordination should be further researched to ensure positive outcomes.	Self-management is an important skill for the management of diabetes and care should prepare patients for self-management.
Lee, S. Y., Park, M. S., Kwon, S.-S., Sung, K. H., Jung, H. S., & Lee, K. M. 2016	Analysis of post-operative outcomes in patients living with diabetes following ankle surgery.	An evaluation of the effect of glycemic control on ankle surgery outcomes along with assessment and identification of risks.	A retrospective cohort study, evaluating medical records reviewed. Fasting blood glucose, A1C, and lipids reviewed and compared pre- and postoperatively . Level 2b	A linear mixed model approach. Study included 60 participants. Researchers found no significant changes in lipid levels, a correlation to increased BMI and increased fasting blood glucose. One month postoperatively , hyperglycemia persisted, Blood sugars	Blood sugars remained increased for months postoperatively and higher sugars were correlated with higher BMI.	Continued research and guidelines should be created to diminish the prolonged hyperglycemia associated with ankle surgery.	Postoperative hyperglycemia should be understood and efforts to minimize same should be taken prior to surgery. .

				decreased on average 2.2 mg/dl per month following the first postoperative month.			
Van Smoorenburg, A., Hertroijs, D., Dekkers, T., Elissen, A., & Melles, M. 2019	Patient perspectives on self-management and disease stressors explored.	What is self-management support from the perspective of patients living with type 2 diabetes?	Ten patients were interviewed with structured interview questions. Level 2C	Qualitative research. Patients were interviewed to ascertain patient perspectives on daily life with type 2 diabetes and self-management support.	Diabetes guidelines are too structured and do not allow for the diverse needs of patients. Researchers found that patients do not feel they are self-managing a disease, they view this as living life with a disease.	More research is needed; studies do not typically include those with adequate glycemic control.	The importance and positive outcomes associated with self-management ability were reiterated. This should be transitioned into practice.
Underwood, P., Askari, R., Hurwitz, S., Chamarthi, B., & Garg, R. 2014	Determine the association between A1C and noncardiac surgical outcomes.	What is the relationship between preoperative A1C and outcomes in patients living with diabetes undergoing noncardiac surgery?	622 patient charts reviewed from 2005-2010 to determine A1C and surgical outcome associations. Level 2b.	Data were obtained from the National Surgical Quality Improvement Program database and the Research Patient Data Registry of the Brigham and Women's	Multivariate regression analysis found a higher A1C value was associated with longer hospital stays. Patients with an A1C of 6.5- less than 8% did not have these outcomes.	Continued research and further associations should be explored.	A1C should be considered prior to surgery.

				Hospital. Patients admitted to the hospital for [greater than or equal to] 1 day after undergoing noncardiac surgery from 2005 to 2010 were included in the study.			
Asida, S. M., Atalla, M. M. M., Gad, G. S., Eisa, K. M., & Mohamed, H. S. 2013	Examined outcomes in two study groups, one with tight glycemic control and one with hyperglycemia.	What is the relationship between glycemic control and perioperative outcomes?	Prospective cohort study. 100 patients with diabetes divided into two groups. One group was provided with IV rapid insulin intraoperatively to ensure blood sugars between 80 and 110 and the second group blood sugars were kept above 180. Level 1B	SPSS satirical analysis tool was used with a power analysis for sample size. Glucose was higher in the group not receiving insulin and outcomes were statistically significantly different in the two groups. The well-controlled group had less postoperative complications.	More stringent glycemic control leads to better patient outcomes.	More research is needed to confirm recommendation .	Blood glucose control may affect postoperative outcomes.
Penrose, M., & Lee, G. A.	A literature review determining the	What is the effect of pre-operative glycemic control	A systematic review of the literature. Ten	The association of postoperative	Focus on pre-operative glycemic control	Continued research and publication on	Pre-operative and postoperative

2013	effects of pre-operative glycemic control on post-operative complications.	on postoperative complications?	literary works were reviewed and analyzed. Level 2a	glycemic control and postoperative outcomes is commonly explored; however, pre-operative glycemic control and its effects on glycemic control are often narrowly discussed.	is necessary to ensure intra and postoperative glycemic control and reduction of postoperative complications.	pre-operative glycemic control is necessary to make an educated consensus.	control should be considered in patients living with type 2 diabetes.
Davis. S., Johnson, V., McClory, M., & Warneck, J. 2019	A 7 week shared medical appointment program roll out to determine impact on diabetes empowerment.	What is the effect of shared medical appointments led by nurses on diabetes empowerment?	A cohort study with patient responses was completed to determine the effects of nurse-led shared medical appointments on patient perspectives. Level 2b	Statistical software was used to determine outcomes on the small group. Evaluations were completed prior to intervention and with a 3 month follow up. Validated surveys were used to collect data.	Nurse-led, shared medical appointments with education led to improved perceptions of empowerment.	More research is required to fully analyze the effect of this program on diabetes empowerment and outcomes.	Empowerment appears to be an important concept in diabetes management and should be further explored.
Garg, R., Metzger, C., Rein, R., Lortie, M., Underwood,	Further analyzes the nurse practitioners role in access to care and care management.	Do patients receiving care from nurse practitioners have improved	Case control study; one control group, two study phases. Level 3b	222 patients received care via a nurse practitioner pre-operatively to	87% of patients in the group receiving the intervention had improved	Continued research on specific nurse practitioner care should be completed.	Intervention by nurse practitioners lead to increased care access and

P., Hurwitz, S., … Schuman, B. 2016		glycemic control per-operatively?		improve glycemic control when found to have an A1C above 8%. A statistical analysis of glycemic control and outcome was completed.	glycemic control.		improved glycemic control
Joensen, L. E., Willaing, I., Holt, R. I. G., Wens, J., Skovlund, S., & Peyrot, M. 2017	Based on the original DAWN study, a more in-depth review of the psychosocial needs of the patient living with diabetes was explored.	What are the needs, wishes, and attitudes of patients living with diabetes?	Interviews of family, friends, caregivers, and individuals living with diabetes were conducted. Level 1B	15,438 participants from 17 different countries were questioned about the effect of diabetes on their daily life and psychosocial well-being.	The burden of diabetes extends beyond the physical complications into the psychological realm and effects patients with diabetes, their families and friends, and healthcare providers.	Continued research on ways to decrease the burden of diabetes on the patient living with the disease is necessary.	Diabetes places a psychological strain on the patient living with diabetes and this should be considered, recognized, and treated.
Funnell, M. M. 2006	The original DAWN study explored the attitudes, wishes, . needs of patients living with diabetes and their caregivers	What are the attitudes, wishes, and needs of patients living with diabetes and their caregivers?	A cross-sectional international study. Patients and caregivers were randomly selected from 13 countries for study inclusion. Level 1B	Questions were statistically analyzed for outcomes. Patient responses were compared against healthcare provider responses.	Patients felt and experienced many symptoms of psychological distress related to diabetes and caregivers overall failed to recognize this distress and disease burden.	Continued research on the impact of psychological distress on diabetes management is needed.	Healthcare professionals fail to recognize and adequately treat the psychological problems caused by diabetes burden.

Sabione, I., Cavalot, F., Paccotti, P., Massucco, P., & Vigna-Taglianti, F. D. 2018	An exploration of diabetes specialized care model vs. integrated management.	What are the different outcomes in patients living with diabetes participating in specialized car vs. integrated management services?	Patients from a specific area were compared based on outcomes over a six year period. One group followed with specialized care and one group had integrated management services. Level 2B	1326 patients were enrolled in integrated management and 3494 patients were enrolled in specialized care. There were differences in population size, gender, age, and current treatment algorithm.	Specialized care and integrated management services did not have a statistically significant difference in outcomes.	Research on specific care details to improve glycemic control is warranted.	Care provided by those knowledgeable about diabetes, however, not subspecializing in diabetes is just as effective as specialty care.
Armani Kian, A., Vahdani, B., Noorbala, A. A., Nejatisafa, A., Arbabi, M., Zenoozian, S., & Nakhjavani, M. 2018	An exploration of a growing trend to focus on the psychological well0being of patients living with diabetes to improve diabetes management.	What is the effect of mindfulness-based stress reduction on the perceived emotional status of patients living with type 2 diabetes?	RCT included 60 adult patients living with type 2 diabetes. One group received mindfulness stress reduction education. Level 2B	Patients were assessed for baseline glycemic control and psychological distress prior to and following the intervention. The intervention group was compared to the non-intervention group.	Mindfulness-based stress reduction intervention led to improved glycemic and perceived psychological well-bring.	More research surrounding the outcomes of mindfulness-based stress reduction is warranted.	Stress and stress reduction may play roles in the management of glycemic control and consideration to stress reduction techniques should be considered.
Stuij, M., Elling, M. A., & Abma, T. A.	An exploration of the unique role of the nurse and the implications	What is the impact of the nurse-patient relationship on	Qualitative, ethnographic study. Interviews and observations exploring the	The observations and statements were analyzed	Patients feel more comfortable and disclose more information	Nurse-patient relationships are improved when patients are able to see and learn	External events may improve nurse-patient relationships.

2019	for patient outcomes.	lifestyle modification?	impact of the nurse-patient relationship were explored. Level 5	and reviewed. Nurse-patient relationships were bounded by healthcare organizations, improved with both individual and group care, the ability to gain rapport, and differentiation from a professional nursing role.	when nurses are seen outside a clinical setting, such as an exam room.	from nurses outside of a clinical space.	

Appendix B: Clinical Practice Guideline

Clinical Practice Guideline Manual for the Glycemic Management of Type 2 Diabetes Following an Orthopedic Procedure Requiring Hospitalization

Table of Contents

Purpose

Diabetes affects 30.3 million Americans and 9.4% of the United States population as of 2015 (American Diabetes Association, [ADA], (2019a). The prevalence rate continues to increase and the annual cost of diabetes was estimated to be $327 billion as of 2017 (ADA, 2019a). Type 2 diabetes is a complex disease that has eight noted body disruptions known as the ominous octet (DeFronzo et al., 2013). The dysfunctions occur at the brain, gut, pancreas, liver, and kidneys and contribute to a diabetes diagnosis (DeFronzo et al., 2013). Because of the many body dysfunctions, it is often necessary to use multiple medications and an intense treatment algorithm to combat hyperglycemia and to achieve adequate glycemic control (ADA, 2019b).

The achievement of adequate glycemic control is imperative for the prevention of complications. Uncontrolled diabetes can lead to both microvascular and macrovascular complications (Hayfron-Benjamin et al., 2019). These complications may include heart attack, heart disease, vascular disease, and strokes (Hayfron-Benjamin et al., 2019). Additionally, nephropathy, retinopathy, and neuropathy are common complications seen with uncontrolled diabetes (Hayfron-Benjamin et al., 2019). Hyperglycemia has also been correlated to dementia, depression, and decreased quality of life (Funnell, 2006; Simo, Ciudin, Sino-Servat, & Hernandez, 2017). The complications of diabetes may contribute to physical, mental, and psychological abnormalities (Hayfron-Benjamin et al., 2016; Sino et al., 2017).

The need for surgical procedures presents special challenges to the patient living with type 2 diabetes. First, patients living with type 2 diabetes have an increased need for orthopedic surgeries related to average age of diagnosis, the medications effect on bone health, and the comorbidities and complications of diabetes (Lee et al., 2016; Sundararaghavan, Mazur, Evans, Liu, & Ebraheim, 2017). Patients living with type 2 diabetes are at risk for surgical complications including infection, evisceration, poor healing, prolonged hospital stay, inadequate and untimely return to work and previous lifestyle, as well as mortality (Yong et al., 2018). Both preoperative and postoperative glycemic control appear to have an effect on the risk of surgical complications (Garg et al., 2016; Yong et al., 2018).

As diabetes incidence continues to grow and the knowledge of the complications and cost of the illness have spread, a variety of organizations have issued guidelines to assist with the management of type 2 diabetes. The ADA (2019a) issues yearly recommendations on the management of diabetes throughout varying phases of life, including during hospitalization and postoperatively. The American Association of Clinical Endocrinologists (AACE, 2019) and the American College of Endocrinology (ACE) joined together to publish a type 2 diabetes treatment algorithm. The Endocrine Society established a practice guideline for the management of diabetes during hospitalization (Umpierrez et al., 2012). In addition to these published guidelines, numerous researchers have published studies and opinions on both the effect of poor

glycemic control postoperatively as well as potential procedures to improve postoperative glycemic control.

The established guidelines are lengthy and often surround the medical management of diabetes. Funnell (2006) published the results of the Diabetes Attitudes, Wishes, and Needs Study that surveyed patients living with diabetes and caregivers of patients living with diabetes to determine the impact of the disease on the daily life of the individual living with the disease. The researchers determined that diabetes had a great impact on the patient's life from a psychological stance (Funnell, 2006). Azani et al. (2018) wrote of the correlation between disease distress and lack of psychological well-being to poor glycemic control. This was established and discussed by Armani Kian et al. (2018). Therefore, to improve glycemic control following an orthopedic procedure requiring hospitalization in a patient living with type 2 diabetes, it is important to have a guideline that clearly and concisely depicts the treatment algorithm which should include efforts to enhance the psychological well-being of the patient living with diabetes.

A review of the current literature and guidelines shows the vast importance of preoperative glycemic control in order to obtain postoperative glycemic control (Underwood, Askari, Hurwitz, Chamarthi, & Garg, 2014). Underwood et al. (2014) recommend an A1C of 8% or less prior to surgery at a minimum with A1C of 6.5% or less for optimal postoperative glycemic control and outcomes. Suboptimal glycemic control prior to surgery increases the risk of postoperative complications and negative

patient outcomes (Yong et al., 2018). Because of this, it is vital to include preoperative glycemic control recommendations in this clinical practice guideline.

The purpose of this clinical practice guideline is to:

1. Create a clinical practice guideline that is concise, evidence-based, and easily implementable.
2. Focus on improvement of the negative health consequences of type 2 diabetes postoperatively.
3. Create an understanding of the importance of preoperative glycemic control for postoperative glycemic control.
4. Ensure self-management and self-efficacy are addressed during the care of the patient with type 2 diabetes.
5. Ensure appropriate and adequate assessment and management of psychological distress is completed.

Stakeholder Involvement and Clinical Practice Guideline Development:

This clinical practice guideline was developed using the guidelines and recommendations of several professional organizations including ADA (2019a), AACE (2019), and several works of high-quality research. The medical recommendations, current guidelines, and research on preoperative glycemic control, postoperative glycemic control, patients living with type 2 diabetes perspectives and needs, were also used. The evidence on self-management, self-efficacy, and psychological distress were also examined and incorporated into the clinical practice guideline development.

Additionally, the clinical practice guideline was reviewed in its entirety and graded using the AGREE II tool by two endocrinologists, an orthopedic surgeon, an orthopedic nurse, two endocrinology nurses, and two diabetes educators.

Sustainability:

The clinical practice guideline should be reviewed and amended annually by the organizational policy review board. The guideline should be updated based on high quality and new recommendations, guidelines, and evidence-based practice findings.

Recommendation Guide

The recommendations were graded using the Oxford Centre for Evidence-Based Medicine Levels of Evidence (2011). The Oxford Centre for Evidence-Based Medicine Levels of Evidence (2011) ranks sources of literature based on strength of study. Additionally, the literature ranking is easily transferrable to a grading recommendation using the Oxford Centre for Evidence-Based Medicine Grading Recommendation Guide. The grades provided for recommendation range from A through D with a recommendation grade of A holding the strongest recommendation and recommendation grade D holding the weakest recommendation.

Questions:

The following questions acted as a guide for the Clinical Practice Guideline Development and focused on the important role of the nurse, patient's self-efficacy and self-management skills, as well as the importance of the patient's psychological status for diabetes management.

1. What effect does preoperative, intraoperative, and postoperative glycemic control have on postoperative outcomes?
2. What is the effect of diabetes self-management education on glycemic control?
3. What is the effect of psychological distress and disease distress on glycemic control?
4. What is the effect of the nurse-patient relationship on glycemic control?

5. What is the treatment algorithm for glycemic control postoperatively?
6. When should an individual receive psychological assistance due to diabetes distress?

Target Population:

Adults aged 18 and older living with a type 2 diabetes diagnosis who have undergone an orthopedic surgical procedure requiring hospitalization.

Preoperative Measures

A1C values of 8% and higher were attributed to poor surgical outcomes which included longer duration of hospitalization when compared to patients living with diabetes with a preoperative A1C of 6.5% or less (Underwood et al., 2014). Akiboye and Rayman (2017) cite increased length of stay and increased risk of pulmonary embolism in patients living with diabetes with an A1C greater than 6.5% having cervical laminoplasty and increased risk of mortality with an A1C greater than 7% in patients receiving joint arthroplasty. Asida, Atallia, Gad, Eisa, and Mohamed (2013) found hyperglycemia prior to surgery places patients living with diabetes at an increased risk for infection, stroke, heart block, and death. Additionally, patients with well-maintained preoperative and intraoperative blood sugars, greater than 100 were at a 34% higher risk of postoperative complications for every 20 points blood sugar is above target (Asida et al., 2013). Therefore, attention to preoperative glycemic control is important (Penrose & Lee, 2013).

Sudhakaran and Surami (2015) offer recommendations to ensuring improved glycemic control pre, intra, and postoperatively which include the need for frequent glucose monitoring and review, medical management strategies, and the need to rule out current complications of hyperglycemia including diabetic ketoacidosis (DKA), hyperglycemic hyperosmolar syndrome (HHS), and electrolyte imbalances. To manage diabetes prior to surgery and in general, the AACE (2019) and ACE joint treatment algorithm should be used. This algorithm calls for the titration and addition of medications until goal glycemic control is achieved (AACE, 2019). This algorithm does use medications that may increase the risk of complications such as dehydration and DKA, HHS, and these medications should be held prior to surgery to reduce the risk of DKA and dehydration (Sudhakaran and Surami, 2015).

Recommendations for preoperative glycemic control:

1. A1C should be below 8%, preferably less than 6.5% prior to elective surgery to promote positive postoperative outcomes, and to reduce the risk of pulmonary embolism, decrease the length of stay, and decrease the risk of mortality (Underwood et al., 2014). Grade B
2. Preoperative glucose goal of 100 is adequate to reduce postoperative complication rates (Asida et al., 2013). Grade A
3. Frequent monitoring of blood sugars should be completed by the patient and reviewed frequently (ADA, 2019b). Grade D

4. Medication adjustments should be completed following the joint AACE (2019) and ACE type 2 diabetes treatment algorithm. Grade D
5. DKA and electrolyte imbalances should be ruled out prior to surgery (Sudhakaran & Surami, 2015). Grade A
6. Antihyperglycemic medications should be reviewed and any class of medications that may contribute to complications including DKA and electrolyte imbalances should be discontinued prior to surgery. These medications include biguanides, alpha glucosidase inhibitors, thiazolidinediones, sulfonylureas, sodium–glucose co-transporter 2 (SGLT2) inhibitors, dipeptidyl peptidase-4 (DPP-4) inhibitors, and glucagon like peptide 1 (GLP-1) receptor agonists. Grade B

Rationale:

Preoperative glycemic control greatly effects postoperative glycemic control and outcomes (Underwood et al., 2014). Because of the pathophysiology of the human body, when speaking of orthopedic surgeries involving joints, glycemic control is of the utmost importance to prevent surgical failures and complications (Akiboye & Rayman, 2017). Clinicians, including nurses should be educated and advocate for the patient to ensure that (1) the patient and providers are aware of the importance of glycemic control, and potential poor outcomes associated with poor control, (2) glycemic control is achieved using appropriate guidelines, and (3) the patient's safety is held at the forefront of decision making and advocacy efforts.

General Diabetes Management Goals

The purpose of managing type 2 diabetes is to reduce the complications associated with the disease and improve the quality of life of patients living with the disease (ADA, 2019a). Both the ADA (2019a) and AACE (2019) offer recommendations for diabetes management. The recommendations include blood glucose and A1C targets.

Goal	ADA Guidelines	AACE Guidelines
A1C	<7% <8% in elderly, unhealthy	<6.5%
Fasting Blood Sugar Level	70-130	<110
Postprandial Blood Sugar Level	<180	<140

Lifestyle Modifications for the Management of Diabetes

Type 2 diabetes management requires an array of medical and lifestyle contributions to adequately reach optimal glycemic targets. The first step in the treatment algorithm is lifestyle modification through dietary, exercise and lifestyle modification efforts (ADA, 2019b). AACE (2019) further discusses the needs of lifestyle modification to include behavioral modifications. Lifestyle modification has the ability to delay the onset of a type 2 diabetes diagnosis or improve the glycemic control following a diagnosis of type 2 diabetes (ADA, 2019b). Those that do not make lifestyle

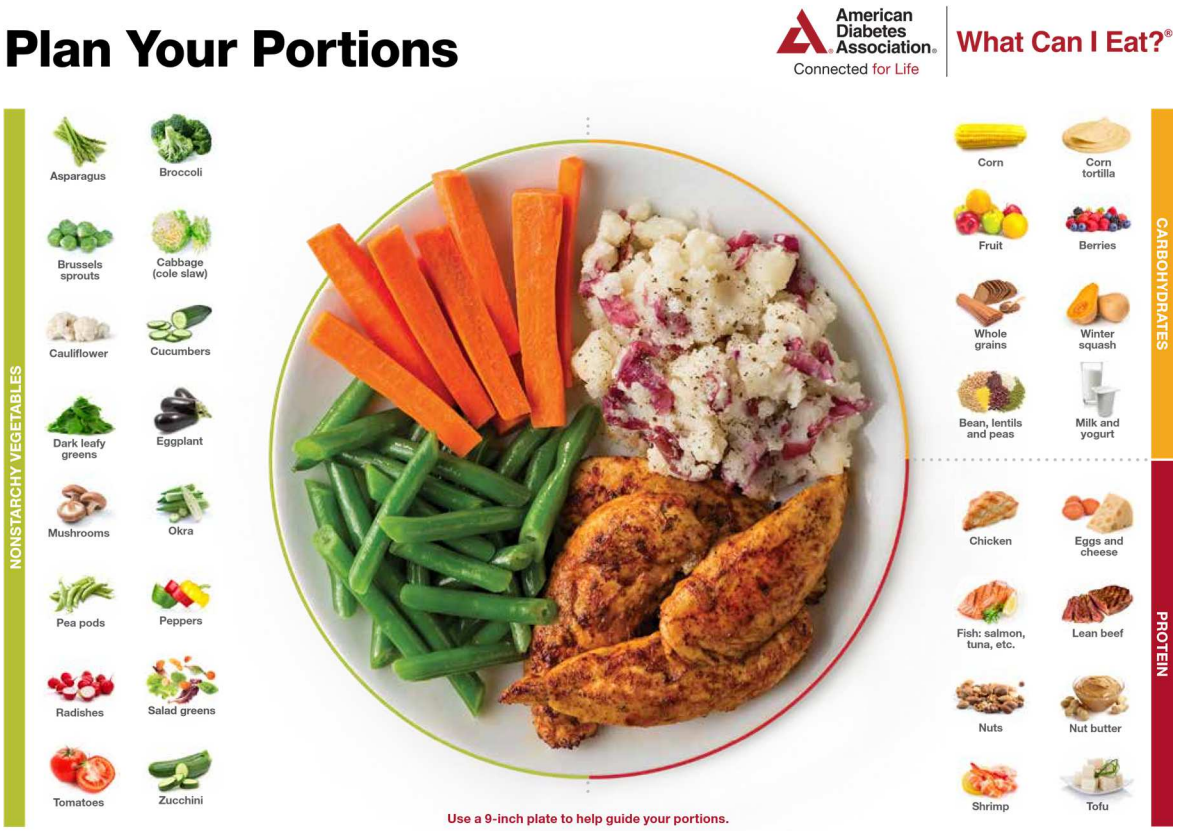
modifications tend to have poorer glycemic control and higher rates of complications associated with type 2 diabetes (Azami et al., 2018).

Recommendations for glycemic control through lifestyle management:

1. Improve nutrition to maintain or decreased weight (ADA, 2019b). Grade B
2. Increase physical activity to 150 minutes weekly with two days of strength training weekly (ADA, 2019b). Grade B
3. Improve sleep habits and ensure seven hours of sleep nightly (ADA, 2019b). Grade D
4. Minimize alcohol consumption (ADA, 2019b). Grade D
5. Avoid or quit using tobacco products(ADA, 2019b). Grade D

Rationale:

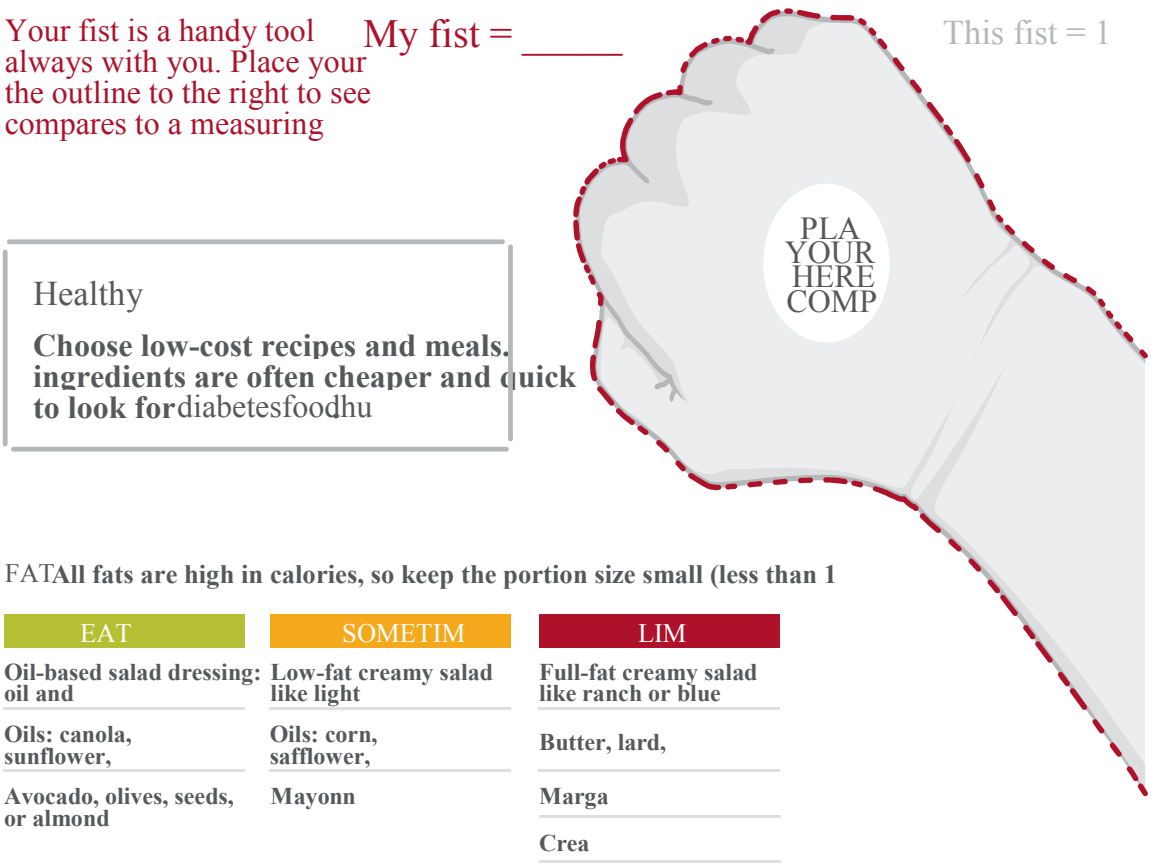
The ADA (2019a) and AACE (2019) both offer guidance on goal A1C and glucose targets. Lifestyle modifications have been shown to improve glycemic control (ADA, 2019b). As such, clinicians, including nurses, should assist the patient in understanding the potential benefits of improving dietary choices, increasing physical exercise, improving sleep patterns, and decreasing tobacco and alcohol consumptions to positively impact glycemic control (ADA, 2019b). The ADA offers several resources to assist with nutrition improvements and two resources may be found below. From a preoperative standpoint, these lifestyle modifications assist with the needed improvements in glycemic control and decrease the associated risks of postoperative complications related to poor glycemic control (Underwood et al., 2014).



What Can I Eat? | 1-800-DIABETES (1-800-342-2383) | diabetes.org/whatcanieat

Plan Your Portions

American Diabetes Association.
Connected for Life
What Can I Eat?®



What Can I Eat? | 1-800-DIABETES (1-800-342-2383) | diabetes.org/whatcanieat

Excerpted from American Diabetes Association Patient Education Materials (2019). What Can I Eat? Page 1-2

Medications

When A1C is elevated despite lifestyle modification, medication initiation is recommended following an algorithm (AACE, 2019). The AACE and ACE published a medication initiation and titration algorithm to assist with treatment plan creation for patients living with type 2 diabetes (AACE, 2019). It is often necessary to use several

medications to achieve optimal glycemic control (ADA, 2019a). Medications used to treat hyperglycemia in patients living with type 2 diabetes have different mechanisms of action and assist with glycemic control in a variety of ways (AACE, 2019). Therefore, it is important to understand the pharmacodynamics and pharmacokinetics of each medication to ensure improved glycemic control will result (ADA, 2019a). Though specialized providers are knowledgeable on the disease states and medications used for diseases, providers of non-specialty origin with extensive knowledge on the specific disease may be an effective resource as well (Reategui et al., 2015). Additionally, Sabione, Cavalot, Paccotti, Massucco, and Vigna-Taglianti (2018) found little difference in patient outcomes when patients were treated in a specialty office versus a care management team approach. If the treatment algorithm is correct, patients are compliant and have adequate self-efficacy, the outcomes will follow (Sabione et al., 2018).

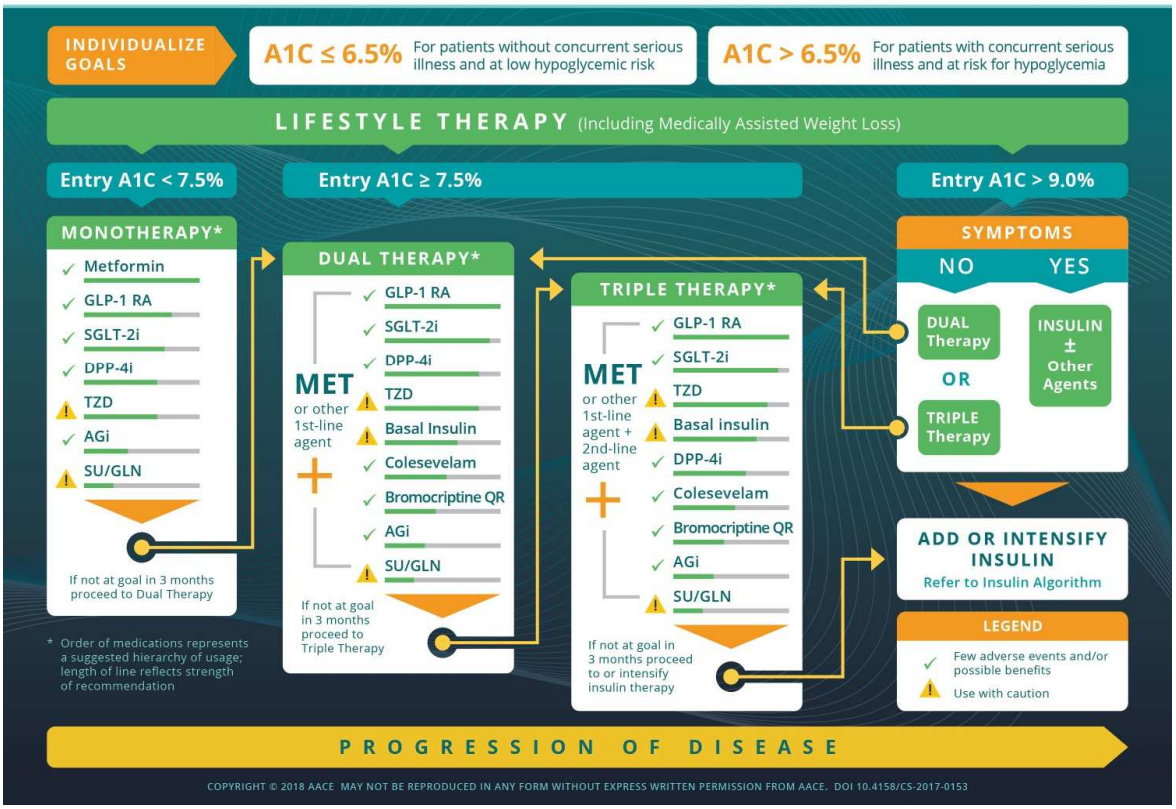
Recommendations for pharmacologic management of glycemic control:

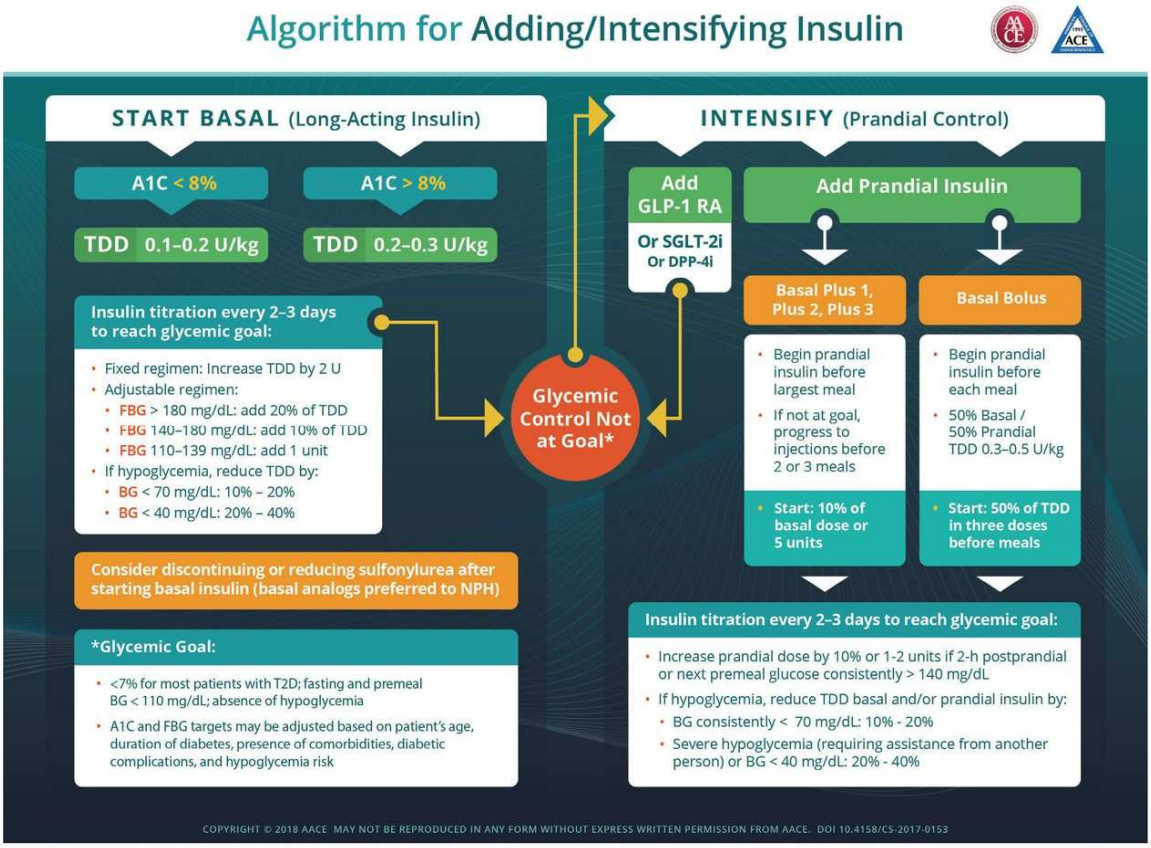
1. Use the AACE/ACE medication algorithm for pharmacologic management of type 2 diabetes (AACE, 2019). Grade D
2. Use the AACE/ACE insulin titration algorithm for improved glycemic control for individuals on insulin therapy (AACE, 2019). Grade D
3. Use resources from the ADA to improve knowledge and understanding of the pharmacodynamics of antihyperglycemic agents (AACE, 2019). Grade D

Rationale:

The joint AACE/ACE (2019) algorithm was developed using extensive expert opinion and has been continually revised to adapt to the latest pharmacologic advancements and knowledge from diabetes research. Clinicians and nurses should ensure medication adjustments are made or advocated for based on the most recent findings to promote glycemic control. Again, achieving glycemic control prior to orthopedic surgery decreases the risk of poor outcomes (Underwood et al., 2014).

Glycemic Control Algorithm





Excerpted from AACE/ACE Comprehensive Type 2 Diabetes Algorithm. (2019).

Diabetes Education, Self-Management, and Self-Efficacy

Diabetes education is warranted during the early stages of disease progression to enhance knowledge and self-management skills (ADA, 2019a). Continued diabetes education with an emphasis on self-management and self-efficacy is vital (Van Smoorenburg et al., 2019). Self-management ability contributes to improved patient outcomes (Janiszewski, O'Brien, & Lipman, 2015). Type 2 diabetes requires the attention and decision making skills of the patient, thus, the patient must be self-reliant and have the knowledge and ability to self-manage type 2 diabetes (Van Smoorenburg et al., 2019).

As the patient progresses through life or changes to health status, economic status, or activities of daily living change, additional education and support opportunities should be made available to the patient (Warshaw et al., 2019). Additionally, yearly educational reviews have proven beneficial (Warshaw et al., 2019). Diabetes education programs should be individualized to meet each and every patients needs (Van Smoorenburg et al., 2019).

The American Association of Diabetes Educators (AADE, 2020) is a great resource for healthcare professionals and patients living with diabetes alike. The organization established the seven self-care behaviors as follows: (a) "healthy eating, (b) being active, (c) monitoring, (d) taking medication, (e) problem-solving,(f) reducing risk, and (g) healthy coping" (AADE, 2020). Additionally, the AADE in conjunction with the CDC follow the standards for diabetes self-management education when developing educational programs (Beck, Greenwood, & Blanton, 2017). The standards are reviewed and updated to ensure superior development of educational programs and improved patient outcomes (Beck et al., 2017).

10 National Standards for Diabetes Self-Management Education:

1. The program should be sustained within an organization and follow goals and a mission set forth by the organization (Beck et al., 2017).
2. Experts in the field and stakeholders shall evaluate the program to ensure continued efficacy (Beck et al., 2017).

3. The program should be accessible and created with the lifestyle of the community in mind (Beck et al., 2017).
4. The quality and rigor of the program shall be assessed by one individual responsible entirely for ensuring the program follows the standards, remains relevant, evidence-based, and appropriate (Beck et al., 2017).
5. The education team must include one registered nurse, dietitian, pharmacist, or other individual with a current certified diabetes educator license or advanced diabetes board management certification (Beck et al., 2017).
6. The educational material should be relevant, up to date, research and evidence based (Beck et al., 2017).
7. The program shall not be so structured so that the individual patient needs are ignored or overshadowed. Education should be personalized (Beck et al., 2017).
8. Education shall include continued education opportunities and ways to receive continued support (Beck et al., 2017).
9. Participants should identify personal goals that shall be evaluated through the educational experience (Beck et al., 2017).
10. Quality and patient outcomes should be assessed and reviewed with implementation of change as needed (Beck et al., 2017).

Recommendations for diabetes self-management, self-education, and self-efficacy for improved glycemic control:

1. Use resources including the AADE website to locate and refer patients to diabetes education (AADE, 2019). Grade D
2. Reinforce diabetes education teaching with patient interaction (Beck et al., 2017). Grade D
3. Monitor patients for self-management and self-efficacy skill (AADE, 2019). Grade D
4. Consider referring patients to diabetes education at diagnosis. on a yearly basis and as life circumstances change (AADE, 2019). Grade D
5. Educate patient on support and education resources such as ADA website and AADE website (Beck et al., 2017). Grade D
6. Incorporate self-care behavior education into patient interaction (AADE, 2019). Grade D

Rationale:

Diabetes requires the ability of the patient to self-manage and use self-efficacy (AADE, 2019). Diabetes education programs that improve the patients' ability to self-mange and improve self-efficacy behaviors allow for improved glycemic control (Beck et al., 2017). Clinicians including nurses should contribute to the patients' education levels and be aware of the resources available to the patient (Beck et al., 2017). This effort may

contribute to improved glycemic control preoperatively and better patient outcomes postoperatively (Underwood et al., 2014).

Psychological Impact

The psychological impact of living with diabetes should not be understated. The initial Diabetes Attitudes, Wishes, and Needs (DAWN) study explored the psychological implications of life with diabetes (Funnell, 2006). Participants from 13 countries were questioned in regard to disease distress and impact of living with diabetes on their daily life (Funnell, 2006). The study findings determined high rates of diabetes distress for patients living with a diabetes diagnosis (Funnell, 2006). Additionally, healthcare providers caring for individuals with diabetes also felt the burden of the disease (Funnell, 2006). Because diabetes distress and living with diabetes is a psychological burden on the patient and caregivers the psychological feelings should be treated to ensure quality of life (Funnell, 2006).

The DAWN 2 study further solidified the findings of the initial DAWN study (Joensen et al., 2017). The study surveyed individuals living with diabetes as well as caregivers and family members in 17 countries to ascertain the emotional effects of life with diabetes (Joensen et al., 2017). An impressive 15,000 participants were surveyed with similar findings when compared to the DAWN study (Joensen et al., 2017). Nearly half of the participants living with diabetes admitted to diabetes distress (Joensen et al., 2017). Disease distress and stress in general may contribute to impaired glycemic control as well (Armani Kian et al., 2018). Research suggests that stress reduction may lead to

improve glycemic control, improve quality of life, and improved psychological wellbeing (Armani Kian et al., 2018). The DAWN and DAWN 2 (Funell, 2006; Joensen et al., 2017) studies as well as the research of Armani Kian et al. (2018) suggest a correlation between diabetes distress and poor glycemic control. Therefore, patients should be asked about their level of distress and their psychosocial health should be assessed (ADA, 2019b).

Diabetes distress and depression are two separate diagnoses. Similarly to diabetes distress, depression has been positively correlated to a diabetes diagnosis (Egede, Bishu, Walker, & Bismuke, 2016). Depression also plays a role in the patients quality of life as well as effects self-care and self-management (Egede et al., 2016). Depression as a comorbidity is associated with increased healthcare expenditure as well (Egede et al., 2016). It is important to screen for both diabetes distress and depression in patients with a diabetes diagnosis. The PHQ-9 is a patient questionnaire used to assess patients level of depression (University of Washington, 2020).

Recommendations for psychological management in the patient with type 2 diabetes contributing to improved glycemic control:

1. Patients living with diabetes should be screened for depression using an approved and reputable screening tool such as the PHQ-9 tool (AADE, 2019). Grade D
2. Patients living with diabetes should be assessed for disease distress such as the PAID Scale (AADE, 2019). Grade D

3. Patients should be referred to a mental health provider if screening for depression or disease distress is positive (ADA, 2019b). Grade D
4. Patients should be referred to diabetes self-management education when appropriate to enhance self-management and self-efficacy skills and to decrease disease burden (Beck et al., 2017). Grade D

Rationale:

Both diabetes distress and depression have negative consequences and lead to poor glycemic control (Egede et al., 2016; Joensen et al., 2017). It is imperative for clinicians, including nurses to understand the potential negative effects of depression and distress on the patient living with type 2 diabetes. It is also important for clinicians, including nurses to understand the high rates of disease distress and depression seen in patients living with diabetes (Egede et al., 2016). Because diabetes distress and depression negatively impact glycemic control, preoperative patients especially should be screened for these disorders to ensure good preoperative and postoperative glycemic control.

Nurses Role

Nurses are uniquely positioned in the healthcare industry and this position affords the profession optimal access to assist patients with chronic disease (Stuij et al., 2019). Researchers have found that using a team approach to assist with type 2 diabetes management when the team involves a nurse allows for improved glycemic control and patient empowerment (Janiszewskin et al., 2015). Additionally, shared medical appointments in which patients living with type 2 diabetes meet with other patients living

with type 2 diabetes, led by nurses resulted in improved patient empowerment (Davis, Johnson, McClory, & Warneck, 2019). Garg et al. (2016) wrote of the positive outcomes seen following a nurse practitioner led diabetes management program. Following the introduction of a program led by nurse practitioners to assist with glycemic control, 87% of participants reached glycemic target as noted by A1C value (Garg et al., 2016). The research conducted by Stuij et al. (2019) found nurse-patient relationships were best cultivated outside of a clinical space. Community based activities may lead to improved nurse-patient relationships, therefore, improved glycemic control (Stuij et al., 2019). Recommendations for nurses to assist with improvement of preoperative glycemic control:

1. The nurse-patient relationship should be cultivated to engage patients and assist with the improvement of glycemic control and patient outcomes (Garg et al., 2016). Grade B
2. Nurses should be included in the team approach for diabetes management (Janiszewskin et al., 2015). Grade B
3. Shared medical appointments led by nurses may be considered to assist with patient empowerment and glycemic outcomes (Davis et al., 2019). Grade B
4. Nurse practitioners offer a great resource to patients and may assist with glycemic control, therefore, should be used as appropriate per licensure (Garg et al., 2016). Grade B

5. Community based programs that allow patients to interact and receive education from nurses outside of a clinical space should be considered (Stuij et al., 2019). Grade D

Rationale:

Nurses hold a powerful role in the patient-care experience and have the ability to influence care and outcomes in a unique way (Stuij et al., 2019). Additionally, nurse practitioners have the ability to continue the positive patient-nurse relationship and provide high quality patient care (Garg et al., 2016). Achieving glycemic control preoperatively requires attention and time that may be an interdisciplinary team including a nurse and nurse practitioner (Davis et al., 2019). Achievement of glycemic control preoperatively requires intense management, support, and decision making, therefore, involvement of nurses and nurse practitioners should be considered.

Intraoperative Glycemic Control

Glycemic control during an orthopedic surgical procedure should be monitored closely as intraoperative glucose level also play a role in postoperative outcomes (Asida et al., 2013). Researchers found that more intensive glycemic control during surgery translated to fewer negative outcomes and postoperative complications when compared to a blood sugar target of greater than 180 (Asida et al., 2013). Glycemic control may be achieved using the guideline for treatment of diabetes during hospitalization (ADA, 2019b).

Recommendations for intraoperative glycemic control:

1. Monitor glucose levels frequently during surgery (Asida et al., 2013). Grade A
2. Use the ADA guidelines to appropriately manage glucose levels during hospitalization (ADA, 2019b). Grade D
3. Keep blood sugar between 100 and 180 during surgical procedure to improve patient outcomes and decrease the risk of postoperative complications (Asida et al., 2013). Grade A

Rationale:

Just as noted with preoperative glycemic control, intraoperative glycemic control must be achieved in order to achieve postoperative glycemic control (Aside et al., 2013). Additionally, poor glycemic control intraoperatively leads to a multitude of complications not dissimilar to poor postoperative glycemic control (Asida et al., 2013).

For the patient undergoing orthopedic surgery, intraoperative control should be achieved to decrease risks of postoperative complications (Asida et al., 2013).

Postoperative Glycemic Control

Postoperative control relies heavily on preoperative and intraoperative control (Penrose & Lee, 2013). Akiboye and Rayman, 2017 published research correlating postoperative complications to perioperative glycemic control. Lee at al. (2016) found blood sugars remain elevated for months postoperatively, significantly impacting the daily life, perceptions of quality of life, and health outcomes of the patient living with type 2 diabetes. Guidelines suggesting appropriate care approaches postoperatively and during hospitalizations have been published by the ADA (2019 a), the AACE (2019) as well as the Endocrine Society (Umpierrez et al., 2012). These recommendations are lengthy and intricate, therefore, may not be followed appropriately. To improve postoperative glycemic control, a synthesis of the organizational guidelines and recommendations has been created to allow for ease of use with the aim of improving patient outcomes in terms of glycemic control and reduction of complications associated with glycemic imbalances postoperatively.

Treatment Recommendations during hospitalization:

1. An A1C should be checked on all patients with known diabetes if one has not been performed in the last 3 months and also for all individuals with a blood sugar level above 140 (ADA, 2019b). Grade D
2. Though a sliding scale should not be used solely, a correction scale should be ordered in order to correct hyperglycemia in addition to a basal insulin when required (ADA, 2019b). Grade B

3. A combination of basal, prandial, and correction insulin is recommended for glycemic control during hospitalization (ADA, 2019b). Grade A
4. Diabetes education, endocrinology, or other specialized care provider should be consulted to assist with glycemic management (ADA, 2019b). Grade D
5. Insulin therapy should begin with a blood glucose level above 180 (ADA, 2019b). Grade A
6. Blood glucose level targets should be 140-180 for most individuals, 110-140 if the patient is able to tolerate and is not on a critical care unit (ADA, 2019b). Grade B
7. Blood sugar should be checked at bedside before meals and at bedtime for patients eating (ADA, 2019b). Grade D
8. Blood sugars should be checked every four to six hours for patients unable to eat (ADA, 2019b). Grade D
9. Hypoglycemia in the hospital setting shall be defined as any blood sugar reading less than 70 (ADA, 2019b). Grade B
10. If a patient has a hypoglycemia event, the pre-established hypoglycemia protocol should be initiated (ADA, 2019b). Grade B
11. The insulin regimen should be decreased if a hypoglycemia event occurs (ADA, 2019b). Grade B

12. Diabetes education and medical nutrition therapy consults should be placed on an as needed basis (ADA, 2019b). Grade D
13. A comprehensive discharge plan shall be established prior to hospital discharge
(ADA, 2019a). Grade B

Rationale:

Glycemic control in the hospital postoperatively is important to decrease the risk of postoperative complications following an orthopedic procedure (ADA, 2019b; Underwood et al., 2014). The ADA (2019b) has published established guidelines for the management of glycemic control during hospitalization. These guidelines aim to eliminate hypoglycemia while controlling blood glucose adequately (ADA, 2019b). Clinicians, including nurses can use these recommendations as well as the preoperative glycemic control recommendations including the medication algorithms to advocate for and educate patients and other healthcare professionals on glycemic control.

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