

SELF MANAGEMENT EDUCATION FOR PREVENTION, EARLY DETECTION, AND  
TREATMENT OF HYPOGLYCEMIA: AN INTEGRATIVE REVIEW

A Scholarly Project

Submitted to the

Faculty of Nursing Liberty University

In partial fulfillment for the degree of

Doctor of Nursing Practice

By

Rosemary Ikwueme

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C2020

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### **Abstract**

Hypoglycemia is a major complication from poor diabetic care management. Available literature indicates that it is the underlying cause of mortality in over 258,000 deaths reported in 2017. That notwithstanding, it remains a phenomenon that is given less attention than it deserves, particularly in adults with type 2 diabetes. Aside from the huge annual financial costs to the health care system (about \$327 billion) in 2017, patients with hypoglycemia complications risk many cardiovascular and neurological complications, including skipped time from work in middle aged adults, dementia, falls, hospitalization and death. The purpose of this integrative review is to educate nurses and support staff who work in Emergency Department (ED) and Emergency Department Observatory (EDO) as the frontline staff, so that they can apply the knowledge gained to the treatment of patients who present at ED and EDO. The proposed educational intervention will utilize Diabetes Basics to educate nurses on how to balance diabetes treatment to reduce blood glucose without inducing hypoglycemia through effective glycemic control, balanced nutrition, and lifestyle changes. The target population for this project are adults with type 2 diabetes mellitus (T2DM) patients aged between 35 and 97 years.

*Keywords:* hypoglycemia, “diabetes complications”, glycaemia, “glycemic control”, and ‘diabetic management’ or ‘diabetic care’.

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List of Abbreviations

American Diabetes Association (ADA)

Association of Diabetes Care and Education Specialists (ADCES)

Center for Disease Control and Prevention (CDC)

Doctor of Nursing Practice (DNP)

Evidence-Based Practice (EBP)

Institutional Review Board (IRB)

Levels of Evidence (LOE)

*The Diabetes Educator* (TDE)

Type 2 Diabetes Mellitus (T2DM)

United States of America (US)

### **Section One: Introduction**

Individuals with diabetes mellitus often experience acute and chronic complications such as hypoglycemia and other cardio vascular conditions due to a lack of knowledge of how to manage their conditions. In other cases, patients suffer hypoglycemia episodes due to poor choices or inability to make necessary lifestyle changes, thereby leading to costly re-hospitalization and sometimes death. Contributory factors for hypoglycemia include “poor nutrition, renal failure, heart disease, advanced liver disease, advanced age, infections, and the intensity of treatment regimen (Akirov et al, 2018, p. 343).

The primary essence of managing type 2 diabetes is to avoid or postpone any form of complications while assisting the patient to maintain quality of life through effective control of glycaemia level and possible cardiovascular diseases (Davies, D’Alessio, Franklin, & Kernan, 2018). Effective management of diabetes involves medication, proper dieting, and making right choices or lifestyle changes. Successful patient outcomes vary from individual to individual. Even some best cases of pharmacologic management of diabetes still result in hypoglycemic complications. This can complicate further treatment. As a result, other factors may have to be considered in setting a target for controlling a patient’s glycemic level. These will include weighing the risk for hypoglycemia, age of the patient, life’s expectancy, comorbidities, mental health issues, and available support systems (Boels et al., 2018). Finding such a delicate balance in managing diabetes and avoiding the risk of hypoglycemia complication has now become the focus of interdisciplinary care (Yana et al, 2018), and furthers Essential VI of the DNP Nursing Essential (AACN, 2006).

To review and synthesize the literature on hypoglycemia to advance evidence-based methods for preventing, detecting and managing the complication, this scholarly project adopts an integrative systematic review. Such a design will particularly confirm what is known about hypoglycemia and expose the knowledge gap about the topic. Most of all, this project will draw attention to a critical aspect of managing hypoglycemia that is often ignored – providing educational intervention to frontline nurses who work in emergency department (ED) and emergency department observatory (EDO) on effective management of T2DM patients. Once adequately trained, these nurses are better positioned to educate T2DM outpatients on how to detect and avoid episodes of hypoglycemia and the resulting unplanned hospital re-admissions. One of the core requirements for the completion of the Doctor of Nursing Practice (DNP) program is the successful completion a scholarly research project (AACN, 2006). This integrative review is a product of evidence-based project that aims to produce some credible research findings. It also affords this researcher an opportunity to develop an expertise in diabetes care management with particular focus on hypoglycemia. Most importantly, this study will adequately prepare the researcher to navigate the complex practice environment particularly in an area that draws constant attention in the healthcare. LaManna et al states that the “prevention, detection, and treatment of diabetes complications, including hypoglycemia are within the core focus of diabetes education which can be provided patients (2019, p. 352). From this point of view, integrative review when properly done can “advance nursing science”, “contribute to theory development”, and “impact clinical practice and policy” (Whittenmore, & Knafel, 2005, p. 546).

## **Background**

According to an American Diabetes Association (ADA) updated report on diabetes in 2018, “the estimated total costs of diagnosed diabetes in 2017 was \$327 billion, including \$237 billion in direct medical costs and \$90 billion in reduced productivity” (ADA, 2018). That report further confirms that diabetes was the underlying or contributing cause of 252,806 deaths. Of that number (252,806 deaths), hypoglycemia was the leading cause of complication that resulted in the reported deaths. Similarly, the setting for this project is Pittsylvania County in rural Central Virginia, with approximately 100,000 people (U.S. Census Bureau, 2019). This area’s data on diabetes complication is above the state average for Virginia and the national average. There is 12% annual cases of new diabetes among the target population (U.S. Census Bureau, 2019).

There are different thresholds for the definition of hypoglycemia, depending on whether it is in respect to patients with type 1 or 2 diabetes, or gestational hypoglycemia or none-diabetic patients. This study relates to patients with type 2 diabetes mellitus (T2DM). According to the Workgroups of the American Diabetes Association (ADA) and the Endocrine Society, hypoglycemia can be defined as “all episodes of an abnormally low plasma glucose concentration that expose the individual to potential harm” ((Cryer, 2008, pp. 3173-3174). This definition is more comprehensive than the recent joint statement of the International Hypoglycemia Study Group (IHSG), which implicitly sets the existence of hypoglycemia to a glucose concentration of less than 3.0 mmol/L (IHSG, 2020). The latter has been criticized for not being evidence-based. A more acceptable definitional element excludes a single baseline value for plasma glucose concentration for denoting hypoglycemia because the level of glycaemia or blood glucose that sets off symptoms of hypoglycemia varies from person to

person. It is therefore better to categorize hypoglycemia by the level of its severity. Admittedly, the IHSG definition of hypoglycemia is intended for clinical trials, not for individual patients in a clinical setting (Heller, Buse, & Ratner, 2020). That in part explains the use of a glucose concentration level to define hypoglycemia.

Hypoglycemia can be severe, symptomatic and asymptomatic, or probable symptomatic, and pseudo-hypoglycemia (Shahid et al., 2018). In severe hypoglycemic episodes, the patient suffers an event requiring assistance in order to be resuscitated by being administered some carbohydrate or a peptide hormone that forces the liver to convert stored glucagon into glucose. A study by Dissanayake et al. (2018) found a positive correlation between severity of hypoglycemia and the age or duration of diabetes. Symptomatic hypoglycemia on the other hand is marked by an event in which the patient experiences symptoms of hypoglycemia that are measured by glucose level of  $<70$  MG/Dl (3.9 mmol/L) (Seaquist et al., 2013). In asymptomatic hypoglycemia, as the name implies, there are no obvious symptoms of hypoglycemia, and the patient is unaware that he or she is having hypoglycemia. In probable symptomatic hypoglycemia, there is no measured glucose level pointing conclusively to the presence of hypoglycemia; instead, the presence of pointed complications is presumed. Pseudo-hypoglycemia, on another hand, is marked by glucose level of  $>70$  mg/Dl (3.9 mmol/L) (Seaquist et al., 2013). Generally, therefore, the inception of hypoglycemia can set in even at glucose levels below 3.6 mmol/L and goes even higher in patients with poorly controlled blood glucose level (Cryer, 2016).

Hypoglycemia is widely studied and known among patients with type 1 diabetes, but not as much among those with type 2 diabetes mellitus. This makes it difficult for many people to gain knowledge of the complication (Gehlaut et al., 2015; Barnett et al., 2010). Accordingly,

many patients do not know if or when they have events of hypoglycemia, particularly older patients with T2DM. This is a major contributing factor to the incidence of hypoglycemia in T2DM, and the resulting costs to the healthcare, hospitals, and patients. Gehlaut (2015), for instance, observed that the cost of hospitalization is much higher among diabetes patients with hypoglycemia complications as opposed to those without, placing the costs at \$50247 and \$3405 respectively (p. 1000). According to a 2014 report by the Center for Disease Control, out of a total of 14.2 million visits to the emergency units that year, hypoglycemia accounted for a total of 245,000 patients (11.2% of every 1000 patients) (CDC, 2017). This integrative review therefore aims to introduce an evidence-based educational intervention for empowering adult inpatients to become increasingly cognizant of the symptoms of hypoglycemia and to be able to make necessary lifestyle changes or health choices to avoid the episode or its recurrence. To this end, this integrative review captures the essence of Essentials II, III and VII of the DNP Nursing Essentials (AACN, 2006).

### **Problem Statement**

According to Yang et al. (2016), “hypoglycemia results in both marked physiological and pathophysiological consequences to the cardio-vascular system with such side effects as increase in heart rate and peripheral systolic blood pressure, a decrease in central blood pressure, weakening of the artery, and increased myocardial contractility” (Yang et al, 2016, p. 802). Persons with diabetes who experience repeat episodes of hypoglycemia requiring admission to the hospital have an increased risk of death. Many hypoglycemic events are the result of other comorbidities that fall beyond a patient’s control. A patient who is empowered with the knowledge of how to take care of their health will be better equipped to make the necessary lifestyle choices to prevent the incidence of hypoglycemia and improve their health outcomes. This function relates to the role of an advanced nurse practitioner in promoting advanced practice pursuant to Essential VIII of the DNP Nursing Essential (AACN, 2006).

Despite the litany of literature on the management of diabetes for reducing hypoglycemic complication, many patients continue to face the reality of recurring episodes of hypoglycemia, particularly older patients with T2DM. Similarly, many discharged patients are re-admitted to hospitals due to complications from hypoglycemia (McCoy et al., 2018). Such preventable re-admissions add to the strain on the healthcare system as well as hospitals and patients.

Unfortunately, the reliance on diabetic educators fail to catch many cases of patients who come to ED and EO. First, as hospitals continue to face budget challenge to hire or retain enough highly qualified nursing staff, diabetes educators are usually insufficient to meet the mounting needs of patients. Second, frontline nurses that work in ED and EDO lack the knowledge to provide needed diabetes care or intervention, or to catch symptoms of hypoglycemia among outpatients. Pischaro-Lowden, Haidet, & Umpierrez (2017, p. 614) join a line of diabetes societies and clinical organizations that argue that “continuing education for healthcare providers is the cornerstone of hospitals’ glycemic control to optimize care for this population.” The authors particularly decry the knowledge gap among healthcare providers in such areas as “contextual biomedical care, attitudes, clinical decision making, confidence, and knowledge of hospital’s resources for providing diabetes care (Pischaro-Lowden, Haidet, & Umpierrez, 2017, p. 615). It is therefore invaluable to provide educational intervention to frontline nurses so that they become better equipped to educate patients with diabetes who are at risk of hypoglycemia (Lucidi, 2018; Palmer, 2017).

### **Purpose of the Project**

The purpose of this integrative review is to establish a correlation between proper patient education and successful prevention or management of hypoglycemia in T2DM. The knowledge gained from the intervention will enable ED and EDO nurses as frontline staff to deliver

effective diabetes care to patients with T2DM using Diabetes Basics. The secondary purpose of this research is to reduce the knowledge gap among adult patients with type 2 diabetes mellitus so that they can avoid episodes of hypoglycemia.

Diabetes and related complications amounted to over \$327 billion in 2017 alone (ADA, 2017). Aside from such huge financial costs to the health care system, available data further confirm that hypoglycemia complications risk many cardiovascular and neurological complications, including skipped time from work in middle-aged adults, dementia, falls, hospitalization and death. Such staggering associated costs and associated deaths in this country cannot be easily overlooked. This article further aims to review the literature to establish a correlation between proper patient education, coupled with effective glycemic control and necessary lifestyle changes in preventing or successfully managing the risk of hypoglycemia in adult patients with type 2 diabetes. Although the incidence of hypoglycemia is higher among patients with type 1 diabetes mellitus (T1DM), the rate of diabetes is much higher among older people, thereby underscoring the need to study the cases of hypoglycemia among T2DM patients. The present lack of sufficient studies on hypoglycemia among T2DM patients relative to T1DM patients further emphasizes the essence of this study – to provide educational intervention to nurses to reduce patient knowledge gap on hypoglycemia complications among T2DM adults. This population is at the most risk of the complication. The research will further advance the current evidence-based clinical practice on the treatment of hypoglycemia: (i) that places emphasis first on preventing hypoglycemia (particularly in older patients), and (ii) then on maintaining glycemic control (Lucidi et al., 2018, p.2).

### **Clinical Question**

The Workgroups of the American Diabetes Association (ADA) and the Endocrine Society provide a general baseline for the definition of hypoglycemia that points to any episodes of an abnormally low plasma glucose concentration that expose the individual to potential harm (Cryer, 2016). Using that guideline, this research identifies the following clinical question for consideration:

- i. Whether education of nurses in ED and EDO on proper diabetes care can help bridge the patient knowledge gap and prevent or reduce hypoglycemia episodes?
- ii. Whether proper patient education can help patients prevent or detect early signs of hypoglycemia, and avoid or reduce future recurrence of hypoglycemia episodes?
- iii. Whether such diabetes education will result in improved patient outcomes, while reducing re-hospitalization of patients with T2DM.

### **Project Goals**

- i. To determine an evidence-based practice of detecting, preventing, and treating hypoglycemia among T2DM through educational intervention delivered to frontline nurses? These nurses interface with patients with diabetes more routinely rather than relying on diabetic educators.
- ii. To evaluate whether patient education will lead to improved diabetes care outcomes which has been known to have a direct correlation with hypoglycemia?

This research outcome will be disseminated to hospitals in Lynchburg, Virginia. The findings will also be submitted for publication in *The Diabetes Educator*, a peer-reviewed journal of the American Association of Diabetes Educators (AADE). To effectively perform this integrative review will involve performing focused research for secondary source materials, developing subject terms, and establishing criteria for evaluating the eligibility of relevant

information. Next, this project will involve a detailed research for resources that answer the project questions using the electronic databases at the Jerry Falwell's Library.

### **Building the Scholarly Project**

This Scholarly Project is primarily about how to prevent or detect early signs of hypoglycemia in adult T2DM patients, and effectively treat the condition to prevent future recurrence or the attendant adverse effects. Such a review requires a thorough literature review of the topic in order to ascertain the epidemiology, incidence, and clinical manifestations of the complication in order to establish an evidence-based intervention that promises the best patient outcomes, while pointing to any gap in knowledge of the condition. The findings will become the basis for the proposed educational intervention to nurses in the ED or EDO in any healthcare institution as frontline staff and consequently foster improved patient care and education in accordance with Essentials V and VII of the DNP Essentials (AACN, 2006).

## **Section Two: Methodology**

### **Protocol and Framework/Model Used**

The basis of scholarly project as a scientific inquiry lies in its anchor on philosophical framework or theoretical foundation, or both. The execution of this scholarly project as a scientific inquiry complies with Essential I of the DNP Essentials that anchors nursing practice upon scientific underpinnings (AACN, 2006). When properly formulated, it also serves as the fulcrum for “translating research-based knowledge such as evidence-based clinical practice guidelines into hospital-based nursing practice” (Breimaier, Heckemann, Halfens., & Lohrmann, 2015, p.2). Developing a protocol for a scholarly project as this guarantees that prior to setting out the methodological process from creating a search strategy, to extracting data, and synthesis, processes are properly considered and justified, enhancing the integrity and trustworthiness of

the results (Terry et al., 2020, p. 241). It will also reduce arbitrariness in data and synthesis processes (Moher et al., 2015).

The theoretical foundation for this research derives from a theory of social- poetic concept of nursing care. As advanced by Nola Pender, this philosophy supports a shift from the health care model to a perspective of the clients' commitment to their well-being (Tomey, 2006). Even from a purely Scriptural perspective, people perish for lack of wisdom (Hos. 4:6). According to this philosophical foundation, the socio-poetic concept of nursing care reveals a perspective of where the ethics of care, translated into respect for clients and their knowledge for self-care, lead to autonomy, solidarity between these professionals (dos Santos et al., 2010). This research asserts that a critical component of diabetes care, which covers the topic of hypoglycemia, is that patients and their caregivers (in many cases) lack knowledge of the patients' conditions. This is particularly true of elderly patients with T2DM in connection with hypoglycemia complication. They do not know some of the early symptoms of hypoglycemia, or how to manage their conditions to prevent the complication or its recurrence. Nurses, who are on the frontline of care, are often ill-equipped to assist patients with diabetes. With the appropriate training of nurses, particularly those who work in ED and EDO, they can reduce the knowledge gap so that patients can manage their conditions, understand early symptoms of hypoglycemia and seek help in a timely manner.

The socio-poetic theory further supports a model whereby patients are involved in the decision-making process concerning their health and, armed with knowledge, can become self-aware of what they need to lead quality lives. Effective nursing care is attainable when there is constructive interaction between the provider and the patient in advancing the patient's wellness and outcomes (Silva, Santos, & Tavares, 2015), or when a patient assumes responsibility "for the

knowledge produced and the spiritual, human sense of the forms and contents of knowledge” (dos Santos et al., 2012, p. 470). The focus of diabetes care management is on preventing hypoglycemia while maintaining effective glycemic control. The philosophy of socio-poetic foundation gives autonomy to the patient who thereby assumes a major role in the nursing care relationship as care becomes individualized based on the best interest of the patient. In the same vein, the provision of educational intervention by nurses in ED and EDO in the context of socio-poetic construct leads to the perception that nurses as professionals are fulfilling their ethical obligation to assist patients to accept the challenge for their health and wellness. According to dos Santos, “the nurse fills the role of providing guidance for self-care that establishes the exercise of citizenship for the professional and promotion of client’s independence.” (dos Santos et al, 2010, p. 644).

### **Eligibility Criteria**

The next point in developing a protocol for this integrative review is setting the criteria for acceptable resource. First, it is necessary to recast the research question. In the instance, this project seeks to determine whether there is a systematic method for early detection, prevention and treatment of hypoglycemia by providing diabetes educational intervention to nurses in ED and EDO as frontline staff so that they can better educate patients on how to prevent hypoglycemia and improve patient health outcomes? The process requires a systematic approach that calls for evidence-based competency in order to locate relevant evidence that supports the proposed educational intervention (Melnyk, Gallagher-Ford, Lloyd, & Fineout-Overholt, 2014)

This researcher created subject search terms such as ‘hypoglycemia,’ ‘glycaemia’ or ‘glycemic control,’ “diabetes complications,” and ‘diabetic management’ or ‘diabetic care.’ Articles that relate to the consequences of hypoglycemia and how it affects persons with diabetes

especially the population for this study, are selected for evaluation. Similarly, eligible articles must address the effects of educational intervention in the care and management of hypoglycemia. The articles selected were published in various continents, including North America (United States and Canada), Africa, Asia, and Europe. Only articles written in English will meet the selection criteria.

Eligibility was also based on peer-review, and coverage of the subject search terms as well as the depth of treatment. Articles more than five years from the date of publication were rejected, except in few cases where such articles were repeatedly cited by the more recent, selected ones. Only this project leader applies the eligibility criteria, thus ensuring that all articles were reviewed objectively using the same criteria.

### **Information Sources**

The next step was to conduct searches for academic journals. The searches first located 687 peer-reviewed articles (102 from PubMed Central, 98 from Wiley Online Library, 125 from Medline, 50 from Nursing and Allied Health [Cinahl], 112 from Health Source: Nursing/Academic Edition, 52 from ProQuest, 77 from Ovid, and 53 from electronic databases. Additional 28 articles were located from publications of relevant professional diabetes organizations and government websites such as the DiabeticPro – a publication of the American Diabetes Association (ADA), the Center for Disease Control (CDC), and the World Health Organization (WHO). After the initial search, this project leader next narrowed them down to one hundred and twenty articles, before finally selecting the most relevant 20 articles.

### **Search**

In conducting the literature search, this research made use of the Melnyk's hierarchy of Evidence Based Practice to critically assess the quality of particular articles (Fineout-Overholt, & Melnyk, 2005). Such evaluation is necessary to assess the quality of such articles but also to elicit confidence among clinicians who are likely going to rely on the findings to effect translation in practice (Melnyk, 2016). Such a rigor also reinforces the nature of this research as a scientific exercise as required by Essentials I, II, and VII of the DNP Nursing Essential (AACN, 2006). At first, this researcher met with a librarian who helped develop search terms for this study. The search syntax (See Table 1) for the project follows the guideline from the Cochrane handbook.

Based on Melnyk level of evidence, the first level of evidence is a systematic review/meta-analysis, which is a synthesis of all randomized controlled trials (RCTs) and other studies. Level 2 evidence on the other hand relates to randomized controlled trials where participants in the study or experiments are placed in a controlled group. At the third level of the hierarchy is the controlled trial with no randomization. Level four evidence are case controlled or cohort studies, in which a group of subjects having a condition (case) is compared with another group not having the condition (controlled group). Level 5 evidence derives from systematic review of qualitative or descriptive studies in which researchers find answers to clinical questions by synthesizing qualitative or descriptive evidence. Level 6 evidence are descriptive and qualitative studies. Qualitative studies include data gleaned from interviews or other explorations in order to resolve a phenomenon. As part of level 6 evidence, Descriptive studies, on the other hand, utilizes background information, but also the what, when, and where of a phenomenon to resolve questions relating to a topic. Level 7 evidence cover expert or committee opinion, statement or consensus on a topic of interest. The essence of such a critical evaluation of

evidence from selected articles in the course of this scholarly endeavor is to utilize high quality articles that builds validity, reliability, and rigor into the scholarship thereby ensuring greater reliance on the findings by clinicians (Melnyk, 2016, p. 337). When a research study follows the due process, the results are deemed as valid in the sense of being as close to the truth as possible based on its strict adherence to a rigorous methodology. With the exception of some articles reflecting statements from highly respected experts from the American Diabetes Association (ADA), the World Health Organization (WHO), or CDC, as well as similar organizations, which fall within level 7 of the Melnyk's hierarchy of evidence, most of the articles selected rank within the first five levels of Melnyk's hierarchy.

### **Study Selection**

This integrative review involves comprehensive review of academic peer-reviewed journals on early detection, prevention and treatment of hypoglycemia in T2DM patients. Articles that deal with diabetes complications, and management of diabetes will also be reviewed particularly if they relate to glycemic control of patients' blood glucose as well as patient education on the prevention or reduction of episodes of hypoglycemia among this population. Resources were selected from most recent journal articles on the topic, but also expert statements of expert committee from highly reputable diabetes organization and international endocrine societies. Prior to the data selection, this researcher obtained Institutional Review Board (IRB) approval for this scholarly project.

The review involves initial research for literature on the topic using electronic databases, which turned up over seven hundred articles. That was followed by another filter, which reduced the selection to one hundred and twenty five articles. After the final review, the project leader ended up selecting 35 most relevant articles that met the inclusion and selection criteria.

### **Data Collection Process**

Rigorous data collection procedures in research is critical to the quality and trustworthiness of the study findings (Kallio et al., 2016, p. 2955). Due to the nature of this review, this research utilized different types of data to generate results, including meta-analysis, qualitative, and descriptive data. This researcher prepared a predefined data extraction form for the project. The form is arranged by citation, year of publication, author, objective of the paper, and primary subject area of the paper (Badu, Brien, & Mitchell, 2019, p. 3). Similarly, due to the variety of data to be captured, the project coded data according to the quality of their methodology and theoretical consistency, as well as the relevance of the data using the 2-point scale (high and low) (Whittenmore, & Knafel, 2005, p. 548; Sundean et al., 2017, p. 363). Understandably, for a project that employs myriad study design, data abstraction will no doubt be a challenge. At the same time, such array of datasets makes for the generalizability of this research results.

This researcher solely collected data for the study as a means of maintaining data integrity, and ensuring that empirical reports follow laid down methodology or theoretical procedure. That, too, creates rigor with the project. All requisite approvals for conducting this research were duly obtained, including the CITI Certification and the Institutional Review Board (IRB) approval.

After selecting the topic for this research, this researcher sought the assistance of librarians, who helped develop the subject terms for the research and chose the most appropriate electronic databases for locating relevant journal articles. Those databases include CINAHL, Medline, Ovid, Wiley Online Library, and PubMed.

Initial data screening required only articles written in English language. Although peer-reviewed studies is the first choice for gathering relevant journal articles, this research utilized diverse study designs having regard to the nature of the study as an integrative review, such as

evidence-based clinical studies. The first search of the literature focused generally on hypoglycemic complications among persons with diabetes. Next, the results were filtered by the population for the study (adult inpatients and patients in ED and EDO with T2DM). That was followed by a targeted search in the specific academic and professional databases for articles on hypoglycemia complications and “glycemic control”. Finally, the project leader narrowed the results to the 20 most relevant journal articles.

### **Data Items**

In order to generate useful data for interpreting the variables for this research, the first most important thing is to reduce the volumes of information pulled from literature search and review into manageable bits. To arrive at that juncture, this researcher completed searches for relevant articles, categorized them by relevance (from high to low) and generalizability having regard to a study’s sample size. Inclusion of journal articles also represent diverse countries with a view to measuring the extent of variability of data samples across board. Additionally, the quality of the large sample size, coupled with the research methodology, was preferred in order to promote rigor (Wykes et al., 2008, p. 524).

### **Risk of Bias in Individual Studies**

Integrative review involves all types of studies with various methodologies hence the need to develop a framework that assures the quality of such studies (Jones et al., 2018). This research uses the Preferred Reporting Items for Systematic and Meta-analysis (PRISMA) guideline to ensure the inclusion of relevant information (Deyno et al., 2019, p. 2; Jones et al., 2018, p. 250). Based on PRISMA, the review process for this project captures a high level overview of primary research that is undertaken to synthesize all relevant research evidence in

order to support policy and evidence-based decisions (Klamwer et al, 2017, p. 286; Jackson, & Kuriyama, 2018). In the process, any person wanting to evaluate this research based on the variety of study types must make some value-judgment that may be either objective or subjective, hence the likelihood of bias. It is therefore critical to acknowledge this possibility of bias and let clinicians who might rely on the findings in the future to decide for themselves. So too, the heterogeneity of the study designs in the form of the selected literature is both a benefit, but also a possible risk factor. When researchers pool articles from distinctly different time periods instead of the same timeline, that affects the study generalization of the findings relied upon (Jackson, & Kuriyama, p. 134). Again, as with many other research undertakings, there is also the problem of “maximum effect” whereby researchers intentionally select participants from high risk population in order to achieve intended findings (Jackson, & Kuriyama, 2018, p. 133). There is further a risk of bias in the selection of articles for review, which were regressed to the year and country of publication, as well as the type of journal (Cramer et al., 2015). Additionally, the sample size of the literature vary from article to article, and pose a risk for possible bias. Studies find that small sample sizes poses the risk of bias when drawing conclusions (Sundean, 2015; Sundean & McGrath, 2016). Being aware of the risk of bias is fundamental to qualifying the generalizability and applying the necessary restraints to a study findings (Cramer et al., 2015, p.2).

### **Summary Measures**

The literature review aims to cover numerous studies dealing with hypoglycemia in the T2DM population, and the current focus of treatment and care. A large number of scholars have focused on the pharmacological approach to maintaining patients’ blood glucose levels and avoiding complications. Unfortunately, such an approach creates the unintended outcome of

hypoglycemia among patients. The literature review synthesizes research findings to ascertain whether there is enough evidence to support a paradigm shift in clinical practice away from focusing diabetic care on maintaining a balanced glycemic control to individualizing care in ways that avoid complications such as hypoglycemia.

### **Synthesis of Results**

Terry et al (2020) notes that developing a plan for data synthesis is the last in the stages of writing review protocol. In order to adequately synthesize the results of this research, it is necessary to re-cast the clinical questions set out at the beginning of this research. First, this research restates what is known of hypoglycemia among T2DM. Next, this study seeks to ascertain whether the education of nurses in ED and EDO on proper diabetes care can help bridge the patient knowledge gap and prevent or reduce hypoglycemia episodes? This research further seeks to determine whether proper patient education can help patients prevent or detect early signs of hypoglycemia, and avoid or reduce future recurrence of hypoglycemia episodes? Finally, this study aims to find out whether such diabetes education will result in improved patient outcomes, while reducing re-hospitalization of patients with T2DM.

From the onset, the lack of a generalizable definition of hypoglycemia portrays the dilemma of not only nurses, but worse still persons with diabetes. The fear of hypoglycemic crises is therefore not without biases, especially in older T2DM patients where the crises is linked to loss of independence, increased morbidity, as well as death (Arnaud et al.; 2018; Jafari, & Briton, 2015). Hypoglycemia is also linked to “a negative impact on general health status, psychological well-being, and fear of hypoglycemia, especially in T2DM” (Martyn-Nemeth, 2017, p. 740).

The thesis of this integrative review is that patient knowledge gap, particularly among elderly T2DM contributes to the prevalence of hypoglycemia among this population. Again, there is evidence that providing diabetes educational intervention to nurses who work in ED and EDO will reduce the patient knowledge gap, and improve patient outcomes. This is the focus of Essentials II, III, and VII of the DNP Essentials as one of the foundations of training advanced practice nurses (AACN, 2006).

### **Section Three: Results**

#### **Study Selection**

The process of study selection for this integrative review follows a methodical and reproducible steps necessary to achieve reliability of study findings and build transparency into the process (Waffenschmidt et al., 2019). According to Faggion et al (2018), reproducibility of findings appears to be problematic in many research, citing the fact that more than 70% of researchers could not reproduce other researchers' findings and about 50% of researchers could not reproduce their own findings (p. 53). Reproducibility can be compromised when there are errors in analysis of variables, weak study design, statistics, or inconsistency in the assessment criteria (Faggion et al, 2018, p. 54). The present review steps follow a systematic literature search, followed by a thorough review of publications prior to selection, thus ensuring that studies that contain evidence with inherent bias affecting the validity of such studies do not go undetected.

This research first developed a search strategy for relevant articles in Ovid, Cochrane, PubMed, Medline, Cinahl and Wiley Online Library. Using the "references" contained in some relevant articles as well as the "similar articles" feature in most of the databases searched, the initial search results were filtered. The first step in excluding irrelevant articles was based on a

review of the titles and abstracts of the initial results. Next, the project leader obtained the full-text of the selected articles. The final inclusion decision of articles was based on a screening of the full-text of the selected publications. A Table of the selection process based on the PRISMA 2009 Flow Diagram can be located the Appendix “B”).

The initial search pulled 687 articles that contain some of the criteria for study selection in varying degrees, including 102 from PubMed Central, 98 from Wiley Online Library, 125 from Medline, 50 from Nursing and Allied Health [Cinahl], 112 from Health Source: Nursing/Academic Edition, 52 from ProQuest, 77 from Ovid, and 53 from PsychInfo. Additional searches from DiabeticPro, the official publication of the American Diabetes Association (ADA), the websites of the Center for Disease Control (CDC), and the World Health Organization (WHO) produced another 28 results. After the initial search, this researcher screened the results down to 120 using title and abstract review. Finally, only 20 articles met the section criteria after excluding 15 out of the 35 met the eligibility criteria. Those 15 articles were either excluded because they focused on T1DM exclusively (n=8), were published in a language other than English (n+=2), or were more than 6 years old (n=5) with the exception of few outliers (See Appendix B).

As noted earlier in this research, the studies that met the section criteria reflect various designs, including qualitative and quantitative studies. Accordingly, the choice of integrative review serves to reconcile such varied data sources to improve the holistic understanding of the topic of interest (Vaismoradi et al., 2015, p. 628). It also ensures a comprehensive coverage of a phenomenon which is necessary for clinical practice (Whittemore, & Knalf, 2005).

### **Study Characteristics**

This stage focuses on reviewing the question for the scholarly project, ensuring that all variables are tested and the research process followed methodically. This review explores whether the introduction of educational intervention to frontline nurses in ED and EDO will substantially improve nurses' knowledge and confidence level in providing diabetes care, and help patients with knowing early signs of hypoglycemia, how to prevent its occurrence or recurrence, and manage T2DM. The study characteristics further requires a review of the purpose of this research, and re-confirms the inclusion and exclusion criteria to ensure that only relevant studies meet selection criteria. This stage further enables the researcher to check off that none of the selected studies contain any undetected bias, using the PRISMA and Cochrane guidelines.

Studies included coverage of type 2 diabetes, and articles are selected from various countries and continents (including North America [U.S. and Canada], Africa, Asia [Sri Lanka], and Europe [United Kingdom]). One study can be considered an outlier in the sense of dealing with both type 1 and 2 diabetes mellitus.

### **Results of Individual Studies**

Cryer (2016) subscribes to the definition by the American Diabetes Association which views hypoglycemia as “all episodes of an abnormally low plasma glucose concentration that expose the individual to potential harm” (Cryer, 2008, p. 3174) to the exclusion of the baseline of below 3.0 mmol/L (IHSG, 2020). In support of Cryer, everyone reacts differently, or shows symptoms of hypoglycemia at different glycemic level. Some patients might therefore not be cognizant that they are undergoing hypoglycemia crises even below the 3.0 mmol/L threshold, while another patient might have experienced some crises long before hitting the baseline. Rightly, therefore, the IHSG has not taken the position that the ADA definition be ignored or

abandoned, so that the ADA definition continues to be the gold standard for defining hypoglycemia (Home, 2020). In line with the American Diabetes Association definition, hypoglycemia is categorized based on the level of severity rather setting the lowest threshold. Such understanding is critical to the study selection and the research findings.

Hypoglycemia is prevalent in patients with diabetes, but can also happen to individuals without diabetic (Jaffari, & Britton, 2015). There are two main methods of glycemic control – pharmacological and non-pharmacological. The essence of pharmacological intervention is with insulin dosing to control the patient’s glycemic level and avoid hypoglycemia. In order to achieve proper dosing and maintain better blood glucose and A1C level, however, it is critical that a patient maintains a good glycemic control. This explains why Jaffari, & Britton describes hypoglycemia as a treatment-related complication of diabetes because almost 50% of diabetes medication presents with adverse side effects that results in hypoglycemia (Jaffari, & Britton, 2015; p. 450). Treatment with insulin raises the likelihood of hypoglycemia event particularly among older patients. According to Jaffari, & Britton, some of the risk factors include old age, longer period of diabetes, rigorous treatment aimed at maintaining decent blood glucose level, poor nutrition or lack of meals, as well as previous history of hypoglycemia (p. 461). Such is the fear among many people who have experienced hypoglycemia episode. This in turn leads to "poorer metabolic control, higher diabetes-related distress, and low psychological well as well as poor health condition" (Martyn-Nemeth et al., 2017, p.740).

Citing old age as a factor because of the likelihood of more health challenges, older patients with diabetes are at increased risk of renal malfunction, which in turn reduces the use of effective medication for treating diabetic condition on the one hand, while predisposing the patient to hypoglycemic complications (Chelliah, & Burge, 2004). In such older patients, the risk

of hypoglycemia can get on the way to achieving proper glycemic control thereby changing the focus of care to striking a balance between what is in the best interest of the patient against patient need, regard being had to the age of the patient, quality of life or life's expectancy.

Hypoglycemic complication symptoms include dizziness, sweating, palpitation, headache, anxiety, nervousness, and confusion, and possibly brain damage (Cryer, 2016; Barnett et al., 2010, p. 1123. See also Table 1 [Signs and symptoms of Hypoglycemia]). In repeated cases of hypoglycemia, the side effects can vary depending on the age and health of the individual. In young adults, repeated cases of hypoglycemia have not been shown to produce any worse consequences than individuals who have had no previous crises of the complication (Huang, & Gao, 2017). The consequences are somewhat different in middle-aged adults, where repeated cases of hypoglycemia have been linked with skipped time from work. In older individuals, even mild cases of hypoglycemia could result in dizziness, weakness, and increased risk of dementia, falls and hospitalization (Arnaud et al., 2018, p. 2086; Clayton et al., 2019). Most patients are unaware of the symptoms of Hypoglycemia. Gehlert et al (2015) notes that as much as 75% adult participants in their study did not know that they had at least one episode of hypoglycemia (p. 1102). This knowledge gap extends to care providers as well. The existing knowledge gap among frontline nurses and consequently many outpatients that visit ED and EDOs make hypoglycemia complications very alarming, hence the essence of this research.

LaManna et al (2019) explores the evidence and gaps in the literature from studies that assessed the impact of diabetes education on hypoglycemia outcomes (p. 353). The study reviewed fourteen studies, including randomized controlled trials, quasi experimental, and case control studies on the implication of diabetes education on hypoglycemia (p. 360). Eight of the articles found a positive result of diabetes self-education and support on hypoglycemia

outcomes; two out of the eight results showed a reduction in hypoglycemia episodes among the controlled group who received the intervention (p. 366). Another one showed a reduction in hypoglycemia in both groups, whereas five studies showed a significant reduction in symptoms of hypoglycemia (p. 366). Overall, LaManna found that diabetes education is very important for reducing hypoglycemia events and/or symptoms.

Another study by Pichardo-Lowden, Haidet, & Umpierrez (2017) explores the nature of the education gap, which includes non-availability of educational strategies to effectively educate providers on the management of diabetes in the hospital. Other areas of paucity of education include “contextualized biomedical knowledge, attitudes, clinical decision making, confidence, and familiarity with existing hospital resources in regards to hospital diabetes care” (p. 614-615). The authors were in favor of providing situated learning to health care workers (such as nurses or nurse practitioners). They defined situated learning as “learning that occurs through apprenticeship, or in a setting that offers collaboration with other learners and through dynamic interactions between the learner and their environment” (Pichardo-Lowden, Haidet, & Umpierrez, 2017, p. 615). The study found positive changes in knowledge, confidence and practice behaviors among participants in the studies reviewed (p. 620). It is necessary that such patient education is delivered by skilled and properly educated nursing staff, particularly those who work “at all points on the pathway of care (example, pre-hospital, emergency, rehabilitation, long-term care, and primary care)” (Jones et al., 2018, p. 249). For patients with diabetes who are at increased risk of hypoglycemia, the ED and EDO are the most frequent point of contacts with outpatients with T2DM.

Most findings support long term continuing quality improvement as opposed to a time-specific educational intervention that can be improved upon over time. In Akirov et al, a cohort

study with a 4715 samples, the study explores the pre-admission risk factors for in-patient hypoglycemia or serious hypoglycemia complications (2018, p. 344). The findings indicate that patients with DM who had hypoglycemia or serious hypoglycemia were mostly older patients, particularly those with renal failure or cardio-vascular diseases or those who have been treated with insulin (Akirov et al, 2018, p. 347). It has been further noted that about 18% of Medicare beneficiaries admitted for hypoglycemia will be readmitted within 30 days of discharge, and that about 23.3% of those will die within a year (LaManna et al, 2019, p. 351).

One of the studies argued that inappropriate prescribing is probably the most common cause of hypoglycemia in a hospital setting (Kulasa, & Juang, 2017; p. 74[3/10]). According to the authors, other identified causes include “lack of proper nutrition delivery, inadequate monitoring, insulin delivery, inappropriate management of the first incident of hypoglycemia, as well as failure to timely identify and manage glycemic outliers” (p. 74[4/10]). Kulasa & Juang concluded that “staff education is a primary component of any quality improvement effort, and noted that the target audience for reducing the prevalence of hypoglycemia episodes necessarily involves members of the care team, including physicians, nurse practitioners, nurses, dietitians” (p. 70). The authors further noted that there are certain proven education modalities that have effectively reduced hypoglycemia, including case-based learning tutorials, online modules, grand rounds, and unit-based lectures (p. 73). The basis of their conclusion is that increased knowledge of the care team directly correlated to a reduction in rates of hypoglycemia (Kulasa, & Juang, 2017, pp. 73-78).

According to the ADA, a primary method of preventing hypoglycemia requires addressing the causative factors, and focusing any treatment approach at reducing the risks, and involves administering low measured level of glucose. Alternatively, self-monitoring of glucose

level (SMBG) or continuous glucose monitoring (CGM) can be a critical tool for gathering useful data about an individual's glucose level and with such data determine any likely hypoglycemic episodes. Such information can further help to adjust a person's insulin dose based on the person's glucose patterns (Amiel et al., 2015). Whether it is a case of over-prescribing or under-prescribing, or lack of confidence to care for diabetes patients, or even knowing the symptoms of hypoglycemia, it comes down to properly educating the nurses on diabetes care. Accordingly, an educated patient will know how best to manager his or her condition to avoid complications, avoid frequent re-hospitalizations, and maintain improved care outcomes.

Other measures for managing hypoglycemia from the studies reviewed include patient education in terms of structured insulin dosing based on patient's adjustment of their medications, meal plans and lifestyle based on the patterns of their glucose levels. A study that reviewed the role of nurses who work with patients with diabetes mellitus rebutted the previously held presumption that most nurses possess the knowledge of diabetes patient care (Nikitara et al, 2019). Nikitara et al in their study found that the literature is replete with cases of poor inpatient experience, particularly in relation to nurses' lack of knowledge of diabetes care (p. 61[3/10]). According to the authors, "aside from lacking knowledge of specific areas of diabetes, nurses have poor knowledge of practical aspects of managing diabetes, including timing and insulin dosing, and particularly how to recognize symptoms of hypoglycemia" (Ndebu, & Jones, 2018, p. 22; Nikitara et al, 61[8/16]; Barnett et al., 2019, p. 1122). The authors went further to identify some essential nursing roles in diabetes care management, including achieving improved patient outcomes, serving as advanced care providers, and patient motivator (Nikitara et al, 61 [12/16]). Of these roles, diabetes education remains the foundation of diabetes care management. In Ndebu, & Jones (2018), the study found that out of 40 registered nurses and healthcare assistants

surveyed, 93.5% of those who worked in the Diabetic Ward knew all hypoglycemia symptoms, whereas only 25% of those in Critical Ward recognized all symptoms of hypoglycemia. Such a finding indicate that the nurses were either unfamiliar with their hospital guidelines or the general guidelines on hypoglycemia management. All of these bear on the barriers to effective nursing care for diabetes patients in the form of lack of training, resources and collaboration. In effect, once these barriers are eliminated, and nurses receive the training they need, they will be better equipped to educate and motivate patients on how to manage their health and avoid such complication as hypoglycemia episodes.

The theme of education also includes instructing patients on how to treat and not over-treat, themselves (Iqbal, & Heller, 2018). Patients should also be taught how to use blood glucose monitoring equipment such as glucometer. Mastering the glucometer can be helpful in discerning when a patient is having asymptomatic hypoglycemia without even being aware. Some of the benefits of glycemetic control includes reduced risks of retinopathy, nephropathy, and neuropathy, as well as possibly reducing the risks of cardiovascular conditions (Cryer, 2014).

Once the causes of hypoglycemia have been identified, it is crucial to formulate and institute a prevention plan. Firstly, a total evaluation of the patient should be carried out to identify possible predisposing risk factors. Secondly, target glycaemia goals should be tailored to each patient. Thirdly, selection of antidiabetic agents should be judicious. So too, patients and family should be educated to recognize and treat hypoglycemia (Chelliah, & Burge, 2004).

There is a divergence among various studies on the incidence and development of hypoglycemia which makes it difficult to build consensus on the distribution and possible control of the complication (Bonaventura, Montecucco, & Dallegri, 2015). Most studies point to the fact that effective glycemetic control is the best strategy for managing diabetes. Unfortunately,

hypoglycemia poses a limiting factor in achieving effective glycemic control, particularly in T2DM where insulin is used for controlling a patient's glucose level. Iatrogenic hypoglycemia (the fear of repeat episodes of hypoglycemia when there is a failure in clinical balancing of insulin treatment in a bid to halt reducing glucose level by administering excess insulin) compromises a person's body defenses against recurrent episodes, resulting in comorbidity and possibly death (de Galan, 2013). Cryer in his study comprehensively documents linkages between incidence of hypoglycemia and mortality in diabetic patients (Cryer, 2012; p. 3). As a result, the ADA rightly articulates that the key to controlling diabetes "is all about optimization and balance between two key markers—frequency of hypoglycemia and HbA<sub>1c</sub> reflecting average BG and primarily driven by the extent of hyperglycemia" (Kobatchev, & Cobelli, 2016; p.502). Jafari et al further confirms that frequent episodes of hypoglycemia is connected with "increased risk of hospitalization, extended hospital stay, and mortality" (2015, p. 462). Consequently, the thrust of care for all hypoglycemia patients lies in setting individualized goals and delivering structured patient education in order to minimize hypoglycemia incidence without giving up the goal of achieving glycemic control (Amiel et al., 2018, p. 1587). Unfortunately, there is huge knowledge gap on the part of healthcare providers, including nurses, concerning the management of diabetes complications. Offering diabetes education will increase the knowledge, confidence, glucose monitoring, reduce management errors, and reduce length of hospitalization (Pichardo-Lowden, Haidet, & Umpierrez, 2017, p. 620). Education of nurses will indirectly lead to improved awareness on the part of patients who, according to Kulasa, & Juang (2017), are also "a valuable target of hypoglycemia education" (p. 74 [10/10]). Corl et al (2015, p. 17) and Nowakowski-Grier (2018) corroborated the finding that the provision of nurse diabetes education increases nurses' knowledge and level of confidence as well as expertise in inpatient

diabetes care while reducing the rate of re-admission due to diabetes complication such as hypoglycemia. Both studies conducted a quality improvement and performance improvement projects respectively to gauge the outcome of nurses' bedside diabetes education on the rate of re-admission. Both cases found a correlation between education of nurses on diabetes care and inpatient re-admission rates resulting from diabetes-related complications.

An alternative approach to bridging the existing knowledge is to proactively offer an interactive training to nurses in graduate programs on some critical and practical health topics such as diabetes and hypoglycemia. Such trainings will equip nurse for complex nursing practice. As leaders in their various organizations, it is important that nurses possess diverse knowledge and skills that are relevant to their eventual clinical environment. In Beverley et al. (2019), the authors argue that medical students should learn about "patients' everyday experiences of diabetes in order to have an understanding of and confidence to assess and treat hypoglycemia" (p. 8). This position captures the essence of the 2004 Doctor of Nursing Program (DNP) position statement on the need and benefits of the practice-driven program (DNP) in equipping nurses with advanced competencies for a complex practice environment (AACN, 2004, p. 4). It also ensures that nurses acquire superior knowledge necessary to advance nursing practice and patient outcomes as required by Essential VIII of the DNP Nursing Essentials (AACN, 2006, p. 16). It is therefore imperative that nurses get exposed to the various practical aspects of healthcare such as diabetes and related complications, including hypoglycemia.

### **Synthesis of Results**

Synthesis of results involves a tripartite approach, including (a) a thoughtful coding of the findings of each study reviewed by this scholarly project; (b) categorizing the findings into themes; (c) and generating analytical themes (Thomas & Harden, 2008;

Maurer, Draganescu, & Gattinger, 2019, 2393). The approach derives from the application of a type of synthesis known as “thematic synthesis” which is a process used in analyzing all qualitative research (Thomas & Harden, 2008, p. 45, 2/10). This researcher distilled all the selected articles so as to gain firm knowledge of the data. Finally, the findings were carefully coded in relation to the characteristics of each study in order to properly grasp their unique contexts and not lump everything together thereby misapplying the data findings (Joanna Briggs Institute, 2014).

### **Data reduction**

Data reduction is an integral part of the systematic research. Not every information source in an article produces a data source. A researcher must wield through the diverse articles to sift the data, which then has to be arranged in a methodical manner that makes it easy for readers or even reviewers to assess the scholarly project. Such arrangement can be done by various categorizations, including arranging the data in alphabetical or chronological order, or by themes so that reader can comprehend the uniqueness of each article and their context. Ultimately, the essence of such arrangement is to make it easy for readers or reviewers to understand each article, and be able to compare and contrast the study’s variables (Whittenmore, & Knafel, 2003; Rothwell, 2016).

### **Data display**

Collected data need be arranged in a format that permits for meaningful deductive conclusions. The use of table and themes provide such a structure for this research and aid in the organization distribution and comparison of subsets of data from various studies.

### **Data comparison**

This researcher compared the various data sets from various articles reviewed to determine if certain variables in the findings are representative of all participants (Malmstrom et al., 2015). Data comparison also serves to establish variations in data sources, and help explain where discrepancies or variations are statistically significant (Li et al., 2019). Ultimately the comparison of the relationship between data trends enables this researcher to come to conclusions on a study. Whittenmore & Knalf highlight the creativity required of a researcher during data analysis in order to methodically arrange data sets in a meaningful structure or sequence (2003).

Among other things, the data results confirm a serious knowledge gap among nurses and nurse support staff in ED and EDO on the management of hypoglycemia and glycemic control. There is also useful data in support of a focused, individualized treatment and management of hypoglycemia (rather than setting a number-driven definition of hypoglycemia). Previous data further support the fact that older people have more cases of hypoglycemia than younger ones. A study by McCoy et al. found that elderly patients aged 75 and older are most likely to be readmitted for new hypoglycemia (2018, p. 697). There is also enough data in support of basing diabetes care on striking a balance between glycemic control and meeting patients' expressed quality of life priorities. Available data further support a reduction in re-hospitalization rate and lower incidents of hypoglycemia complications with the intervention of diabetes education. All of these point to an improved patient outcomes.

### **Conclusion drawing and verification**

Data verification and conclusion are the last steps in the analytical process. This researcher set up an audit to verify the data using the protocols established for this purpose,

thereby allowing for objective judgment based on deductive inferences. After setting up the audit for data verification using the selection criteria earlier set up for the project, this researcher verified the accuracy of the variables to ensure that they are matched up during evaluation. Finally, this researcher reviewed the all the data for consistency of common trends, being that this will impact the implementation of the final results.

### **Additional Analysis**

The preponderance of studies reviewed share the same conclusion that a safe bet for managing diabetes and at the same time lowering the risk of hypoglycemia is to set individualized glycemic goals based on individuals' age, risk and physiological conditions (Cryer, 2014). The place of patient education in achieving success with balancing patients' glycemic control cannot be over-emphasized. Educational intervention will reduce patient knowledge gaps, and empower patients to use applicable technology (such as glucometer) for monitoring their glucose level, Technology for continuous glucose monitoring has advanced with evidence of scientific effectiveness, such as the continuous glucose monitoring (CGM) sensor technology that can assist patients in detecting and preventing hypoglycemia (Lucidi et al., 2018). Teaching patients on the proper use of technology for monitoring their glucose level incorporates Essentials IV of the DNP Essentials and is critical to improving and transforming patient care outcomes (AACN, 2006). Additionally, educating frontline nurses will help them avoid over treatment by administering excess insulin to the patient.

On the part of patients, when nurses are properly trained, that will in turn help reduce patients' knowledge gaps. More patients will become cognizant of the symptoms of hypoglycemia and thereby avoid episodes or recurrence of hypoglycemia. People living with diabetes often experience emotional, physiological, and social influences which can

impact their motivation to follow through or comply with their treatment regimen (Basinger, Farris, & Delaney, 2020). Nurses who are properly trained to care for diabetes patients will be in a much better position to refer patients to diabetes resources available in the community. When patients meet with other people who are similarly situated, they will overcome shame and other psychological impediment that often prohibit them =from seeking help.

Education of nurses will also promote the use of proper, non-judging language when dealing with patients with T2DM. Besides self-judging among people with diabetes, the use of certain language to refer to people living with diabetes or diabetes complications can connote some negativity in the provision of care. The provision educational intervention to individuals with T2DM will help empower patients, while improving communication with patients and their families. Nurses will learn and use acceptable communication when referring to patients with diabetes. For example, words like “a person with diabetes” are preferable to a “diabetic” (Cooper et al., 2018).

### **Evaluation Methods**

The findings of this integrative review is a product of rigorous and methodical endeavor. This researcher frequently met with the Scholarly Project Chair to review the project updates. As a scientific project, the Scholarly Chair and the DNP Chair also reviewed the project periodically to ensure that it contains built-in rigor deserving of a doctoral program. Part of the review also looks at the integrity of the work. This researcher also made sure to acknowledge and cite all resources used in the project. Using a set of protocols, this researcher established data selection criteria, and followed methodical steps in completing the analysis that ultimately leads to the assessment, comparison, evaluation and summation or conclusion of the findings.

Further to the above, this research uses a mix of Cochrane risk of bias tool for controlled randomized studies, and the Meta-analysis (PRISMA) guideline to ensure the inclusion of relevant information, while at the same time reporting fully all the factors that are likely to affect the generalization of the results so that reviewers and clinicians will make use of the result in a most appropriate way (Deyno et al., 2019; Jones et al., 2018). The Cochrane guidelines is mostly suggested for randomized trials (except in non-randomized trials with least likelihood of bias).

As part of the evaluation, this research used Melnyk's Level of Evidence to assess the level of evidence and the weight to be attached to it (Fineout-Overholt, & Melnyk, 2005). Selected studies for this review reflect various levels of evidence, particularly from level one studies (controlled randomized trials) to level five. There were few level seven studies and narrative reviews done by some professional diabetes organizations and experts under some working groups or select committees on diabetes care. Those studies although not highly ranked based on Melnyk hierarchy of evidence still carry reasonable weight due to the caliber of experts or the professional organizations they are associated with, plus the less likelihood of bias of such studies thus warranting their inclusion in this study.

This researcher also observed all ethical considerations involved in the systematic review. A quint-essential principle of nursing research and practice is to do no patient no harm, and to do everything within the nurse's ability in the best interest of the patient (Burnett, & Wolff, 2015). All data that is available for this research is fully reported so that a reviewer or clinician can have sufficient information and evidence before making any policy decision that is capable of affecting patients' wellness. To further ensure that the project leader has deep knowledge of the relevant ethical considerations involved in collecting and analyzing data for this study, this researcher completed the CITI education (See Appendix "B"). Such ethical empowerment program enables this researcher to acquire the skill for sieving through various studies and applying proper methods and patterns for complying with nursing ethics when dealing with data (Jamshidian, Jamshidian, Fateme, and Shariari, & Mohsen, 2019). This researcher also obtained the approval of the Liberty University IRB to conduct this integrative review, thus ensuring that such research undertaking will cause no harm to the human subjects (Ryan, 2016).

## Discussion

### **Summary of Evidence**

The risk of hypoglycemia in diabetic care management is of such a significance to the country's health care system both from the cost burden but also due to its impact on the workforce, as well as the general wellbeing of every American. Health care cost is a primary factor that drives the national debt, and the cost of managing diabetes and its complications is the seventh highest of the health care budget. Of the 258,000 deaths recorded in 2017 from diabetes according to ADA, complications from hypoglycemia is a primary factor.

Hypoglycemia complications is also a known cause of high morbidity and mortality among this study's population, particularly in elderly population, where many patients with diabetes are often not cognizant of the symptoms of the complication.

The philosophical framework for this integrative review is the socio-poetic concept of nursing care, which accords some autonomy to the patient in the patient-nurse relationship. This concept of increased patient autonomy also places a shared responsibility on the patients for improving their health and wellness, such as through improved patient education. When patients understand what diabetes is, and how to manage their conditions, it helps reduce the incidence of hypoglycemia and other related complications, including morbidity and death. This integrative review will improve the skill of frontline nurses in managing diabetes complications, add to the body of knowledge of diabetic care, and re-affirm current best practice in the treatment of hypoglycemia.

This study finds that there is not enough patient education for patients with diabetes on how to manage their conditions to avoid developing hypoglycemia. This study also finds that improved diabetes education of nurses will increase their experience and confidence in managing

patients with diabetes and reduce re-admission rates from diabetes-related complications, including hypoglycemia. The practice of relying on diabetic educators to provide educational intervention in hospitals leaves much gap in delivering the intended benefits to patients most of whom come to the ED or EDOs. Nurses that work in ED and EDOs maintain daily contacts with the patients and, given the right training, have the opportunity to deliver diabetes care education to the patients on best practices for glycemic control, lifestyle and nutritional changes in order to achieve improved patient outcomes. When nurses and support staff are properly trained, their knowledge and confidence in providing diabetes care go up, and they are in a better position to educate patients on how to take care of their health.

## **Results**

The primary trigger for this research is the increasing incidence of hypoglycemic complications among T2DM patients. The fact that such a serious topic continues to receive less than deserving attention in many clinical study designs, plus the cost and health implications to the study population, deserves serious attention. Some of the reported symptoms include dizziness, feeling of fainting, confusion, shakiness, heart palpitations and rapid heartbeat. Repeat episodes of hypoglycemia puts patients at the risk of developing other complications, such as retinopathy, nephropathy, neuropathy, cardiovascular diseases, or even death (Kulina, & Rayfield, 2017). Based on the cost factor, morbidity and mortality of hypoglycemia complications among patients with diabetes, any top tier or magnet hospital will want to maintain a record of excellence in patient care. Developing an effective diabetes care approach is one area a hospital can good reputation.

In light of the above, this researcher performed a search in Liberty University Nursing databases and reviewed twenty literature on hypoglycemia among patients with diabetes. The

outcome of the search confirmed the existence of a enough research to guide practice. That in turn formed the basis of this research results that establish the following:

- i. That nursing staff intervention through education on proper monitoring and effective glycemic control will lead to effective management of type 2 diabetes.
- ii. Promote better glucose reading.
- iii. Reduce hypoglycemia episodes; and
- iv. Confirm that patients who received diabetes educational intervention and effective glycemic control will better know how to manage their condition. Consequently, patients who know how to monitor their glucose levels, and commit to making necessary lifestyle changes will be at reduced risk of hypoglycemia.

### **Limitations**

According to Kearney (2017), this part of the research provide readers with an interpretation of the results while taking all relevant context into account. First, this integrative review did not discriminate between findings that deal with male or female samples, even where different studies reviewed made that distinction (Akirov et al, 2018). Equally, other factors such as social and economic status were taken into account by different studies reviewed. This research does not make such a distinction. As a result, it is a possible limitation on the generalization of some findings because it is not known whether adult male or female patients with diabetes react differently to managing their conditions or present different incidence of hypoglycemic complications to the extent that is statistically significant. The findings in this research are therefore based on the assumptions that those distinctions or absence thereof (including male or female adults, economic or social status, etc.) do not affect the validity of the results.

Again, while some of the studies reviewed have more samples, others did not. That notwithstanding, the evaluations and conclusions drawn by this research does not treat any sample variation as a factor affecting the study results. Similarly, different studies were performed within different timelines, and could have some impacts on those results. These factors should therefore be taken into consideration in deciding the generalization or validity of the results. This research does not draw such distinction as well.

### **Conclusion**

The study of hypoglycemia is critically important due to the “increased costs, poor patient outcomes, and mortality” (Kulasa, & Juang, 2017, p. 74, 1 of 10). Notwithstanding any limitations noted above, the findings in this research strengthen the practice of combining individualized care of T2DM patients in a way that incorporates insulin dosing in deserving cases with or of other lifestyle changes and other non-insulin treatment. The findings further confirm that increased patient education will help reduce hypoglycemic episodes and the incidence of morbidity and mortality among patients with diabetes, particularly in elderly patients. Nurses share a critical role in educating and enabling patients and their family members to adequately manage their diabetes in order to avoid or reduce hypoglycemia episodes (Smith, 2018, p. 59). Unfortunately, many nurses lack the knowledge to help their patients take full responsibility for their health. Nurses who are properly educated in diabetes care will help patients maintain effective glycemic control, promote better glucose reading, reduce hypoglycemia episodes, and improve general patient outcomes. This study therefore provides further elucidation on a topic that is generally under-recognized, but which deserves significant attention due to its impacts on the health care system and its high mortality rate.

The potentials of any scholarly work is not fully exploited without a consideration of means of dissemination. Becker, Johnson, Rucker, & Finell (2018) assert that dissemination of a scholarly publication is a vehicle that allows DNP graduates to be involved in advanced nursing practice and (and the profession), but also provides guidance for evidence-based practice. The basis for using evidence to advance practice or improve patient outcomes is contained in the DNP Nursing Essential III (AACN, 2006; Moran, Burson, & Conrad, 2017). This research findings will be disseminated through continuing education module, and poster presentations. The primary setting for sharing this research findings will be at the hospital that provided the triggers and consequently led to the choice of topic for this research. This researcher plans to present the findings to the ED and EDO of the hospital where this researcher works. It is also hoped that such presentation will form a continuing education module for future hires in the Unit, who will be required to go through the module in order to better understand how to support patients with diabetes from developing various complications such as hypoglycemia as a result lack of knowledge of the disease care and treatment. Alternatively, such diabetes education program can be introduced as part of the hospital's continuing quality improvement program (Pichardo-Lowden, Haidet, & Umpierrez, 2017)

Besides, this researcher intends to submit a draft of this study to the Association of Diabetes Care and Education Specialists (ADCES) and if accepted, to have it published in *The Diabetes Educator (TDE)* – a peer-reviewed, bi-monthly journal of the ADCES that publishes on patient education and professional education but also a reference source diabetes management (ADCES, 2020). As the privilege to publish in *TDE* journal is an exclusive reserve of the association's membership, this researcher plans to pick up the association's membership upon completion of this research work. The researcher will therefore be on the look-out for call for

abstracts by the AADE and related professional associations by checking their websites and searching such professional associations' newsletters. Opportunities for call for abstracts can also be explored from professional membership organizations, or through the Institutional Office of Research and Evidence-Based Practice or any academic institution (Linder, 2012). This researcher is equally open to an opportunity for podium and poster presentations. This is much easier than traditional conference presentation of paper.

Additionally, this researcher will explore opportunities for the poster presentations because the chance for podium presentation is usually very limited (Imani et al., 2018; Linder, 2012). Another advantage of poster presentation is that it can be used for both completed and incomplete scholarly project, so that even if there were some final edits that need to be done to the project before the deadline of the call for abstracts, this researcher will still be able to get the abstracts accepted (Ecoff, & Stichler, 2015).

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**Appendix “A” (Literature Review)**

| Article Title, Author, etc. (Current APA Format)   | Study Purpose  | Sample (Characteristics of the Sample: Demographics, etc.)   | Methods                       | Study Results  | Level of Evidence (Use Melnyk Framework) | Study Limitations   | Would Use as Evidence to Support a Change? (Yes or No) Provide Rationale.  |
|--|--|--|-------------------------------|--|--|---|--|
| <p>Article 1<br/>                     Akirov A, Amitai O, Masri-Iraqi H, Diker-Cohen, T., Shochat, T., ... &amp; Shimon, I. (2018). Predictors of hypoglycemia in hospitalized patients with diabetes mellitus, <i>Internal Emergency Medicine</i>, 13(3), 343-350.<br/> <a href="http://doi:10.1007/s11739-018-1787-0">http://doi:10.1007/s11739-018-1787-0</a></p> | <p>To identify pre-admission risks that are linked to in-hospital hypoglycemia</p> | <p>Study included 5301 patients (mean age 73 ± 13 years, 51% male), including 792 patients (15%) with hypoglycemia, among them 392 patients (7%) with serious hypoglycemia</p> | <p>This is a Cohort Study</p> | <p>Study identified age of diabetes (such as 10 years and older), and treatment with insulin as the major risk factors associated with in-hospital hypoglycemia.</p> | <p>This is a level 4 evidence</p>        | <p>Study based on a retrospective design. Available data was made available from hospital report Also, as subjects were inpatients, there is higher chances of checking their blood glucose all the time, making it easy to detect hypoglycemia symptoms among them than would have been the case for outpatients</p> | <p>Yes: Cohort studies are good due to the large number of subject samples, which makes the findings generalizable</p> |

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| <p>Article 2<br/>American Diabetes Association. (2017). Economic Costs of Diabetes in the U.S. in 2017. <i>Diabetes Care</i>, dci180007; doi: 10.2337/dci18-0007</p>   | <p>To provide update on the estimates of the economic burden of diagnosed diabetes and quantifies the increased health resource use and lost productivity associated with diabetes in 2017.</p> | <p>Study made use of state and federal data, including the American Community Survey (ACS), Behavioral Risk Factor Surveillance System (BRFSS), Medicare Current Beneficiary Survey (MCBS), and Long Term Care Minimum Data Set (MDS). Sources for national data.</p> | <p>Study uses a prevalence-based approach that combines the demographics of the U.S. population in 2017 with diabetes prevalence, epidemiological data, health care cost, and economic data into a Cost of Diabetes Model.</p> | <p>Study confirms total estimated cost of diagnosed diabetes in 2017 is \$327 billion, including \$237 billion in direct medical costs and \$90 billion in reduced productivity.</p> | <p>This is a Level 1 Evidence</p> | <p>The only issue with this type of study is that the data can be skewed.</p>  | <p>Yes. This type of study uses a statistical approach to combine the results from multiple studies in an effort to increase power (over individual studies), improve estimates of the size of the effect and/or to resolve uncertainty</p> |
| <p>Article 3<br/>Amiel, S. A., Aschner, P., Childs, B., Cryer, P. E., Galan, B. E. d., Heller, S. R., . . . International Hypoglycemia Study Group. (2015). Minimizing hypoglycemia in diabetes. <i>Diabetes Care</i>, 38(8), 1583-1591. <a href="http://doi:10.2337/dc15-0279">http://doi:10.2337/dc15-0279</a></p> | <p>To review background literature on hypoglycemia and propose pragmatic ways for minimizing hypoglycemia</p>   | <p>Not applicable. Instead, the studies reviewed contained samples of various sizes depending on whether they are descriptive or qualitative studies</p>  | <p>This is a Systematic Review of descriptive and qualitative studies.</p>   | <p>Study finds that in order to minimize the incidence of hypoglycemia, it is important to consider each risk factor, and apply the principle of intensive glycemic</p>              | <p>This is a Level 5 evidence</p> | <p>The summary of the literature provided in a systematic review is only as reliable as the method applied to evaluate the essence of each primary</p> | <p>Yes. Such review provides good depth of coverage and treatment of the phenomenon by looking at a wide swath of descriptive and qualitative studies.</p>  |

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|   |  |  |                              | therapy, including making selective drug selection. Another key finding is the importance of individualizing the treatment approach based on each patient  |                         | study reviewed  |   |
| <p>Article 4<br/>Annersten Gershater, M., Pilhammar, E., Alm Roijer, C., Malmö University, &amp; Faculty of Health and Society. (2011). Documentation of diabetes care in home nursing service in a Swedish municipality: A cross-sectional study on nurses' documentation. <i>Scandinavian Journal of Caring Sciences</i>, 25(2), 220-226.<br/><a href="http://doi:10.1111/j.1471-6712.2010.00812.x">http://doi:10.1111/j.1471-6712.2010.00812.x</a></p> | <p>To assess what registered nurses in a Swedish hospital document regarding diabetes care, as well as the extent diabetes-related nursing actions were planned for, performed and evaluated according to the goals of metabolic control, treatment and prevention of complications.</p> | <p>Study involves a recording of 2301 by home nursing service.</p> | <p>Cross-Sectional Study</p> | <p>Study shows that insufficient documentation (including blood glucose measurements, HbA1c, weight and nutrition status, complications, regular blood pressure measurements, protective foot care, and education of health care assistants in assisted diabetes self-care) may lead</p> | <p>Level 5 Evidence</p> | <p>The main limitation of this study is its small sample size</p> | <p>Yes. Although this type of study design is not generalizable due to the small study sample, it offers rich data which can be used to support the thesis of this research on the need for for proper meal documentation rather than relying on a device</p> |

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|   |  |  |  | to impaired quality of care.   |                         |   |  |
| <p>Article 5<br/>Arnaud, M.; Pariente, A.; Bezin, J.; Bégaud, B.; &amp; Salvo, F. (2018). Risk of serious trauma with glucose-lowering drugs in older persons: A Nested Case-Control Study. <i>Journal of American Geriatric Society</i>, 66(11), 2086 - 2091. . doi:10.1111/jgs.15515</p>  | <p>To assess the risk of hospitalization for trauma associated with use of hypoglycemic glucose-lowering drugs</p>                                       | <p>Study included 115,903 individuals who had at least 1 hospitalization for trauma between 2009 and 2015 as potential cases (ICD-10 codes S00-T14, V01-V99, Y30-Y32).</p> | <p>Case Control Study</p>  | <p>Study found greater risk of hospitalization in individuals treated with hypoglycemic GLDs alone, particularly insulin and glinides</p>  | <p>Level 4 Evidence</p> | <p>They are liable to selection bias and generally do not allow calculation of incidence.</p> | <p>Yes. study design is a better option and provides higher evidence for testing the prognosis of the selected drugs</p> |
| <p>Article 6<br/>Barnett, A. H., Cradock, S., Fisher, M., Hall, G., Hughes, E., &amp; Middleton, A. (2010). Key considerations around the risks and consequences of hypoglycemia in people with type 2 diabetes. <i>International Journal of Clinical Practice</i>, 64(8), 1121-1129. http://doi:10.1111/j.1742-1241.2009.02332.x</p> | <p>To discuss the important challenges to achieving good glycemic control in people with type 2 diabetes whilst minimizing the risk of hypoglycemia.</p> | <p>Not applicable. Instead, the studies reviewed contained samples of various sizes depending on whether they are descriptive or qualitative studies.</p>                  | <p>This is a Systematic Review of descriptive and qualitative studies.</p> | <p>The use of oral glucose-lowering therapy should be viewed as a second line of treatment for people with high risk of Hypoglycemia. Instead, treatment for minimizing Hypoglycemia episodes should be individualized, regard</p> | <p>Level 5 Evidence</p> | <p>Sample size unknown</p>  | <p>Yes. This type of study has good depth of literature coverage.</p>  |

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|  |   |  |  | being had to each individual's quality of life, and the need for avoiding long term diabetes complications.   |                                 |   |  |
| <p>Article 7<br/>                 Beverly, E. A., Ritholz, M. D., Rennie, R. G., &amp; Mort, S. C. (2019). A brief interactive training with medical students improves their diabetes knowledge about hypoglycemia. <i>BMC Medical Education, 19</i>(1), 171-10. doi:10.1186/s12909-019-1615-x</p> | <p>To assess the effectiveness of a brief training to improve medical students' knowledge and attitudes about diabetes, hypoglycemia, and glucagon administration</p> | <p>217 participants averaging 25 years old</p> | <p>This is a Feasibility Study (An Analysis)</p> | <p>Medical students need to learn about patients' everyday experiences of diabetes in order to have an understanding of and confidence to assess and treat hypoglycemia</p> | <p>Level 6 Evidence</p>         | <p>Possibility of objections from previous studies being introduced into the study (such as lack of time or high costs, etc.)</p> | <p>Yes: Although a Level 6 Evidence, it incorporates an critical aspect of the DNP Nursing Essential, which is necessary to adequately prepare DNP-trained nurses for practice</p> |
| <p>Article 8<br/>                 Bonaventura, A., Montecucco, F., &amp; Dallegri, F. (2015). Update on strategies limiting iatrogenic hypoglycemia. <i>Endocrine Connections, 4</i>(3), R37-R45. http://doi:10.1530/EC-15-0044</p>  | <p>To provide an overview of Hypoglycemia, including the epidemiology and treatment, as well as how to minimize the episodes</p>                                      | <p>Not Applicable</p>                          | <p>This is a Narrative Review</p>                | <p>Study suggests that due to the higher risk of hypoglycemia people with diabetes that makes it difficult to desired glycemic control, it is necessary</p>                 | <p>Study is not an Evidence</p> | <p>Study is not an evidence, although it can be evidence-based, providing an overview of the research on the topic.</p>           | <p>Yes, but with circumspect to reinforce other studies that serve as evidence</p>   |

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|  |   |   |  | to individualize the treatment plan for each patient  |                                   |   |   |
| <p>Article 9<br/>Chelliah, A., &amp; Burge, M.R. (2004). Hypoglycemia in elderly patients with diabetes mellitus: Causes and strategies for prevention. <i>Drugs &amp; Aging, 21(8)</i>, 511-530. <a href="http://doi:10.2165/00002512-200421080-00003">http://doi:10.2165/00002512-200421080-00003</a></p>  | <p>To review the problem of Hypoglycemia among elderly individuals with diabetes</p>  | <p>Study reviews the literature, including surveys, and data on the incidence of diabetes and its complications (particularly Hypoglycemia) in the U.S. and Canada.</p> | <p>This is Systematic review of descriptive and qualitative studies.</p> | <p>The focus of Hypoglycemia management should focus on glycemic control, such goal such being individualized.</p>  | <p>This is a Level 5 Evidence</p> | <p>N/A</p>  | <p>Yes, because conclusions of a review are more reliable than those from a single study</p>  |
| <p>Article 10<br/>Davies, M. J., D'Alessio, D. A., Fradkin, J., Kernan, W. N., Mathieu, C., Mingrone, G., . . . Buse, J. B. (2018). Management of hypoglycemia in type 2 diabetes, 2018. A consensus report by the American Diabetes Association (ADA) and the European Association for the Study of Diabetes (EASD). <i>Diabetes Care, 41(12)</i>, 2669-2701. <a href="http://doi:10.2337/dci18-0033">http://doi:10.2337/dci18-0033</a></p> | <p>To assess what registered nurses document in regard to diabetes care in a Swedish municipality's home nursing service; but also to determine the extent to which diabetes-related nursing actions were planned</p> | <p>This is a consensus report of the American Diabetes Association (ADA) and the European Association for the Study of Diabetes</p>                                     | <p>This is a Position Statement</p>                                      | <p>Position Statement reinforce need for careful consideration of patient factors and preferences must inform the process of individualizing treatment goals and strategies</p> | <p>This is a Level 7 Evidence</p> | <p>This is ordinarily a low level of evidence study. Possible bias by experts, and the fact that such report might not be evidence-based.</p> | <p>Yes. Notwithstanding that it is a position statement of from two relevant associations that have done so much on the study and research into diabetes. Such report carries some weight in terms of the reliability</p> |

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|   | for, performed and evaluated according to the goals of metabolic control, treatment in order to prevent complications.          |   |   |  |                            |  |  |
| Article 11<br>Dissanayake, H. A.; Keerthisena, G. S. P.; Gamage, K. K.; Liyanage, J. H.; ... , & Katulanda, P. (2018). Hypoglycemia in diabetes: Do we think enough of the cause? An observational study on prevalence and causes of hypoglycemia among patients with type 2 diabetes in an out-patient setting in Sri Lanka. <i>BMC Endocrine Disorders</i> , 18(1).     | To study the prevalence of symptomatic hypoglycemia among patients with diabetes mellitus and identify risk factors and causes. | 254 participants.   | This is an observational study                    | Study finds a prevalence of Hypoglycemia among patients with diabetes, and that patients need advice on regular diet and exercise.     | This is a Level 4 Evidence | Bias, confounding, and issues with validity are more common with observational study design. | Yes. Such study design confers high degree of validity on the findings because observational studies offer the potential to observe participants in a natural setting, which can reveal penetrating insights unavailable through other methods |
| Article 12<br>Gehlaut, R. R., Dogbey, G. Y., Schwartz, F. L., Marling, C. R., & Shubrook, J. H. (2015). Hypoglycemia in type 2 diabetes – more common than you think: A continuous glucose monitoring study. <i>Journal of Diabetes Science and Technology</i> , 9(5), 999-1005.<br><a href="http://doi:10.1177/1932296815581052">http://doi:10.1177/1932296815581052</a> | To review the actual prevalence of Hypoglycemia in adult type 2 diabetes mellitus patients                                      | 108 patients with type 2 diabetes mellitus participated in the study. | A Prospective, non-binded trial of adult patients | This study did show that Hypoglycemia occurs even in people who are on medications not known to cause hypoglycemia. Also a substantial | Level 2 Evidence           | Small Sample size  | Yes, such study has high reliability. Also study design is useful when attempting to establish the risk factors of a disease, such as Hypoglycemia.  |

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|---|---|----------------|------------------------------------|--|------------------|-----------------------------|--|
|   |   |                |                                    | number of people with T2DM are not aware of the symptoms of hypoglycemia. Study also highlights the imperative for diabetes education once a patient is diagnosed with hypoglycemia.   |                  |                             |  |
| Article 13<br>Home, P. (2020). How Valid Are the New Hypoglycemia definitions for Use in Clinical Trials? <i>Diabetes Care</i> , 43 (2) 272-274; <a href="https://doi.org/10.2337/dci19-0056">https://doi: 10.2337/dci19-0056</a> | To evaluate some of the definitions of hypoglycemia, particularly that put forward by the International Hypoglycemia Study Group (IHSG) | Not Applicable | This is a single-qualitative study | The new IHSG definition of hypoglycemia compared with the previous ADA definition can result in statistically more robust findings when comparing insulins. However, other similar analyses on lower-power studies may not support | Level 7 Evidence | Cannot generalize findings. | Yes, although its validity remains suspect. For one thing, it attacks the general position statement put out by the IHSG on the definition of hypoglycemia. Future studies can either confirm or rebut such analysis |

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| <p>Article 14<br/>Jones, S. P., Miller, C., Gibson, J. M. E., Cook, J., Price, C., &amp; Watkins, C. L. (2018). The impact of education and training interventions for nurses and other health care staff involved in the delivery of stroke care: An integrative review. <i>Nurse Education Today</i>, 61, 249-257. <a href="http://doi:10.1016/j.nedt.2017.11.024">http://doi:10.1016/j.nedt.2017.11.024</a></p> | <p>To review the impact of nurse education and training on nurses and other health staff involved in the delivery of stroke care</p> | <p>Study identified 2850 studies of which 21 met the inclusion criteria</p> | <p>Integrative Review</p> | <p>that conclusion.<br/>Practice educators should consider the delivery of interactive education and training delivered to multidisciplinary groups, and the use of protocols or guidelines, which tend to be associated with a positive impact on both patient and quality of care outcomes. There is also a need to ensure that the provision of care along the pathway is delivered by staff with the appropriate education and skills at all</p> | <p>Level 3 Evidence</p> | <p>Small sample size. Also all had common methodology, and none did a comparison of two or more educational delivery of patient education</p> | <p>Yes. This is a systematic way of evaluating the strength of available evidence in an area of work, and pointing or bridging the gap between what is known and what needs to be considered in future research</p> |
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|  |  |                       |  |   |                                   |  |   |
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|  |  |                       |  | points on the stroke pathway (e.g. pre-hospital, emergency, rehabilitation, long-term care, and primary care).  |                                   |  |   |
| <p>Article 15<br/>Jafari, B., &amp; Britton, M.E. (2015). Hypoglycemia in elderly patients with type 2 diabetes mellitus: A review of risk factors, consequences and prevention. <i>Journal of Pharmacy Practice &amp; Research</i>, 45(4): 459-469</p>                          | <p>To provide a narrative review of published literature on the frequency risk factors, consequences and prevention of hypoglycemia in elderly patients with type 2 diabetes mellitus.</p> | <p>Not Applicable</p> | <p>This is a Narrative Review</p>  | <p>Study finds that older T2DM patients are more susceptible to hypoglycemia, and that they are more likely to miss the symptoms or to be misdiagnosed because the clinical manifestations are different from younger people.</p> | <p>Not Applicable</p>             | <p>Study is not an evidence, although it can be evidence-based, providing an overview of the research on the topic</p> | <p>Yes, with caution, being that although an evidenced-based study, the findings are not evidence, but can be used to reinforce other relevant literature on the topic.</p> |
| <p>Article 16<br/>Kovatchev, B., &amp; Cobelli, C. (2016). Glucose variability: Timing, risk analysis, and relationship to hypoglycemia in diabetes. <i>Diabetes Care</i>, 39(4), 502-510. <a href="https://doi.org/10.2337/dc15-2035">https://doi.org/10.2337/dc15-2035</a></p> | <p>To explore how to optimize diabetes care management by balancing the frequency of hypoglycemia and HbA<sub>1c</sub></p>   | <p>Not Applicable</p> | <p>This is a systematic review of descriptive and qualitative studies.</p> | <p>Diabetes control is all about optimization and a balance, or “trade-off,” between two key markers: frequency of hypoglyc</p>   | <p>This is a Level 5 Evidence</p> | <p>Can be resource intensive</p>   | <p>Yes, because conclusions of a review are more reliable than those from a single study</p>  |

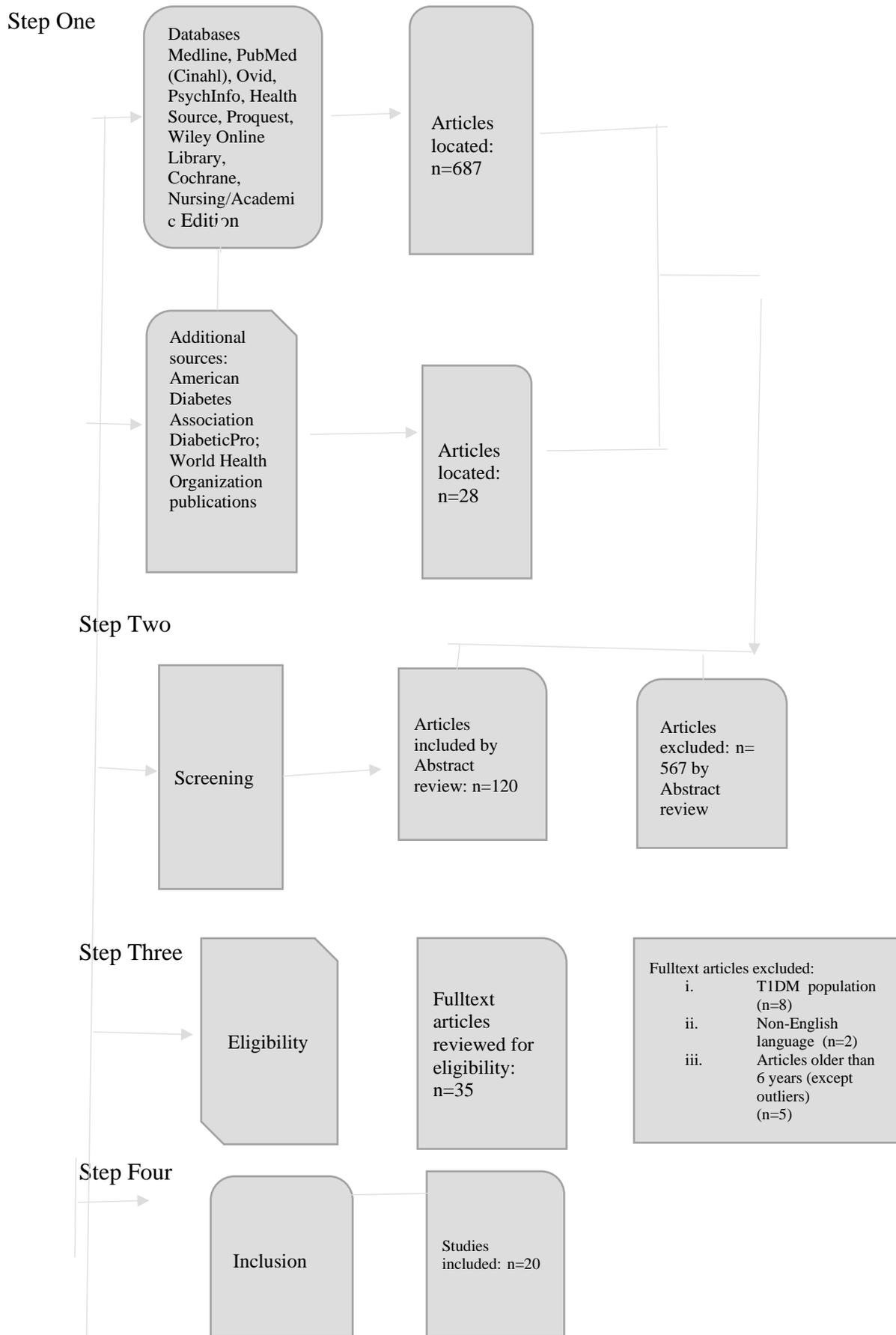
|  |   |                       |                          |   |                                   |   |  |
|--|---|-----------------------|--------------------------|---|-----------------------------------|---|--|
|  |   |                       |                          | emia and HbA <sub>1c</sub> ,  |                                   |   |  |
| <p>Article 17<br/>Kulasa, K., &amp; Juang, P. (2017). How low can you go? Reducing rate of hypoglycemia in the non-critical care hospital setting. <i>Current Diabetes Reports</i>, 17(9), 1-10.<br/><a href="https://doi.org/10.1007/s11892-017-0902-3">https://doi.org/10.1007/s11892-017-0902-3</a></p> | <p>To discuss strategies to reduce rates of hypoglycemia in the non-critical care setting</p> | <p>Not Applicable</p> | <p>Systematic Review</p> | <p>Among other strategies, staff education is a very important component of any quality improvement effort for reducing the incidence of hypoglycemia, and the target</p> | <p>This is a Level 5 Evidence</p> | <p>Study as reliable as the methods used to analyze each primary study used</p> | <p>Yes. Study reflects a higher level of evidence, and such findings are found reliable.</p> |

|   |   |  |   |   |                  |  |   |
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|   |   |  |   | audience should include members of the care team such as physicians, nurse practitioners, physician assistants, trainees, pharmacists, nurses, dietitians, food service, and patients |                  |  |   |
| Article 18<br>Martyn-Nemeth, L., Quinn, L., Penckofer, S., Park, C., Hofer, V., & Burke, L. (2017). Fear of hypoglycemia: Influence on glycemic variability and self-management behavior in young adults with type 1 diabetes. <i>Journal of Diabetes and its</i> | To investigate the role of hypoglycemia on general health status, psychological well-being, | 206 (9.2%) patients with T1DM and 2023 (90.8%) patients with type 2 diabetes | Observational retrospective study involving individuals with type 1 and type 2 diabetes | Hypoglycemia (severe and symptomatic) has a negative impact on general health status,   | Level 4 Evidence | Unavailability of information about cause-effect relationship between fear of hypoglycemia | Yes; It offers immediate access to data |

|  |   |  |                                   |   |                                   |   |   |
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| <p><i>Complications</i>, 31(4), pp. 735-741</p>  | <p>diabetes-related distress and fear of hypoglycemia both in type 1 and type 2 diabetes</p>                                    |  |                                   | <p>psychological well-being, and fear of hypoglycemia, especially in T2DM</p>   |                                   | <p>and clinical and QoL outcomes</p>        |   |
| <p>Article 19<br/>McCoy, R.G.; Herrin, J.; Lipska, K.J; &amp; Shah, N.D. (2018). Recurrent hospitalizations for severe hypoglycemia and hyperglycemia among U.S. adults with diabetes. <i>Journal of Diabetes and its Complications</i>, 32(7), 693-701.</p> | <p>To examine 30-day readmissions for recurrent hypoglycemia and hyperglycemia in a national cohort of adults with diabetes</p> | <p>6872 index hyperglycemia hospitalizations</p> | <p>Retrospective cohort study</p> | <p>Study found that patients who were hospitalized for hyperglycemia are often readmitted for recurrent hyperglycemia, while patients hospitalized for hypoglycemia are generally readmitted for unrelated causes. Early recognition of high risk patients may identify opportunities to improve post-discharge management and reduce these events.</p> | <p>This is a Level 4 Evidence</p> | <p>Not Applicable. Can be prone to bias</p> | <p>Yes. Such studies offer the benefits of cohort studies. They also have distinct advantages compared to prospective studies</p> |

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|   |   |   |                       | New hypoglycemia readmissions were most likely among patients $\geq 75$ years   |                  |   |     |
| <p>Article 20</p> <p>Ndebu, J.; &amp; Jones, C. (2018). Inpatient nursing staff knowledge on Hypoglycemia management. <i>Journal of Diabetes Nursing</i>, 22. ISSN 1368-1109.</p> | To determine when hypoglycemia episodes mostly happen | 40 registered nurses and health assistants completed the cross sectional survey | Cross Sectional Study | Study found that most hypoglycemia happens at night. The study also found that about 93.5% of nurses in Diabetes Unit knew all hypoglycemia symptoms, only 25% of critical care nurses recognized all hypoglycemia symptoms | Level 5 Evidence | Does not necessarily help to explain cause and effect | Yes |

PRISMA FLOW DIAGRAM (Appendix “B”)



**Symptoms and Treatment of Hypoglycemia (Appendix “C”)**

**Symptoms**

| Mild Symptoms   | Moderate Symptoms  | Severe Symptoms |
|---|--|-----------------|
| Shakiness, weakness, dizziness, fast heart rate, blurred vision, trouble concentrating, tingling in fingers or lip, anxiety, headache | Impaired motor function, confusion, inappropriate behavior, combative behavior | Seizures, Coma  |

**Treatment**

**MILD SYMPTOMS**

- \* Consume 15 grams of carbohydrate:
  - 3-4 glucose tablets
  - 8 lifesavers
  - 1/2 c. fruit juice
  - 1/2 c regular soda
  - 8 oz of milk

Repeat after 15 minutes if symptoms do not stop

**MODERATE SYMPTOMS**

- \* Consume 30 grams of carbohydrate:
  - 1 c fruit juice
  - 1 c regular soda
  - 1 tube of glucose gel

Repeat after 15 minutes if symptoms do not stop

**SEVERE SYMPTOMS**

Take Glucagon and call 911  
Get a friend or family member to give patient  
Glucagon  
(This is an emergency)

(Adapted from: Wollengurg, P. (2017). Your guide to understanding Diabetes Management. Omaha, NE HERC Publishing)

**CITI Certification (Appendix “D”)**



Completion Date 28-Aug-2019  
Expiration Date 27-Aug-2023  
Record ID 32967003

This is to certify that:

**rosemary ikwueme**

Has completed the following CITI Program course:

**CITI Conflicts of Interest** (Curriculum Group)  
**Conflicts of Interest** (Course Learner Group)  
**1 - Stage 1** (Stage)

Under requirements set by:

**Liberty University**



Re: [External] Re: Follow-up: Liberty Un... 4:02 PM

**Institutional Review Board Approval (Appendix “E”)**

**From:** [irb@liberty.edu](mailto:irb@liberty.edu) <[irb@liberty.edu](mailto:irb@liberty.edu)>

**Sent:** Monday, July 20, 2020 9:07 AM

**To:** Odedina, Folashade (Doctoral Nursing) <[fodedina@liberty.edu](mailto:fodedina@liberty.edu)>; Ikwueme, Chinedum Rosemary <[rcikwueme@liberty.edu](mailto:rcikwueme@liberty.edu)>

**Subject:** IRB-FY19-20-482 - Initial: Initial - Non-Human Subjects Research

July 20, 2020

Chinedum Ikwueme  
Folashade Odedina

Re: IRB Application - IRB-FY19-20-482 SELF MANAGEMENT EDUCATION FOR  
PREVENTION, EARLY DETECTION, AND TREATMENT OF HYPOGLYCEMIA: AN  
INTEGRATIVE REVIEW

Dear Chinedum Ikwueme, Folashade Odedina:

The Liberty University Institutional Review Board (IRB) has reviewed your application in accordance with the Office for Human Research Protections (OHRP) and Food and Drug Administration (FDA) regulations and finds your study does not classify as human subjects research. This means you may begin your research with the data safeguarding methods mentioned in your IRB application.

Decision: No Human Subjects Research

Explanation: Your study does not classify as human subjects research because:

(1) it will not involve the collection of identifiable, private information.

Please note that this decision only applies to your current research application, and any modifications to your protocol must be reported to the Liberty University IRB for verification of continued non-human subjects research status. You may report these changes by completing a modification submission through your Cayuse IRB account.

If you have any questions about this determination or need assistance in determining whether possible modifications to your protocol would change your application's status, please email us at [irb@liberty.edu](mailto:irb@liberty.edu).

Sincerely,

**G. Michele Baker, MA, CIP**  
*Administrative Chair of Institutional Research*  
**Research Ethics Office**