# The Effects of 1:1 Individualized Diabetes Self-Management Education and Support on Glycemic Control

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## Abstract

**Purpose of Project:** Diabetes self-management education and support (DSMES) has been shown to improve the management and health of people living with diabetes, improve their knowledge, reduce HBA1c and hospital readmission rates. The purpose of this DNP project was to evaluate the effectiveness of 1:1 diabetes self-management education and support (DSMES) on knowledge, HbA1c and hospital readmission rates of diabetic patients.

**Methodology:** Pretest – posttest study. Participants completed two paper questionnaires – the modified Revised Michigan Diabetes Knowledge Test (DKT2) and the diabetes self-management questionnaire (DSMQ) – before and after the intervention. Hospital charts were reviewed for HbA1c, admission glucose levels, and 90 days past admission records. All data were de-identified and stored on Rutgers University password protected cloud storage. Intervention included inpatient diabetes self-management education (DSME) followed by outpatient phone support. Outcome measured were pre-/post-intervention diabetes knowledge, HbA1c level, and 90 -day-readmission rates. Coding and analysis of the data was done using SPSS. Data analyses included descriptive statistics and nonparametric tests- Wilcoxon ranks sum and Mann-Whitney U due to the small sample size.

**Results:** The findings include statistically significant improvements in knowledge ($p$ = .011), HbA1c ($p$= .027) and diabetes related hospital readmission rates ($p$ = .008).

**Implications for Practice:** The findings of this project support the need for a greater focus on patient/caregiver centered care. The creation of patient centered medical homes and hospital to home transitional support. It supports the need for primary care providers

to continually refer their diabetic patients/caregivers for DSME as part of their routine management.

# The Effects of 1:1 Individualized Diabetes Self-Management Education and Support on Glycemic Control

Diabetes mellitus is a complex disease requiring complexity of care and daily decision making (Powers et al., 2015). Individualized diabetes self-management education and support (DSMES) can improve diabetes management skills and the health of people living with diabetes (Lavelle et al., 2016). Some patients who live with diabetes become overwhelmed by the daily requirements of the disease management. Their frustration with the complexity of care may be part of the issues responsible for poor therapy-regimen adherence with resultant poor glycemic control. This leads to complications/disabilities, frequent hospital admissions, and increased cost. DSME has been found to significantly improve glycemic control (García, Brown, Horner, Zuñiga, & Arheart, 2015; Huxley et al., 2015; Korytkowski, Koerbel, Kotagal, Donihi, & DiNardo, 2014; Lewis, Benda, Nassar, & Magee, 2015; Silva & Bosco, 2015). A systematic review and meta-analysis found that DSME was effective in both short term and long-term reductions of all-cause mortality among subjects with diabetes (He et al., 2017).

Patients' understanding of the disease process, severity, risk factors, and complications and the ability to take the right management action have been identified as key factors that can facilitate effective disease management (DiZazzo-Miller et al., 2017). Structured education has been touted as the key to the management of diabetes (García et al., 2015; Huxley et al., 2015). It has been recommended that DSME should be offered to every diabetic patient and their caregiver(s) (American Diabetes Association [ADA], 2018c; Huxley et al., 2015). Referral for DSME however, has been

sub-optimal. Less than 50% of patients with diabetes are offered DSME (Huxley et al., 2015; Korytkowski et al., 2014). Korytkowski et al. (2014), pointed out that hospitalization provides a unique opportunity to initiate and reinforce DSME. This DNP project involved the translation of evidence and evaluation of the effectiveness of a 1:1 inpatient diabetes self-management education and phone follow-up support on glycemic control among patients admitted for uncontrolled diabetes mellitus in a hospital in northern New Jersey.

## Background and Significance

According to the World Health Organization (WHO), diabetes is a chronic disease that is characterized by the pancreas's inability to produce adequate insulin due to inherited or acquired conditions (WHO, 2019). Two main forms have been identified, type 1 and type 2 diabetes mellitus (DM). In type 1 DM, there is a total lack of insulin production. Insulin is produced in type 2 DM, but the production may be inadequate or the body may fail to respond to the insulin produced (ADA, 2018a; Alam, Asghar, Azmi, & Malik, 2014; WHO, 2019)

**Nature versus nurture.** Diabetes mellitus is a complex disease and its expression is multifactorial, involving genetics, epigenetics, environment, and lifestyle, particularly diet and exercise (ADA, 2017) . This means that the presence of the inherited genes does not automatically mean that the carrier will develop diabetes, this is where the environmental factors come into play (Urbanova, Brunerova, & Broz, 2018). Cold weather has been found as a possible trigger for type 1 DM, as well as viruses and early diet(ADA, 2017). Type 2 diabetes on the other hand is mostly triggered by lifestyle (Dean et al., 2004; ADA, 2017). Environmental factors such as lifestyle, diet, and

exercise have been known to influence the manifestation or lack of manifestation of the phenotype of type 2 DM (Alkhatib et al., 2017; Florez et al., 2014; Kolb & Martin, 2017).

**Population and prevalence.** Diabetes is not exclusive for any age group even though certain types of diabetes are more common to certain age groups. Formally, type 1 DM was associated with youth onset and type 2 diabetes with maturity onset, but it has been found that some young people manifest type 2-like DM (maturity onset diabetes of the young [MODY]) while some older people develop type 1-like DM (latent autoimmune diabetes of adult [LADA]) (McCulloch, 2017).

In 2017, the worldwide prevalence of diabetes among adults was about 425 million (9.1%) and by the year 2045 it is estimated that 629 million adults will be living with diabetes worldwide (Piemonte, 2018). In the United States 30.3 million people or 9.4% of the population has diabetes mellitus and more than one third of the population has prediabetes (Beck et al., 2017; Centers for Disease Control and Prevention [CDC], 2017a) and another 84 million people are at high risk for developing diabetes (Beck et al., 2017). In New Jersey, about 12% of the adult population (904,861 people) have diabetes, an additional 37.1% (2,483,000 people) have prediabetes(ADA, 2015). The incidence of diabetes in New Jersey is rising, with about 39,000 new cases each year. This constitutes a high disease burden at the international, national, state, and local levels.

**Quality of life.** Diabetes is the 7th leading cause of death in the USA and the leading cause of lower limb amputation, kidney failure and adult onset blindness (ADA, 2018a; Alam et al., 2014; CDC, 2017b; Powers et al., 2015). Most comorbidities

associated with DM are due to chronic and persistent hyperglycemia associated with uncontrolled diabetes**.** The average years of life lost (YLL) due to diabetes in the United States in 2013 was estimated as 4.4 per person and the average Quality Adjusted Life Years (QALYs) lost due to diabetes was estimated as 5.4.

**Economic cost of diabetes.** One of the major issues with diabetes is its high economic and disease burden. About $727 billion dollars was spent on diabetes worldwide in 2017 (Piemonte, 2018) making up 12% of all adult healthcare-related spending. In 2013, the annual total cost (direct and indirect) attributable to diabetes was $421,598 million in the United States, and the cost per person with diabetes was $ 16,670 (CDC, 2018). The total cost of diabetes in New Jersey in 2013 was $11,872.2 million and cost per person with diabetes was $18,350 (CDC, 2018). Hospital readmission rates for people with diabetes as their primary or secondary diagnosis was shown to be much higher than the readmission rates for people without any history of diabetes (ADA, 2018b; Ostling et al., 2017)

**Diabetes self-management education.** DSME has been defined as a program that helps individuals living with diabetes to learn skills, change behaviors, and gain ability and confidence to manage their disease (Beck et al., 2017; Santorelli, Ekanayake, & Wilkerson-Leconte, 2017). Diabetes is a chronic disease. It is important that people with diabetes learn to develop the knowledge, skills, and confidence for the daily management of their diseases. The ADA recommends that DSMES be offered to all patients living with diabetes (ADA, 2018).

**Needs Assessment**

The ADA reported that the incidences of diabetes among non-Hispanic blacks (12.7%) and Hispanics (12.1%) are only secondary to that of Native Americans (15.1%) (ADA, 2018d). According to county health rankings and roadmaps, Essex County, New Jersey (the location of the site for this project), is the county with the highest percentage of Non-Hispanic African Americans in New Jersey, (38.8% vs 12.9% for New Jersey as a whole), and a percentage of Hispanic population higher than the state's average (23.2 versus New Jersey's average of 20.4%) (University of Winconsin Population health Institute, 2019). Therefore 62% of this region's population are at high risk for diabetes because of their race and ethnicity.

Incidentally, the Office of Disease Prevention and Health Promotion of the US Department of Health and Human Services (HHS) reported that health literacy among these two ethnic groups are the lowest in the United States with 24% of Blacks and 41% of Hispanics having below basics health literacy (HHS, 2008) A more recent study also showed that the percentage of Blacks or Hispanics with low health literacy are much higher than that of the White population (Hickey et al., 2018). According to Hickey et. al. (2018) the ability of people to self-manage their chronic conditions may be impacted by their level of health literacy.

Despite various worldwide studies and literatures that are available on the effectiveness of DSME, and multiple recommendations by the ADA, the percentage of people with diabetes who have attended at least one DSME remains less than 50% (Huxley et al., 2015; Korytkowski et al., 2014; Powers et al., 2015). The population of people with diabetes in New Jersey who have never attended DSME class is 58% and

about 58.3% to 69.8% of the diabetic population living in Essex County has never attended DSME (Santorelli et al., 2017).

Frequent hospital admissions and readmissions and complications that arise from uncontrolled diabetes are great contributing factors to high per capita cost of healthcare worldwide (Silva & Bosco, 2015) and in the United states (ADA, 2018b; Ostling et al., 2017). This will greatly impact the achievability of the Institute for Healthcare Improvement's (IHI) Triple Aim objective, which is to simultaneously improve people's experience of care and population health while decreasing per capita cost of healthcare (IHI, 2019)

**Statement of the Problem**

The DNP student noticed that certain patients with the diagnosis of uncontrolled diabetes kept revolving through the doors of the hospital where she worked. The patients noted as super utilizers of the hospital system have differences in age (young vs old), types of diabetes, and lengths of time living with diabetes. This brought about the questions, why do they keep coming back for the same things? What are they doing wrong? Frequent admissions and readmissions of diabetic patients for uncontrolled diabetes do not help in the achievement of the Triple Aim objective. DSME has been shown to improve diabetes knowledge and glycemic control and decrease readmission rates, yet referrals for DSME have been suboptimal.

This project seeks to determine whether a patient-centered, individualized 1:1 DSME program will improve patients' diabetic knowledge and glycemic control, evidenced by significant decreases in glycosylated hemoglobin (HbA1c) and hospital re-

admissions rates among a sample of patients who were admitted for uncontrolled diabetes in a hospital in Northern New Jersey

**Clinical Question**

Will 1:1 individualized DSME with telephone support be more effective than usual care in improving glycemic control and reducing frequency of hospital readmissions among patients admitted for uncontrolled diabetes?

**P** Patients diagnosed with uncontrolled diabetes.

**I** 1:1 individualized DSME with telephone support.

**C** Usual care

**O** Better glycemic control, improved diabetes knowledge, HBA1c and fewer readmissions for uncontrolled diabetes.

**T** 4 months

**Aims and Objectives**

The primary aim of this healthcare delivery, innovation/quality improvement DNP project is to improve patients' diabetes knowledge and glycemic control and reduce frequent readmissions for uncontrolled diabetes. A secondary (long-term) aim is to encourage the hospital/primary care providers of patients with diabetes to continually refer their patients for DSMES.

Objectives include:

- Assessing the diabetic patient's current diabetes knowledge and selfcare behaviors using two standardized tools (revised Michigan Diabetes Knowledge Test [DKT2] and the Diabetes Self-Management Questionnaire [DSMQ]).

- Providing inpatient 1:1 individualized DSME with phone follow-up support.
- Evaluating outcomes through the reassessment of knowledge and selfcare behaviors using the same tools, assessing patient reported 90-day readmission rates (cross-checked with the hospital's electronic health record [EHR]) and obtaining their 3-month HbA1c from their primary care providers and the hospital, if applicable.
- Sharing the findings with the primary care providers and the hospital to encourage increased patient referrals for DSME.

## Review of Literature

The DNP student completed a systematic search for pertinent and relevant studies on diabetes self-management education and its effects with a reference librarian's assistance using PubMed (MESH) and Scopus. Search terms used included (("diabetes mellitus" OR hyperglycemia or hypoglycemia) AND ("self-management" OR "patient education as topic")) and ("hyperglycemia" AND "patient education" AND readmission). Additional searches were made using EBSCOhost, CINAHL and Google scholar using key phrases such as "diabetes self-management education," "diabetes self-management education and glycemic control," "diabetes self-management education and readmission rates." The literature review included a search for relevant dissertations as well. Applying the following filters - Clinical Trial, Controlled Clinical Trial, Meta-Analysis, Practice Guideline, Randomized Controlled Trial, Systematic Reviews, Full text, Abstract, published in the last 5 years, Humans, English - yielded a list of 390 studies; 342 remained after duplicates were removed. After briefly reviewing the abstracts of the 342 studies, 237 studies were found irrelevant to the phenomenon of

interest and were discarded. The student reviewed the abstracts of the remaining 105 studies and found 34 studies to be relevant or pertinent. After reading the 34 full text studies, 13 of the full text articles were chosen to be included in the table of evidence because of their pertinence to the phenomenon of interest. (See table of evidence in the table section.)

**Diabetic Self-Management Education Trend**

Diabetic self-management education is not a new concept. While searching the literature for appropriate studies, many old studies were found. In 1986, Leitcher surveyed all available literature on hospital-based education from as far back as 1950. He recognized the recurring theme of gap in knowledge among patients who were diabetic (Leichter, 1986). This gap in knowledge still exists and has prompted several forms of DSME programs as evidenced by the amount of available recent studies. In one study, Korytkowski et al. (2014) noted an overall low score in the Diabetes Knowledge Tests (DKT) even though more than half of the participants had a prior diabetic education program. They found this to support the need to offer DSME to all diabetic patients regardless of any prior DSME as a form of ongoing reinforcement. Huxley et al. (2015) also recommended DSME for all patients with diabetes. In another study, Lewis et al. (2015) identified gaps in diabetes related knowledge and skill in the use of glucometer and self-injecting of insulin. They used a learner centered DSME tailored to address identified gaps in knowledge and skill. Gaps in knowledge were also assessed and identified in all the other studies included in this review of literature. One study noted that the patients had an average score of 50% in the Spoken Knowledge in Low Literacy in Diabetes (SKILLD) scale (García et al., 2015).

The ADA, recommends that all diabetic patients receive DSME (ADA, 2018c). DSME has been found to reduce hospital admission and re-admission rates and lower the risk for complications, thereby reducing healthcare costs (Powers et al., 2015). It has also been found to improve HbA1c by about 1% in people with type 2 diabetes. Powers et al. (2015) identified four critical times to assess/reassess for the need of DSMES, including at diagnosis, annualy, with new complications, and during transitions in care.

The daily demands of diabetes disease management is complex and can be overwhelming for some people, DSMES helps people to gain the knowledge, skills and ability they need for self-care (Beck et al., 2017; Powers et al., 2015), Having the knowledge, skills, and ability provided by DSME impacts life style behavior of patients and improves their quality of life. Even though it is a crucial aspect of diabetic care, DSMES is under-utilized (Beck et al., 2017). Advancements in technology is positively affecting the lives of people living with diabetes because it provides convenient access to DMSES and impacts its utilization and outcome. It is important to realize that people are different, have different priorities, ways of life, etc.; therefore DSME should be individualized to reflect the needs and preferences of each patient (Beck et al., 2017; Powers et al., 2015).

While searching the literature, many innovative ways of delivering DSME were identified, these include text messages (Abaza & Marschollek, 2017; Al-Ozairi et al., 2018; Charlier et al., 2016), videos and video games (Calderon et al., 2014; Calle-Bustos, Juan, Garcia-Garcia, & Abad, 2017; Draffin et al., 2017), other games (Calle-Bustos et al., 2017; Charlier et al., 2016; Kientz, 2016), telehealth (Aytekin Kanadli, Ovayolu, & Ovayolu, 2016; Bain, Jones, O'Brian, & Lipman, 2015; Bradway et al.,

2018; Cho et al., 2017; Davis et al., 2010), groups (R. Mash, Kroukamp, Gaziano, & Levitt, 2015; R. J. Mash et al., 2014; Paz-Pacheco et al., 2017), individual DSME (Fan et al., 2016), inpatient DSME (Korytkowski et al., 2014; Leichter, 1986; Nowakowski-Grier, 2018), and home DSME (García et al., 2015; Lavelle et al., 2016; Pauley, Gargaro, Chenard, Cavanagh, & McKay, 2016; Whitehouse, 2016). Despite all these innovative ways of delivering DSME, many studies still reported that the percentage of diabetic patients that had received DSME at least once is less than 50% (2018c; Huxley et al., 2015; Korytkowski et al., 2014).

**Effectiveness of DSME**

Different outcome variables were examined in the various studies selected for this review of literature. For the Doctor of Nursing Practice (DNP) project's objective of translating research into practice, the focus will be on variables that were positively influenced by DSME.

**Knowledge.** Six studies measured patients' preintervention knowledge of the disease. They used different tools like the DKT, the Revised Diabetes Knowledge scale (RDKS), the SKILLD scale, and a diabetes-related knowledge quiz. Four out of six of the studies reassessed knowledge as an outcome variable, and improvement in knowledge was statistically significant in all four studies (Barasheh, Shakerinejad, Nouhjah, & Haghighizadeh, 2017; García et al., 2015; Huxley et al., 2015; Lewis et al., 2015).

**HbA1c**. HbA1c was an outcome variable in eight studies. (Brunisholz et al., 2014; Fan et al., 2016; García et al., 2015; Huxley et al., 2015; Lavelle et al., 2016; Sherifali, Bai, Kenny, Warren, & Ali, 2015; Silva & Bosco, 2015; Whitehouse, Sharts-

Hopko, Smeltzer, & Horowitz, 2018). There was a statistically significant improvement in the HbA1c in seven out of the eight studies (Brunisholz et al., 2014; Fan et al., 2016; García et al., 2015; Huxley et al., 2015; Lavelle et al., 2016; Sherifali et al., 2015; Whitehouse et al., 2018). The eighth study had a borderline p value of 0.051. Even though it was not statistically significant, the authors considered it clinically significant because there was an improvement in HbA1c in 90% of the experimental group as opposed to 50% improvement in the control group (Silva & Bosco, 2015). Also, Silva & Bosco (2015) did a comparative pretest and posttest analysis within each group. The posttest improvement in HbA1c for the intervention group was statistically significant with a p value of 0.006 while that of the control group ($p = 0.131$) was not significant.

**Blood glucose**. Five studies assessed blood glucose, fasting blood sugar (FBS), or capillary blood glucose (CBG) as outcome variables; only two of the studies showed a statistically significant improvement in the mean blood glucose level (Fan et al., 2016; Korytkowski et al., 2014). Lavelle et al. (2016) noted a 12% improvement in the mean capillary blood glucose, with improvement in blood glucose in 70% of the participants, but this was not statistically significant ($p = 0.0994$). Even though a slight improvement in mean blood glucose was noted by Silva & Bosco (2015), it was not statistically significant ($p=0.145$). The mean and standard deviation of FBS for the intervention group in the fifth study decreased from $255.3 \pm 103.9$ before training to $254.6 \pm 88.3$ after training, but this was not statistically significant (Barasheh et al., 2017).

**Readmission rates.** Whitehouse et al. (2018) was the only study that included readmission rate as an outcome variable. They conducted a retrospective chart review that included three treatment modalities – inpatient DSME only, inpatient DSME plus

home care, and usual care. They found that the association between a DSME intervention and 90-day rehospitalization was statistically significant ($\chi 2(2) = 6.865$, $p = 0.032$). They noted that 90-day rehospitalization rates were 10% for DSME plus homecare and 20% for inpatient DSME only, and that the rate of rehospitalization for the usual care group who received no DSME was the highest at 26.7%.

**Other variables.** Some variables are unique to an individual study. Huxley et al. (2015) found a statistically significant improvement in diabetic distress. Korytkowski et al. (2014) noted a decrease in hyperglycemia and an increase in patient satistisfaction. Garcia et al. (2015) recorded significant improvement in the number of symptoms, quality of life, and self-efficacy. They also noted statistically significant improvements in total cholesterol and LDL, but not on HDL or triglycerides. Barasheh et al. (2017) noted statistically significant improvements in knowledge, attitude, self-efficacy, behavior, enabling factors, and reinforcing factors ($P<0.001$for all).

It is noteworthy that only one out of five studies that evaluated weigh-related variables – BMI, weight, and waist circumference post DSME found statistically significant improvements in BMI and waist cicumference (Fan et al., 2016). The other four studies did not find any statistically significant improvement in weight-related variables (Barasheh et al., 2017; Huxley et al., 2015; Lavelle et al., 2016; Silva & Bosco, 2015).

## Theoretical Framework

### The Knowledge to Action Cycle

The Knowledge-to-Action (KTA) model (Figure 1) is an amalgamation of two conceptual frameworks – knowledge creation and the action cycle (White, Dudley-

Brown, & Tarhaar, 2016). During knowledge creation, knowledge funnels through three phases: knowledge inquiry. which involves primary reasearch, yields a lot of knowledge that is then synthesized in the knowledge synthesis phase, which leads to the creation of knowledge, tools, and products that can be used to apply the knowledge (White et al., 2016). The action cycle comprises a series of seven actions that are continuous and can be used to tailor knowledge creation and implementation. The components of the action cycle are as follows:

1. Identify a problem that needs to be addressed and/or reviewed, and select the knowledge or research relevant to the problem.
2. Adapt the knowledge used to the local context.
3. Assess barriers to knowledge use.
4. Select, tailor, and implement interventions to promote use of the knowledge.
5. Monitor knowledge use.
6. Evaluate outcomes of knowledge use.
7. Sustain knowledge use (White et al., 2016)

**Framework Implementation**

Using the KTA, frequent admissions and re-admissions of patients with uncontrolled diabetes was identified as the problem that needed to be addressed. The DNP student reviewed the literature to find available evidence on diabetes self management and support. A synthesis of knowledge produced the evidence table. The knowledge was adapted based on the demographics, available resources, and individual needs of participating patients. Assessment of barriers both for knowledge and

implementation was done and the intervention was tailored to the needs of individual participants. Participants were recruited and DSME was implemented during the hospital stay. Monitoring was continuous and was done during phone follow-up support to evaluate how each patient utilized the knowledge.. Intervention and support were retailored and reinforced as needed. Outcomes were evaluated by reviewing fasting blood-glucose log, three-month HbA1c level, and readmission rates. This was necessary to evaluate the effects of knowledge on the desired outcomes.

To encourage sustainablity, family members were included during the implementation phase as much as possible, collaboration with the hospital staff and and individual patients' primary care providers was established to maintain the action circle by continuous monitoring of outcomes and reinforcement of knowledge because DSMES should be an ongoing process.

## Methodology

This project used a pretest – posttest quasi-experimental design. Participants completed two paper surveys before and after the implementation of 1:1 individualized DSMES.

### Setting

Participants were recruited for the study from two inpatient medical units (12 and 36 beds, respectively) of a hospital in northern New Jersey. The hospital is in Essex County, in which 10% of its adult population (20-year-old and above) are living with diabetes, compared to the state average of 9% and 9% for the U.S.'s top-performing counties on this measure (University of Winconsin Population health Institute, 2019). Essex County also has the highest population of African Americans in New Jersey

(38.8%) and a high population of Hispanics (23.2%) (University of Winconsin Population health Institute, 2019).

**Study Population and Sampling**

The population of interest was all patients with uncontrolled diabetes who were admitted in the two selected inpatient units within a one-month period who met the inclusion criteria (described below). Even though approximately 100 patients living with diabetes were admitted in the two units during the recruitment period, about 70% did not meet the inclusion criteria. Thirty-three patients who probably met the inclusion criteria were interviewed but 15 declined participation. Of the 18 who signed the informed consent, one subsequently was dropped because she did not complete the pretest assessment and did not receive the inpatient DSME, another changed his mind after completing initial assessment and DSME, and another was excluded during the posttest period because of pancreatic cancer. The final sample size was 15 even though the targeted sample size was 60.

**Inclusion and Exclusion Criteria**. Participants were recruited based on the following inclusion criteria: adults 18 to 89 years old, admitted in the hospital with a diagnosis of uncontrolled diabetes (blood glucose > 200mg/dl or < 60mg/dl on admission), and/or an HbA1c > 7.5%. Recruited participants were alert and oriented times four, possessed abilities to make decisions and were able to read and understand the English language. They were patients who were discharged to home.

Exclusion criteria applied included age – younger than 18 years or older than 89 years; presence of a mental health disorder or learning disability; patients planned for discharge to skilled nursing facilities or other institutions other than home; or those with

extensive comorbid conditions, such as cancer, HIV/AIDS, sepsis, non-healing wounds and blindness. Women diagnosed with gestational diabetes or those who were in the peripartum/perinatal period were also excluded from the study. Even though the diagnosis of end stage renal disease was included in the "extensive comorbid conditions" listed in the proposal, two participants who were on hemodialysis were included – one with chronic renal failure and the other with acute renal failure with the initiation of hemodialysis during the inpatient recruitment period.

**Consent and Recruitment**

Ethics and values must be considered when translating evidence into practice (Kelley et al., 2012; Lipworth & Axler, 2016). The DNP student collaborated with the hospital staff during this project. Hospital staff identified potential participants (i.e., patients who met the inclusion criteria). Patients were given the freedom to choose whether to participate or not. They were also informed of their freedom to opt out at any point in the project without any reprisal. They were informed that not participating would not affect their usual care. To ensure that the ethical principle of autonomy was observed, informed consent was obtained from every potential participant for this project, without coercion, prior to assessing their health records. (A copy of the consent can be found in Appendix A.) All potential benefits and harms were disclosed to gain an effective informed consent(Cosgrove et al., 2014). Participants received copies of their signed consent forms, which contained the contact information of the DNP candidate for additional questions.

Recruitment posters/fliers (Appendix B.) containing information about the diabetes self-management education project were posted and placed at the nurses'

stations, staff restrooms, and lounge rooms as a constant reminder for nurses to identify potential participants. Nurses were asked to hand out copies of the fliers to eligible patients to sensitize the patients prior to contact with the DNP candidate. A folder was placed at each nurses' station for nurses to place lists of potential participants for the DNP candidate.

Every patient who met the inclusion criteria to be recruited for the project had equal opportunity for consideration to ensure the ethical principal of justice (Dudley-Brown, White, & Terhaar, 2015). All were approached. The expectations of the study were made clear to the patients from the start to ensure veracity and fidelity. The patients were told what to expect in terms of number and frequency of phone calls, length of time for questionnaires and DSME sessions, and topics to be discussed. The DNP-candidate maintained honesty and truthfulness throughout the intervention. There was no financial conflict of interest to disclose. Patients' values and boundaries were considered while maintaining the integrity of the project.

**Risks and harms**. There was minimal risk involved in the process of conducting this healthcare delivery innovation/quality improvement DNP project. The ethical principles of beneficence and non-maleficence were maintained. There were no physical or emotional harms, or discomfort reported with participation in this project. Participants involved in the project did not complain about the time commitment to complete assessments and to receive the DSME, which some might consider burdensome. The motivation for the project was patient-centered and participants' interests and values were considered to balance the burdens with the benefits. (Dudley-Brown, White, & Terhaar, 2015).

The risk for insecure handling of personally identifiable information (PII) and protected health information (PHI) was proactively mitigated. Participants were assigned number identities; all data collected were de-identified. A custom list of the participants was created and stored in the EHR, limiting the PHI and PII included in the list that linked participants' assigned identifying numbers to short versions of their names. Only the DNP student had access to the list linking the participant "nicknames" to the assigned number, which was kept in a password protected file in Rutgers university cloud storage. Participants were kept informed of anything that may have impact their decision to participate or continue to participate.

**Subject cost and compensation**. Patients did not pay to participate in this study and participants were not offered any monetary compensation for participating.

**Study Interventions**

The inpatient length of stay (LOS) at the hospital site varied for individual participants (range 2-19 days Average LOS was about 7 days. Patients were admitted on different days and had different lengths of stay. Due to the varying inpatient periods and lengths of stay, serial recruitments and implementations was done simultaneously over a month's period starting from September 13, 2019. After each participant signed the informed consent; their unique diabetic care goals and needs were assessed on the first inpatient recruitment visit; DSME was individualized based on individual priorities, goals, and needs and was implemented prior to discharge.

Two paper questionnaires were used to assess the participants' diabetes knowledge, skills, activities, and behaviors. Demographic information, relevant histories and participants' areas of DSME interest was collected using an intake form (Appendix

C). Assessment results were used to individualize participants' education based on their individual priorities, preferences, and goals specified in the intake form.

**Pretest assessment**. The modified Revised Michigan Diabetes Knowledge Test (DKT2) - True/False Version (Appendix D), which is a 20-question scale, was used to assess participants' diabetes knowledge. The Diabetes Self-Management Questionnaire (DSMQ) (Appendix E) was used to assess diabetes self-management activities and behaviors. Assessment results were used as a measure of pre-intervention level of diabetes knowledge, skills, and self-care behaviors.

After consenting to participate in the study, participants were asked to complete an intake form and the DKT2 and DSMQ questionnaires. Other pretest data that were collected were admission blood glucose, HbA1c and hospitalization histories in the past 3 months. These were collected through chart review and interview. The pretest data, individual goals, preferences, and priorities were used to tailor and individualize the interventions.

***Instruments reliability and validity.*** All instruments used in this study had been used previously and validated. The DKT2 is an updated version of the original diabetes knowledge test (DKT), which was a 23-item scale designed in 1998 (Alhaiti, Alotaibi, Jones, DaCosta, & Lenon, 2016; Fitzgerald et al., 2016). The 20-item true/false version was created in 2011 and reflects the current standards for DSME (Fitzgerald et al., 2016). A validation study of the DKT was done and a Cronbach's alpha of 0.77 was reported for the 14-item general test and 0.84 for the 9-item subscale related to insulin use (Fitzgerald et al., 2016). The Arabic version of DKT2 also showed good internal

validity with a Cronbach's alpha of 0.75 and an excellent test-retest reliability with an intraclass correlation coefficient (ICC) level of 0.90 (Alhaiti et al., 2016).

The DSMQ was developed in Germany in 2013 to evaluate relatedness of diabetes self-care behaviors and HbA1c (Bukhsh, Lee, Pusparajah, Schmitt, & Khan, 2017; Schmitt et al., 2013). Bukhsh et al. (2017) proposed that DSMQ may be used effectively as a clinical tool for assessing patients with poor diabetes outcomes, determining the factors that lead to poor self-care behaviors. Schmitt et al. (2013) reported a Cronbach's alpha of 0.84, which was good, and the validation of the Urdu version of the DSMQ was excellent, with a Cronbach's alpha of 0.96 (Bukhsh et al., 2017).

**Implementation**. DSME knowledge was adapted from the review of literature and from the American Association of Diabetes Educators' (AADE) AADE7 Self-Care Behaviors, which emphasizes nutrition, physical activity, monitoring, medication, problem solving, risk reduction, and healthy coping. Education was tailored for each participant and implemented in two to three sessions of approximately 30 minutes each, with one session per encounter. The exact timeframe and number of sessions were based on each participant's tolerance, needs, and priorities. Allowing a little flexibility in planned sessions helped to maintain the integrity of the study, which is focused on individualization. Participants were given copies of their individualized DSME study package; relevant patient education topics were also selected from the hospital system and included in the hospital discharge package.

**Follow-up support**. Telephone follow-up support was done with 5-10 minutes calls about once a week for the first month after hospital discharge. Even though

participants were encouraged to reach out to the DNP candidate, as needed with the provided phone number, only two calls were initiated by two different participants, both to report hospital readmission.

**Posttest assessment and data collection.** The same two instruments – the true/false version of the DKT2 and the DSMQ – were utilized for the posttest assessments. Eight participants completed the reassessment over the phone, and one completed hers during a hospital readmission in the posttest period. Posttest HbA1c results were obtained from the EHR for three participants and three were collected from primary care providers using the patients' signed consents. Readmission status was monitored during the follow-up support calls and readmission records were collected from the hospital EHR system. Only one participant reported two admissions in a different hospital and that was added to what was obtained from the hospital site record

**Outcomes measured**. Outcomes measured were the knowledge of the participants about diabetes and self-care, the mean reduction in HbA1c and hospital re-admission rates. The items in the knowledge test are categorical but were summed up to create a continuous variable – the knowledge score. Quantification of the reduction in the HbA1c and hospital re-admission rates are continuous variables. These were the outcome variables tested. The 90-days readmission rates were tested in three categories – diabetes related, non-diabetes related and total 90-days readmission rates.

## Timeline

A Gantt chart detailing the project timeline (Figure 2) can be found in the figures section.

## Resources /Economic Consideration

The projected total cost for the research project was $500 but approximately $230 has been utilized so far and an additional $100 is estimated as the cost for the poster presentation reducing the expense to about $330 (Table 2). Because the research project was not grant-funded, the DNP candidate was solely responsible for all project associated costs. Expenses included cost for printing recruitment materials, handouts, and materials for the educational program; AADE7 training costs and fax service.

**Evaluation**

Process evaluation was done simultaneously during follow-up support. Using the Knowledge-to-Action framework, individual participant's knowledge use was evaluated weekly at first, then bi-monthly using participant reported outcome measures. Knowledge was continually retailored and reinforced to ensure sustainability (White, Dudley-Brown, & Terhaar, 2016).

Support was provided by the DNP candidate for the nine individuals who participated in the follow up support. Participants were ecouraged to set weekly small manageable goals which were evaluated during each call, intervention and support were retailored and reinforced as needed. Outcomes evaluated included fasting blood-glucose– (reviewed during calls), knowledge retention after three months, three-month HbA1c, and readmission rates. These were necessary to evaluate the effects of knowledge on the desired outcomes. A statistically significant improvement in any or all of the outcome variables was used to define the success of the intervention.

**Data Maintenance & Security**

All participants were assigned unique identification (ID) numbers upon recruitment. These ID numbers were used for collecting all data. All de-identified data

were transferred into and maintained in the password protected Rutgers university cloud storage. The list linking participants and assigned number ID was maintained in a password protected file and was destroyed after all posttest data were collected. Only the DNP candidate had access to the list. All de-identified paper surveys were stored in a locker at the site until all data was transferred into the password protected cloud drive and then were destroyed.

All de-identified hard and soft copy data will be destroyed following the Rutgers University guidelines, after the completion of the study, closure of IRB, and publication of the manuscript describing study findings. Soft copies of the aggregate data will be stored at the Rutgers cloud storage and consents will be stored in Dr. Kathy Gunkel's office, at Rutgers University, 65 Bergen Street, Newark NJ 07107 following IRB and University guidelines.

**Data Analysis**

Coding and preliminary analysis were done using both Excel and SPSS software. The preliminary analysis included descriptive statistics, taking into consideration the demographics of the participants. Descriptive data is presented in the form of tables, charts, and graphs in the tables and figures section. A 95% confidence limit was used and the confidence interval for the mean of the distributions was computed. The level of significance used was 0.05. Omitted answers were taken into consideration during data coding.

Due to the small sample size, statistical analyses used the non-parametric tests – Mann-Whitney U and the Wilcoxon signed-rank. The Mann-Whitney U test was used to compare differences between groups and the Wilcoxon signed-rank test was used to

compare pretest and posttest differences in means. Data analyses provided evidence of the efficacy of the project interventions in improving knowledge, decreasing the HbA1c of the patients, and reducing hospital readmission rates.

# Results

## Sample Demographics

The final sample size was 15 participants, majority of whom were females (67% vs. males 33%) and Black/African American (80% vs. Hispanics 20% and Caucasian 0%) (See Table 3 and Figures 3 and 4 in the tables and figures section). Participants' ages ranged from 35 to 83 years, with mean age of 56.87 years. (See Table 4 in the tables section.) Of the 15 participants who completed the inpatient DSME, only nine participated in the telephone follow-up supports. One's provided phone number was a wrong number, two numbers were not in service, and the remaining three never answered or returned calls.

## Pretest Data

Aside from the demographic data described above, pretest data collected included, admission blood glucose (BG) (n =15, min = 134, max = 709 mg/dl, mean = 378.20 mg/dl), HbA1c (n =13, min = 5.8%, max = 14%, mean = 10.14%), 90-day admission history (n =15, min = 1 admission, max = 3 admissions, mean= 1.53 admissions; non-DM related admissions mean = 0.73 admissions, DM related admissions mean = 0.80 admission); and pretest diabetes knowledge score (n= 15, min = 6, max = 18, mean = 12.64). (See Table 4 in the tables section.)

## Posttest Data

The posttest data included the following: HbA1c (n =6, min = 5.3%, max = 11.70% , mean = 7.98%), 90-day readmission history (n =15, min = 0 admission, max = 5 admissions, mean= 1.27 admissions, non-DM related admissions mean = 1.20 admissions, DM related admissions mean = 0.07 admission) and posttest diabetes

knowledge score (n= 9, min = 12, max = 20, mean = 16.78). See Table 5 in the tables section

**Diabetes knowledge**

All 15 participants completed the DKT2 questionnaire during the pretest period but only nine completed the posttest questionnaire. Seven out of nine were completed over the phone while two were completed during a hospital readmission that fell within the reassessment period. Only those who participated in the follow-up support phone calls completed the posttest assessment.

A Mann-Whitney test indicated that there is no statistically significant difference in mean pretest diabetes knowledge scores ($U = 17.00$, $p = .46$) between those who completed both pretest and posttest DKT questionnaire and those who completed pretest only. A Wilcoxon Signed-ranks test showed a statistically significant increase in mean diabetes knowledge score from 12 to 16.78 following participation in DSMES ($Z = 2.55$, $p = .011$, see Table 6).

**HbA1c.** Thirteen participants had pretest HbA1c but only 6 participants had posttest HbA1c. Final analysis was done using only those who had both pretest and posttest data. A Mann-Whitney test indicated that there was no statistically significant difference in mean pretest HbA1c ($U = 16$, $p = .48$) between those who had both pretest and posttest HbA1c and those who had only pretest HbA1c. A Wilcoxon Signed-ranks test showed a statistically significant decrease in mean HbA1c from 9.73% to 7.98% following participation in DSMES ($Z = 2.21$, $p = .027$, see Table 6).

**Readmission rates.** A Mann-Whitney test indicated that there was no statistically significant difference in mean pretest 90-days admission histories – non

diabetes related ($U$ = 24.00, $p$ = .683); diabetes related ($U$ = 24.0, $p$ = .683) or total 90-days admissions histories ($U$ = 19.5, $p$ = .31) between those who completed DSME plus follow-up support and those who completed DSME only without participating in follow-up support.

A Wilcoxon Signed-ranks test showed a statistically significant decrease in mean diabetes related 90-days readmission rate from 0.80 to 0.07 ($Z$ = 2.67, $p$= .008) following participation in DSMES, but there was no statistically significant difference in non-diabetes related readmission rates ($Z$ = 1.09, $p$= .28) and total readmission rates ($Z$ = .74, $p$= .462). See Table 6.

## Discussion

This quality improvement pretest/posttest study was conducted to evaluate the effects of 1:1 individualized DSMES on glycemic control. The study was conducted in a hospital in an area of Northern New Jersey (Essex county) which was considered a diabetes hotspot with a high African American and Hispanic population. The incidences of diabetes among Blacks and Hispanics are much higher than those of other ethnicities aside from that of American Indians (ADA, 2018) whose population is insignificant at 0.7% for the county. The county has the highest African American population in New Jersey (41.9 %) and according to the United States Census Bureau Quick Facts (US department of Commerce, 2019), the actual city, where the hospital is located, has a much higher concentration of African American population – 85.3% followed by Hispanics – 11.3% and Whites – 3.1%.

A study showed that Hispanics and Blacks has lower health literacy than the white population (Hickey et al., 2018). Hickey et al. (2018), also stated that low health

literacy can greatly impact an individual's ability to self- manage a chronic condition. The demographics of the sample almost mirrors that of the city with 80% African – American participants and 20% Hispanic participants.

It was noticed that most of the patients who are living with diabetes, kept revolving through the doors of the hospital, supporting studies that postulated that people who has diabetes are super utilizers of health care (ADA, 2018b; Ostling et al., 2017). A search of the literature also showed that many patients living with diabetes have never participated in a DSME class (Huxley et al., 2015; Korytkowski, Koerbel, Kotagal, Donihi, & DiNardo, 2014; Powers et al., 2015) and that many who had still scored low on a diabetes knowledge test (Korytkowski et al., 2014). Only 53% of the participants in this study admitted to a history of DSME. DSME has been shown to improve knowledge (Barasheh, Shakerinejad, Nouhjah, & Haghighizadeh, 2017; Huxley et al., 2015; Lewis, Benda, Nassar, & Magee, 2015) decrease HbA1c and hospital readmission rates (Powers et al., 2015; Whitehouse, Sharts-Hopko, Smeltzer, & Horowitz, 2018).

This study's results also showed statistically significant improvements in knowledge ($p$ = 0.11), (only 29% of the participants scored up 70% in the pretest DKT but 78% scored 80% or more in the posttest DKT.), HbA1c ($p$ = .027) and diabetes related 90-days readmission rate ($p$ =.008). However, there were no statistically significant improvements in total 90-day readmission rate and non-diabetes related 90-day readmission rate.

**Facilitators and Barriers**

The most significant facilitator for this DNP project was the hospital's stakeholders buy-in and support. The managers and nursing staff were willing to assist in identifying patients who potentially met the inclusion criteria. The DNP student's knowledge of the hospital layout, staff and the EHR system also made the process significantly easier.

One of the major barriers that impacted the project's objective include the delay in IRB process time which caused a month and half delay in the original proposed timeline. Another major barrier is a change in one of the approved unit's bed capacity from a 28 – bed unit to a 12-bed unit. This probably added to the low sample size obtained. The variable and unpredictable LOS, can also count as a barrier because one consented participant who wanted to take time to fill out the intake form and questionnaires was discharged prior to filling any of the forms and was subsequently dropped from the study because inpatient DSME was not implemented.

Although the nurses were very helpful whenever the DNP student was present, they never preemptively utilized the folder the student provided to list potential candidates. The DNP student had to interview each nurse each time to find out who the potential candidates were.

A noteworthy barrier was lack of control over lab tests. The DNP student as proposed, did not request for labs to be ordered in the pretest or posttest period and had to make do with available results from the EHR that coincided with either period, which were supplemented with results from the participants' healthcare providers. Unfortunately, most of the healthcare providers reached did not have up to date HbA1c results, some provided results from 2018, 2015 even 2011 which were not useful. Many

personal care providers approached had no record of the participants that listed them as their providers.

### Limitations

There were many limitations to this study. The small sample size and lack of control over lab tests and their timing were major limitations. Complete pretest/posttest sets of HbA1c were obtain for only 6 participants. Three of the pretest HbA1c were up to a month old during the pretest period, only three of the posttest HbA1c were done 3 months after the intervention as desired. Of the remaining three, one was done 6 weeks post intervention and the remaining two were from one month each after intervention.

### Unintended consequences

An unintended consequence that was reported was increased family involvement in diabetes management. One of the techniques the DNP student utilized was to include the participants' family in the DSME whenever possible. One of the participants reported that her son who received the DSME with her has been a fountain of back-up knowledge and has been acting as her care partner in diabetes self-management. She was one of the most excited to participate in the DSMES project because according to her she did not know what to eat and what not to eat. She was admitted with a BG >300 and a HbA1c > 12 but her HbA1c was < 7 when she was readmitted for an unrelated reason one month after initial encounter.

## Implications

### Implications for Clinical Practice

Diabetes is a chronic disease that will continue to require efficacy of care daily that is impossible to be continually met by health professionals alone. Patients and/or

their caregivers must be knowledgeable enough to meet the daily management demands of this chronic condition outside of the healthcare setting. The pretest data collected for this project shows that some patients have not been able to cope with the daily requirements of diabetes self-care as evidenced by the high mean admission blood glucose and HbA1c. It has been shown that DSME improve diabetes knowledge and reduces HbA1c by as much as 1% without medication (Powers et al., 2015).

This project's implications for clinical practice includes a greater focus on patient education to improve patients' knowledge and self-efficacy in the management of not only diabetes but other chronic conditions that they must live with. This will necessitate adequate training of the nursing staff to provide ongoing self-management educations since nurses are at the center of care. Nurses spend more time with the patients than most other health care team members and may be able to provide patients with short bursts of focused/individualized DSME during their routine nursing activities.

The project illuminates the need to give more attention to the transition in care process with provision of some form of follow-up support in the immediate post hospitalization period. Providing phone follow-up support during this project addressed some of the patients' post-admission concerns and provided an opportunity to reinforce DSME, monitor outcomes and remind patients to keep their follow-up appointments.

This may lead to improved interdisciplinary healthcare team collaboration with nurses, case managers, clinicians, nutritionist and diabetes educators to provide a patient-centered care. The involvement of the interdisciplinary team with the patient at the center aids in a safer and more coordinated transition in care.

**Implications for Healthcare Policy**

This healthcare delivery innovation project supports the Patient-Centered Medical Home (PCMH) model of care. According to the U.S Department of Health and Human Services (HHS), PCMH focuses on partnering with the patients and families to provide accessible, coordinated, and comprehensive care that is mostly preventative in nature, using evidence to improve quality and safety of care (HHS, n.d.). The PCMH model was designed to provide essential care in such a way that it is timely and affordable in the right setting provided by the right professionals. Patient and family engagement as well as strategies to reduce healthcare disparities are essential aspects of the PCMH model of care (Reynolds et al., 2015). According to Reynolds et. al., (2015) one of its aim is to help in the achievability of the "Triple Aim" objectives. The success of this project will encourage the adoption of the PCMH model of care and support health policies on diabetes and chronic disease management.

Research can and should inform policies. The World Health Organization (WHO) recognizes that tobacco use, poor diet and lack of physical activities are some of the factors that contribute to the growing epidemic of chronic diseases(WHO, 2019). (These factors were addressed in the DSME provided in this project). This project supports WHO's recommendation to the ministries of health for the formulation and adoption of policies on chronic disease prevention and management and the promotion of lifestyle modifications through diet and exercise (WHO, 2019).

This DSMES project can inform the following policies recommended by the National Conference of State Legislatures for healthcare legislators.

1. Support payment reform. Provide reimbursement for supplemental primary care services, such as care coordination, patient education and disease self-management.
2. Provide financial incentives for providers to switch to more team-based care. Develop policies that encourage training health care professionals on team-based care
3. Establish health homes to coordinate care for Medicaid beneficiaries. (Comlossy, 2013).

**Implications for Quality & Safety**

Diabetes is the 7th leading cause of death and is the leading cause of health-related complications and disabilities, such as adult onset blindness, kidney failure, and lower limb amputation (American Diabetes Association (ADA), 2018a; Alam, Asghar, Azmi, & Malik, 2014; Centers for Disease Control and Prevention (CDC), 2017b; Powers et al., 2015). Most comorbidities associated with DM are due to chronic and persistent hyperglycemia associated with uncontrolled diabetes (Silva & Bosco, 2015). According to the CDC, the average years of life lost (YLL) due to diabetes in the United States in 2013 was estimated as 4.4 per person and the average Quality Adjusted Life Years (QALYs) lost due to diabetes was estimated as 5.4.

DSME has been shown to significantly improve knowledge, self-care skills and HbA1c in people with diabetes (Powers et al., 2015). This project provided education and support to patients with uncontrolled diabetes with the aim of improving their glycemic control. Achieving glycemic control can make a great impact on their health and quality of life.

The diabetes knowledge gained can also improve patients' safety. During the pretest assessment 50% of the participants answered "TRUE" to DKT2 (diabetes knowledge test) question number 7 which is, "a can of diet soft drink can be used for treating low blood glucose levels". This demonstration of lack of basic knowledge can have a fatal implication on safety. One of the motivations for this study is some patients' erroneous belief that they must always eat because they are diabetic and will demand for extra snacks even though their blood sugar was already very high.

**Implications for Education**

Education is continuous even for those with the highest education degree. The results of this project when published will impart knowledge to the readers.

The project will illuminate the need for DSME on three levels.

1. Patients/caregivers and community's – self-management educations.
2. Nurses and healthcare staff – in services, continuous education and competencies on DSME.
3. Nursing and medical schools – curriculum to include DSME.

The "Triple Aim" objective is to simultaneously increase patient satisfaction with care, improve community health while decreasing cost("The IHI Triple Aim," 2019). The preventative nature of DSME can help in the achievement of these objectives but not many patients are referred for DSME (Huxley et al., 2015) and not many people are trained to provide it (National Certification Board of Diabetes Educators, 2018).

Positive findings in this project will encourage more referrals for patients to receive DSME. It may also encourage policies for nurses and healthcare workers to be trained on DSME so that they can be competent to provide targeted DSME to their

patients in their day to day nursing duties. This DSME education policy can also extend to nursing and medical schools, with the addition of DSME in the curriculum and students given an option to gain certification in diabetes education (CDE).

In 2018 the number of health professionals who hold a CDE certificate in US are 19,584 (National Certification Board of Diabetes Educators, 2018) contrast with the 30.3 million people in United states who have diabetes mellitus and the more than one third who have prediabetes (Beck et al., 2017; CDC, 2017a). Health professionals from New Jersey account for only 2.8% (547) of CDE holders in the country and 904,861 adults have diabetes in New Jersey, and an additional 2,483,000 people have prediabetes (ADA, 2015).

Even though people in the nursing profession hold 49% of CDE certificates in the country (dieticians – 41%, pharmacists – 7%) (National Certification Board of Diabetes Educators, 2018), there is a great shortage of certified diabetes educators to meet the need of the growing population of people living with diabetes in the country at large and in New Jersey in particular. There is a great need for more health professionals with CDE certification.

**Economic Implications**

The financial cost of diabetes has been well established. People with diabetes have been associated with higher rates of hospital admission and readmissions (ADA, 2018b; Ostling et al., 2017) higher direct and indirect health related costs, and higher average Quality Adjusted Life Years (QALYs) lost due to diabetes(CDC, 2018). Diabetes as a chronic condition creates a heavy economic burden on individuals, families and the society at large. The economic cost of diabetes is not just the direct cost

of medications, hospitalizations or treatments but include indirect costs of lost productivity for the individual and for the care giver.

Most people whose diabetes is not controlled, frequently utilize the emergency room for preventable DSME reasons such as hypoglycemia or issues related to hyperglycemia. This was the case for the sample included in this study with 87.5% of the participant having an admission serum blood glucose of 230mg/dl or more with a range or 134 – 709mg/dl and a mean of 378.2 mg/dl. These potentially preventable hospitalization increases the economic cost of the disease.

This project provided education and support that impacted knowledge and encouraged the participants to make consisted small changes that will make a great impact in their daily wellbeing. This will potentially reduce their diabetes related utilization of the emergency room or hospitalization and decrease direct and indirect costs of the disease.

**Implications for Others as Related to Project (organization/ stakeholders)**

The hospital stakeholders and primary care providers will see the need to continually refer patients to DSME, obtain DSME training for the nursing staff, include DSME training in the annual competency training via HealthStream. This may also encourage the hospital to designated care managers to provide follow-up support to their patients after discharge.

**Plans for Sustainability**

DSMES should be an ongoing process. The Knowledge-to-Action (KTA) model was utilized for this project and efforts will be made to maintain the action circle. Collaboration with all stakeholders (i.e., the patients/families, hospital staff, and primary

care providers) will ensure the sustainability of the individualized DSMES program. Patients/families and their primary care providers will be encouraged to maintain the action circle by continuous monitoring of outcomes and reinforcement of knowledge during office visits. Sharing the results with all stakeholders will encourage increased referrals for DSME.

**Professional Reporting/ Future Scholarship**

The results of this project will be disseminated through poster presentations and power point presentations at Rutgers University, the study site, other healthcare settings, and at nursing conferences. The final paper will be stored in the Rutgers university's repository for easy access. Efforts will be made to publish the study's findings in a peer reviewed journal, such as the *Diabetes Educator*, to reach a wider audience. The abstract will be submitted for the American Diabetes Association's 80th Scientific Sessions (#ADA2020).

## Conclusion

The complex nature of diabetes and its management has made it difficult for some patients to cope, hence worsening their glycemic control and increasing complications associated with the condition. Individualized in-patient 1;1 DSMES has been shown to improve diabetes management and the health of diabetic patients. It is cost-effective and helps to reduce HbA1c, blood glucose levels, hospital readmission rates and complications resulting from diabetes. The DSMES project resulted in improvement in diabetes knowledge, higher posttest mean-self-management score, decrease in mean HbA1c and diabetes related 90-day readmission rate. Participant's awareness, knowledge, and participation in self-care improved following this project.

The findings of this project will help, encourage hospitals and primary care providers to continually refer diabetic patients for DSME. The result of this project will be disseminated to all stakeholders, which will help to create more awareness on the importance of DSME for diabetes management. It is anticipated that hospitals and doctor's offices will begin to adopt the 1:1 DSMES approach and continually refer their patients for DSME because of its evidence-based effects on improving patients' diabetes knowledge, lowering HbA1c and diabetes related hospital readmission rate.

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## Tables

Table 1
*Table of evidence*

| Arti-cle # | Author & Date | Evidence Type | Sample, Sample Size, Setting | Study findings that help answer the EBP Question | Limitations | Evidence Level & Quality |
|---|---|---|---|---|---|---|
| 1 | Barasheh et al (2017) | Quasi-experimental | Random sampling/ 110 participants/ Health centers in Bavi city | The percentage of patients with poor self-care reduced from 56.36 to 10.9 in the intervention group. Optimal self-care increased from 23.63% to 69.09% in the intervention group after training. The mean and SD of FBS for the intervention group decreased from 255.3±103.9 before training to 254.6±88.3 after training but this was not statistically significant. There were statistically significant improvements in knowledge, attitude, self-efficacy, behavior etc. all with (P<0.001) | Not stated | II/High |
| 2 | Beck et al. (2017) | 2017 Standards for Diabetes SME and support | N/A | DSME/S is under-utilized. Advancements in technology is positively affecting the lives of people living with diabetes because it provides convenient access to | N/A | 5/High |

| | | | | | | |
|---|---|---|---|---|---|---|
| | | | | DMSE/S and impacts its utilization and outcome. DSME should be individualized to reflect the needs and preferences of each patient | | |
| 3 | Brunisholz et al. (2014) | Quasi-experimental | 4587 participants/ Intermountain Healthcare a not-for-profit integrate delivery system | Patient with DSME had a significant increase in their improvement of their HBA1c (OR=2.80; CI =2.05, 3.83: P,0.0001), and significant increase in their achievement of five parts diabetes bundle (OR=1.49, CI:1.11-2.001:P,0.008), as compared to those without DSME | Variation in practices was not considered. It only considered Caucasians. The registry did not separate the type1 from type 2 cases | 1/Good |
| 4 | Fan et al (2016) | RCT | 280 participants (4 loss to follow-up)/Hospital | After 6 months, there were statistically significant reduction in body mass index (P=0.002), waist circumference (P =0.032), fasting blood glucose (P =0.004), HbA1c (P =0.027), systolic blood pressure (P =0.003), triglyceride (P=0.037) and low-density lipoprotein (P =0.032) | Not stated | 1/High |
| 5 | García, (2015) | A randomized control | 72 Participants/Home | Assessments were done at baseline (BL) after 2months (T2) and after 6 months (T3). There were statistically | High attrition rate (36%). The high attrition was held | I/High |

| | | | | | | |
|---|---|---|---|---|---|---|
| | | led trial | | significant improvements for the experimental group in the following variables.<br>1. HbA1c, BL to T2 (P = 0.001) not at T3<br>2. number of symptoms, BL-T2 (P=0.007), BL- T3 (P=0.002)<br>3. self-efficacy BL-T2 (P=0.001), BL-T3 (P=0.001)<br>4. knowledge BL-T2 (P=0.001), BL- T3 (P=0.015) and<br>5. quality of life BL-T2 (P=0.044), BL-T3 (P=0.033)<br>LDL and total cholesterol significantly improved from BL to T3 only (P=0.015) and (P=0.009) respectfully. | responsible for HbA1c reduction not being statistically significant at T3. | |
| 6 | Huxley (2015) | Quasi-experimental study | 31 participants/ Primary care setting. England. | After 6 months a Significant improvement in HbA1c, p=0.03, diabetes distress p=0.03, knowledge p=0.05 | Small ample size and paucity of information on the patients. It is limited by the lack of a measure of eating habits, several outcomes were self-report, and there was | II/Good |

| | | | | | | |
|---|---|---|---|---|---|---|
| | | | | | possible selection bias | |
| 7 | Korytkowski, (2014) | RCT | 21 Participants/4 medical hospital units in Pittsburg | Patients in the education group experience greater satisfaction with treatment, had less episodes of hyperglycemia (P= 0.03) and improved capillary blood glucose levels (P=0.02) | Small sample size due to difficulty recruiting inpatients. Study lasted during length of admission and results may have been compromised by poor compliance prior to admission. HbA1c was not assessed. | I/good |
| 8 | Lavelle et al. 2016 | Quasi-experimental | 19 participants/ Home | After 4 months the mean HbA1c reduced by 12%(p=0.0107), the mean glucose reduced by 12% (0.0994), the mean BMI reduced by 2% (P= 0.1490) | Lack of generalizability due to small sample size and lack of control group, Patient population ambulatory, difficulty signing patients because of conflict of schedules such as travelling, | II/Low quality |

| | | | | | | |
|---|---|---|---|---|---|---|
| | | | | | working etc. | |
| 9 | Lewis et al. 2015 | Quasi-experimental | 51 participants? Emergency room of a hospital in an urban area | A statistically significant increase in knowledge was noted on 24 -72 hour follow up after a leaner-centered survival skill DSME was provided. | Lack of a control group. All patients received the same learner-centered program, other instruction methods were not considered. | II/Good |
| 10 | Powers et al. (2015) | Position statement | N/A | DSME/S has been found to reduce hospital admission and re-admission rates and lower risk for complications thereby reducing healthcare cost. In people with type 2 diabetes, it has been found to improves HbA1c by about 1%. | N/A | 4/High |
| 11 | Sherifali et al. | Systematic review /metanalysis of 13 RCT studies | 4517 participants/multi setting | Pooled effect of HbA1c was a reduction of -2mmol/mol (0.2%: CI -0.3 to -0.1), tailored interventions (-3mmol/mol (-0.2%; 95% CI -0.4 to -0.1). DSM programs for older adults demonstrates a statistically significant reduction in HbA1c, lipid and BP, and its clinical significance can be | Only studies published in English were included in the study, the quality of original studies varied on the risk bias assessment, Outcome of interest | 1/High |

| | | | | | | |
|---|---|---|---|---|---|---|
| | | | | Improved in conjunction with other diabetes management intervention. | were limited to clinical outcome | |
| 12 | Silva & Bosco | RCT | 23 participants/Metropolitan medical center | There was significant duction in the HbA1c the intervention as posed to the mparison group that owed no fference(P=0.051). A gher percentage of the tervention group hieved HbA1c near e target (<7.5%) than the comparison group. | Not stated | 1/Good |
| 13 | Whitehouse et al. | Quasi Experimental | 180 participants/Hospital and home 3 groups 1. Inpatient DSME only 2. Inpatient DSME plus homecare 3. Usual care | 90-day rehospitalization rate was (10%) for DSME plus homecare, inpatient DSME only (20%) and the usual care group (26.7%). The association between DSME intervention and 90-day rehospitalization was statistically significant ($\chi 2(2) = 6.865$, $p = 0.032$). HbA1c was statistically significant for inpatient DSME only group ($p = 0.004$) and inpatient DSME plus homecare group ($p < 0.001$) over time. Inpatient DSME only was statistically significant only from 90 days to 12 months while DSME plus home care was | The study was a retrospective chart review and depended only on data available in the hospitals EHR. The authors recognized the possibility that participants may have been re-hospitalized in different health care systems or may have had their hbA1c | II/high |

| | | |
|---|---|---|
| | statistically significant from baseline to 90 days, from 90 days to 12 month and from baseline to 12 months (P<0.001 for all) | done outside the hospital. |

Table 2

*Project Budget/Expenses*

| S/No | ITEMs | ANTICIPATED EXPENSE | ACTUAL EXPENSE |
|---|---|---|---|
| 1 | DNP student labor (free) | $0 | $0 |
| 2 | Educational materials (from the hospitals diabetes educator) | $0 | $0 |
| 3 | AADE7 Self-Care Behaviors online modules | $140 | $140 |
| 4 | Handouts, fliers and education contents (printing cost) | $60 | $43 |
| 5 | Subject compensation | $0 | $0 |
| 6 | Computer software and flash drives | $0 | $0 |
| 7 | Equipment (clipboards, pens, etc.) | $50 | $30 |
| 8 | Fax service | - | $17 |
| 9 | Dissemination* | $100 | |
| Total | | $500 | $230 |

*Anticipated expense

Table 3

*Sample Demographics (n=15)*

| Ethnicity | Male | Female | Transgender |
|---|---|---|---|
| White/Caucasian | 0 | 0 | 0 |
| Black/African American | 5 | 7 | 0 |
| Hispanic | 0 | 3 | 0 |

*Note*: No participant identified as transgender. One participant appeared Caucasian but states she always identifies self as Black/African American.

Table 4

*Pretest Data*

| Variables (n=15) | Range (min – max) | Mean | SD |
|---|---|---|---|
| Age | 35.00 – 83.00 | 56.87 | 12.12 |
| DM Years # | 0.50 – 30.00 | 13.25 | 10.24 |
| Adm BG | 134.00 – 709.00 | 378.20 | 182.21 |
| HbA1c* | 5.8 – 14.00 | 10.14 | 2.59 |
| 90-day Adm | 1.00 – 3.00 | 1.53 | 0.72 |
| 90-day Adm Non-DM | 0.00 – 2.00 | 0.73 | 0.57 |
| 90-day Adm DM | 0.00 – 3.00 | 0.80 | 0.75 |
| DSMQ Score | 16.00 – 46.00 | 31.40 | 8.52 |
| DKT Score | 6.00 – 18.00 | 12.64 | 3.62 |

*Note*: # n=14, *n=12, DM years = years lived with diabetes, Adm BG = Admission Blood Glucose level, HbA1c = glycosylated hemoglobin, 90-day Adm = 90-day admission history, 90-day Adm Non-DM = 90-day admission history not related to diabetes, 90-day Adm DM = 90-day admission history related to diabetes, DSMQ Score = Diabetes Self-Management Questionnaire Score (Self efficacy score), DKT Score = Diabetes Knowledge Test score (knowledge)

Table 5

*Posttest Data*

| Variables (n=15) | Range (min – max) | Mean | SD |
|---|---|---|---|
| HbA1c* | 5.30 – 11.70 | 7.98 | 2.44 |
| 90-day Adm | 0.00 – 5.00 | 1.27 | 1.73 |
| 90-day Adm Non-DM | 0.00 – 5.00 | 1.20 | 1.64 |
| 90-day Adm DM | 0.00 – 2.00 | 0.07 | 0.25 |
| DSMQ Score# | 18.00 – 48.00 | 38.67 | 7.10 |
| DKT Score# | 12.00 – 20.00 | 16.78 | 2.48 |

*Note*: *n=6, #n=9. HbA1c = glycosylated hemoglobin, 90-day Adm = 90-day admission history, 90-day Adm Non-DM = 90-day admission history not related to diabetes, 90-day Adm DM = 90-day admission history related to diabetes, DSMQ Score = Diabetes Self-Management Questionnaire Score (Self efficacy score), DKT Score = Diabetes Knowledge Test score (knowledge)

Table 6

*Results*

| Variables (n=15) | Pretest Means | Posttest Means | Mean Differences | *p* values |
|---|---|---|---|---|
| HbA1c* | 9.73 | 7.98 | - 1.75 | .027 |
| 90-day Adm (total) | 1.53 | 1.27 | - 0.26 | .46 |
| 90-day Adm Non-DM | 0.73 | 1.20 | 0.47 | .28 |
| 90-day Adm DM | 0.80 | 0.07 | - 0.73 | .008 |
| DKT Score# | 12 | 16.78 | 4.78 | .011 |

*Note*: *n=6, #n=9. HbA1c = glycosylated hemoglobin, 90-day Adm = 90-day admission history, 90-day Adm Non-DM = 90-day admission history not related to diabetes, 90-day Adm DM = 90-day admission history related to diabetes, DKT Score = Diabetes Knowledge Test score (knowledge)

**Figures**

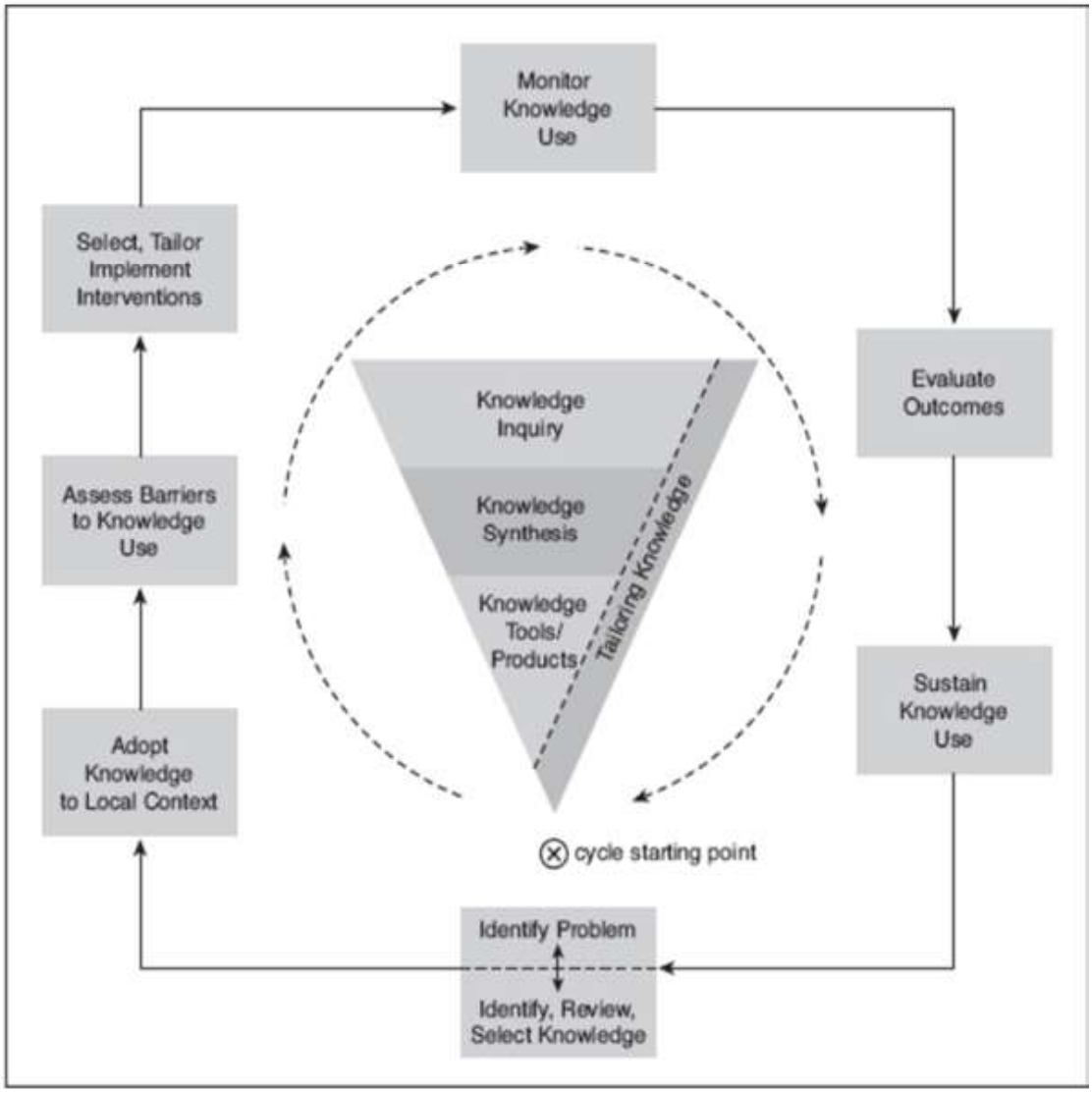


*Figure 1.* Knowledge-to-Action Model. Reprinted from *Translation of Evidence into Nursing and Health Care* (p. 60), by K. M. White, S. Dudley-Brown, & M. F. Terhaar, 2016, New York, NY: Springer Publishing Company. Copyright by Hanley & Belfus, Inc.

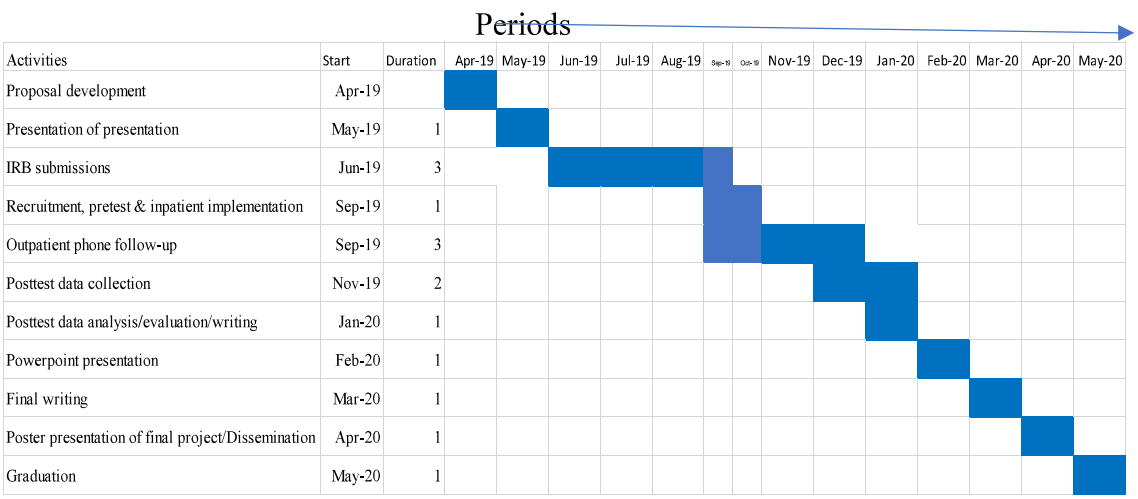


*Figure 2.* Updated project timeline for the implementation of 1:1 individualized diabetes sell-management education and support - from proposal to graduation.

Figures

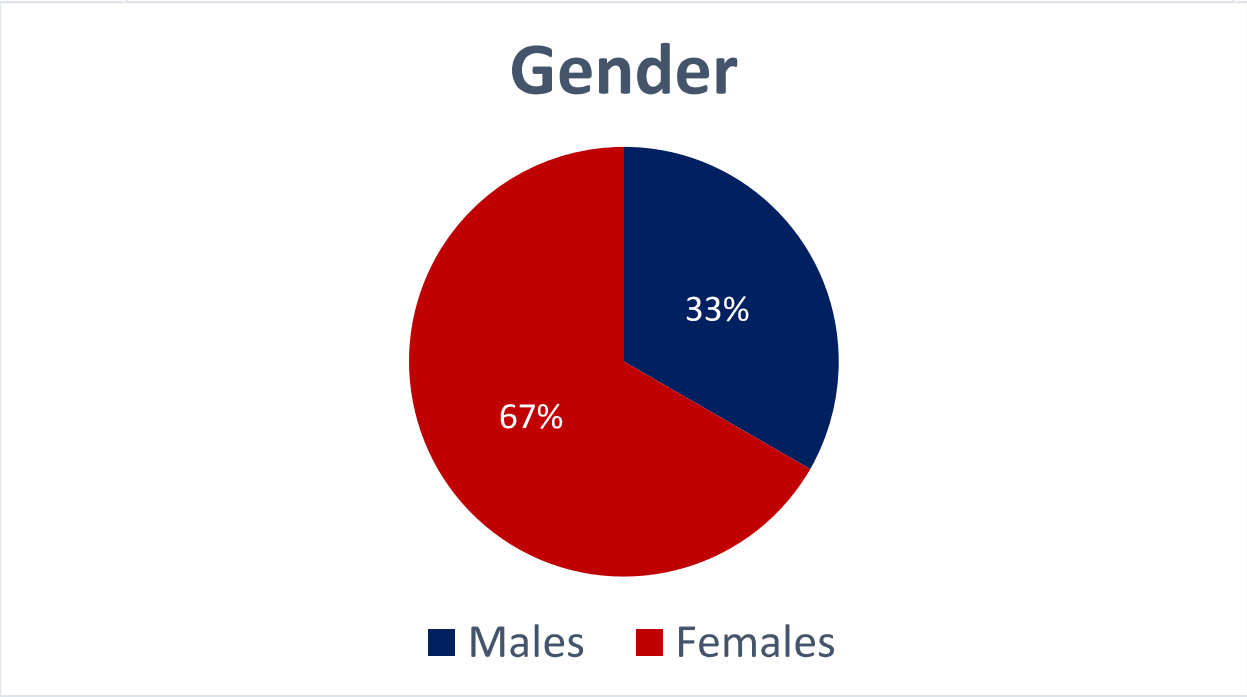


*Figure 3*. Sample Demographics: Gender

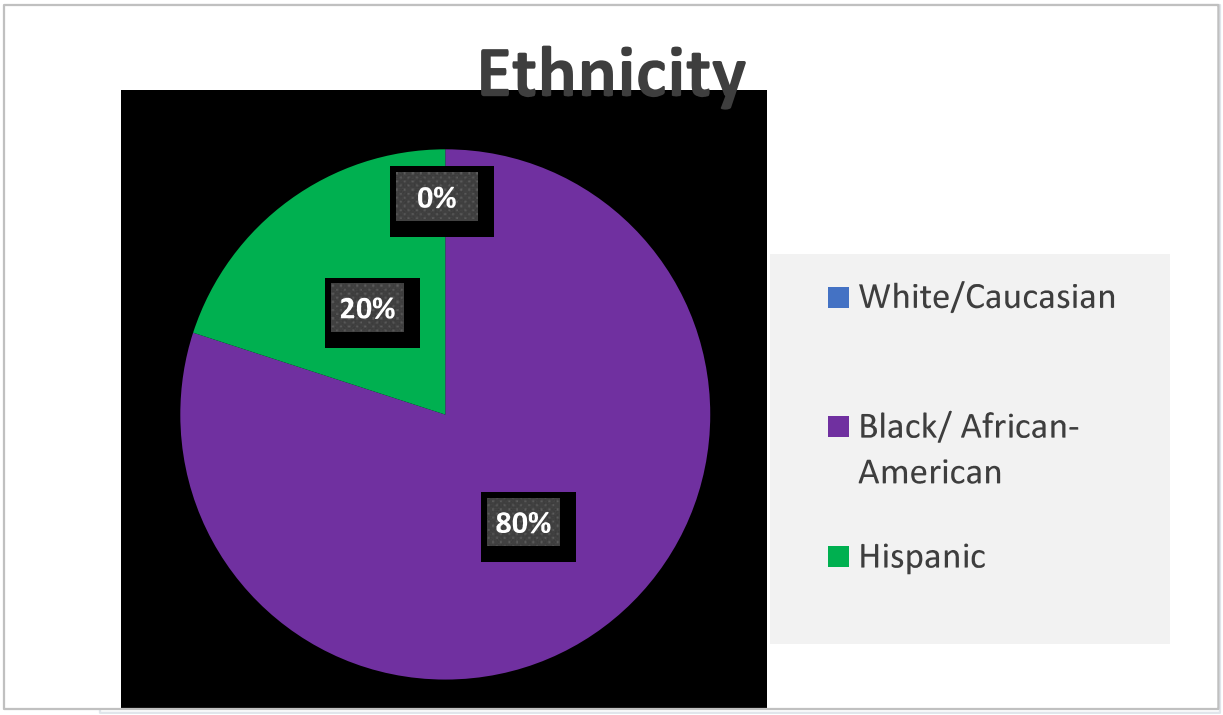


*Figure 4*. Sample Demographics: Ethnicity

## Appendix A

## Consent

RUTGERS
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### CONSENT TO TAKE PART IN A RESEARCH STUDY

**TITLE OF STUDY:** The Effects of 1:1 Individualized Diabetes Self-Management Education
and Support on Glycemic Control
**Principal Investigator:** Kathy Gunkel, DNP, APN, WHNP-C, ANP-C

**STUDY SUMMARY:** This consent form is part of an informed consent process for a research study and it will provide information that will help you decide whether you want to take part in this study. It is your choice to take part or not. The purpose of this study is to find out how learning about many ways to manage diabetes will improve your HbA1c and reduce the number of times you are admitted in the hospital. If you take part in the research, you will be asked to fill out an intake form and two questionnaires. This will help the DNP candidate to find out what is important to you about managing your diabetes, what you want to learn. Then she will visit you about 2 times while you are in the hospital to teach you things you don't already know and things that you want to know about managing your diabetes. After you go home from the hospital, she will call you once a week in the first month to find out how you are doing, and you can call her too with questions. After that she will call two times in one month. How long you spend on the phone depends on you and what you want or need up to 10 minutes per call. After 3 months you will complete the same two questionnaires. Your time in the study includes approximately 30 minutes to complete the intake form and two questionnaires at the beginning of the study and about 15 minutes to complete just the same two questionnaires after three months at the end of the study; about 30 minutes each for the two inpatient teaching sessions and 1-10 minutes for each follow-up phone call. Possible harms or burdens of taking part in the study may be mishandling of personal information and a burden on your time. Possible benefits of taking part may be learning how to better control your diabetes which may reduce the number of times you are sick because your sugar is too high or too low. Also, you do not have to pay for knowledge and support. Your alternative to taking part in the research study is not to take part in it.

The information in this consent form will provide more details about the research study and what will be asked of you if you choose to take part in it. If you have any questions now or during the study, if you choose to take part, you should feel free to ask them and should expect to be given answers you completely understand. After all your questions

have been answered and you wish to take part in the research study, you will be asked to sign this consent form. You are not giving up any of your legal rights by agreeing to take part in this research or by signing this consent form.

**Who is conducting this research study?**
Dr Kathy Gunkel is the Principal Investigator of this research study. A Principal Investigator has the overall responsibility for the conduct of the research. However, there are often other individuals who are part of the research team.

Dr. Kathy Gunkel may be reached at

The Principal investigator or another member of the study team will also be asked to sign this informed consent. You will be given a copy of the signed consent form to keep.

SPONSOR OF THE STUDY: Internal Rutgers Department
**Why is this study being done?**
The purpose of this study is to find out if providing diabetes education and support for people with diabetes will improve what the know about diabetes and how they live with diabetes. The study also wants to see how this knowledge affect how well their diabetes is controlled.
**Who may take part in this study and who may not?**
Any adult 18 to 89 years old, admitted in this hospital with a diagnosis of uncontrolled diabetes and/or HbA1c > 7.5% and/or blood glucose > 200mg/dl or < 60mg/dl on admission. Who can make his or her own decisions and is able to read and understand English language. Participants should be patients who will most likely be discharged to home who do not have too many or very serious health problems
**Why have I been asked to take part in this study?**
You are being invited to be a part of this study because you potentially meet the criteria desired for participants of this study
**How long will the study take and how many subjects will take part?**
About 60 people are desired to participate in this study, each person is expected to be a part of the study for 3 months and the study will last 4 months overall.
**What will I be asked to do if I take part in this study?**
You will be asked to fill out an intake form and two questionnaires. This will help the DNP candidate to find out what is important to you about managing your diabetes, what you want to learn. Then she will visit you about 2 times while you are in the hospital to teach you things you don't already know and things that you want to know about managing your diabetes. After you go home from the hospital, she will call you once a week in the first month to find out how you are doing, and you can call her too with questions. After that she will call two times in one month. How long you spend on the phone depends on you and what you want or need up to 10 minutes per call. After 3 months you will complete the same two questionnaires.

**What are the risks and/or discomforts I might experience if I take part in this study?**
There is minimal risk involved in conducting this research. Breach of confidentiality is a risk of harm, but a data security plan is in place to minimize such a risk. There is no potential risk of physical harm involved in participating in this study, also, some questions may make you feel uncomfortable. If that happens, you can skip those questions or withdraw from the study altogether. If you decide to quit at any time before you have finished the questionnaire your answers will NOT be recorded.

**Are there any benefits to me if I choose to take part in this study?**
The benefits of taking part in this study may be receiving free diabetes education and support and you may learn how to better control your diabetes which may reduce the number of times you are sick because of your sugar being too high or too low. However, it is possible that you may not receive any direct benefit from taking part in this study.

**What are my alternatives if I do not want to take part in this study?**
Your alternative is not to take part in this study.

**How will I know if new information is learned that may affect whether I am willing to stay in the study?**
In the course of the study, you will be updated about any new information that may affect your willingness to continue taking part in the study. If new information is learned that may affect you after the study or your follow-up is completed, you will be contacted.

**Will I receive the results of the research?**
In general, we will not give you any individual results from the study. If we find something of urgent medical importance to you, we will inform you, although we expect that this will be a very rare occurrence.

**Will there be any cost to me to take part in this study?**
No. You do not have to pay any money to take part in this study.

**Will I be paid to take part in this study?**
No. You will not be paid to take part in this study.

**Who might benefit financially from this research?**
There is no conflict of interest.
**How will information about me be kept private or confidential?**
All efforts will be made to keep your personal information in your research record confidential, but total confidentiality cannot be guaranteed.

All participants will be assigned a unique identification (ID) number upon recruitment. This ID number will be used for collecting all data, including PII, Protected Health Information (PHI) and survey responses. All de-identified data will be transferred into and maintained in an encrypted or password protected USB drive.

The list linking participants and assigned number ID will be maintained in a password protected file on one of the computers on the hospital unit until the end of data collection. This list will be destroyed after all posttest data have been collected. Only the DNP candidate will have access to this list. All de-identified paper surveys will be stored in the locker at the site until data have been transferred into the password protected USB drive.

**What will happen to my information collected for this research after the study is over?**

The information collected about you for this research will not be used by or distributed to investigators for other research. All de-identified hard and soft copy data will be destroyed following the Rutgers University guidelines, after the completion of the study, closure of IRB, and publication of the manuscript describing study findings. Hard copies of the aggregate data and consents will be stored in Dr. Kathy Gunkel's office, at Rutgers University, 65 Bergen Street, Newark NJ 07107 following IRB and University guidelines.

**What will happen if I am injured during this study?**

There is no anticipation of physical harm or injury in this research.

**What will happen if I do not wish to take part in the study or if I later decide not to stay in the study?**

It is your choice whether to take part in the research. You may choose to take part, not to take part or you may change your mind and withdraw from the study at any time.

If you do not want to enter the study or decide to stop taking part, your relationship with the study staff will not change, and you may do so without penalty and without loss of benefits which you are otherwise entitled to.

You may also withdraw your consent for the use of data already collected about you, but you must do this in writing to Dr. Kathy Gunkel, Rutgers Biomedical and Health Sciences, Stanley S. Bergen Building 65 Bergen St. Newark, NJ 07107

**Who can I call if I have questions?**

If you have questions about taking part in this study, you can call the Principal Investigator: Dr. Kathy Gunkel, Rutgers Biomedical and Health Sciences, Stanley S. Bergen Building 65 Bergen St. Newark, NJ 07107. Phone number: (973) 972-0893

If you have questions about your rights as a research subject, you can call the IRB Director at:

*Newark HealthSci (973)-972-3608*

**PERMISSION (Authorization) TO USE OR SHARE HEALTH INFORMATION THAT IDENTIFIES YOU FOR A RESEARCH STUDY**

The next few paragraphs tell you about how investigators want to use and share identifiable health information from your medical record in this research. Your information will only be used as described here or as allowed or required by law. If you sign this consent form, you agree to let the investigators use your identifiable health

information in the research and share it with others as described below. Ask questions if there is something you do not understand.

**What is the purpose of the research and how will my information be used?**
You are being invited to take part in this research study which is described at the beginning of this form. The purpose of collecting and using your health information for this study is to help investigators answer the questions that are being asked in the research.

**What information about me will be used?**

- Hospital admissions history three months prior to the research and during the research
- HbA1c and initial blood glucose/ blood sugar results on admission to the hospital.
- Post study HbA1c result from your primary doctor or the hospital after the DSMES.
- Pre and post intervention diabetes knowledge tests results.
- Questionnaire results

**Who may use, share or receive my information?**
The research team may use or share your information collected or created for this study with the following people and institutions:

- Rutgers University investigators involved in the study;
- University Hospital or Robert Wood University Hospital personnel to communicate information necessary for health care operations;
- The Rutgers University Institutional Review Board and Compliance Boards
- The Office for Human Research Protections in the U.S. Dept. of Health and Human Services

Those persons or organizations that receive your information may not be required by Federal privacy laws to protect it and may share your information with others without your permission, if permitted by the laws governing them.

**Will I be able to review my research record while the research is ongoing?**
No. We are not able to share information in the research records with you until the study is over. To ask for this information, please contact the Principal Investigator, the person in charge of this research study.

**Do I have to give my permission?**
No. You do not have to permit use of your information. But, if you do not give permission, you cannot take part in this study. (Saying no does not stop you from getting medical care or other benefits you are eligible for outside of this study.)

**If I say yes now, can I change my mind and take away my permission later?**
Yes. You may change your mind and not allow the continued use of your information (and to stop taking part in the study) at any time. If you take away permission, your information will no longer be used or shared in the study, but we will not be able to take

back information that have already been used or shared with others. If you say yes now but change your mind later for use of your information in the research, you must write to the researcher and tell her of your decision: Dr. Kathy Gunkel, Rutgers Biomedical and Health Sciences, Stanley S. Bergen Building 65 Bergen St. Newark, NJ 07107

**How long will my permission last?**
Your permission for the use and sharing of your health information will last until the end of the research study.

## AGREEMENT TO PARTICIPATE

### 1. Subject consent:

I have read this entire consent form, or it has been read to me, and I believe that I understand what has been discussed. All of my questions about this form and this study have been answered. I agree to take part in this study.

Subject Name:_____
_____

Subject Signature:_____ Date:_____
_____

### 2. Signature of Investigator/Individual Obtaining Consent:

To the best of my ability, I have explained and discussed all the important details about the study including all of the information contained in this consent form.

Investigator/Person Obtaining Consent (printed name):_____
_____

Signature:_____ Date: _____
_____

**Appendix B**

**Recruitment Flier**

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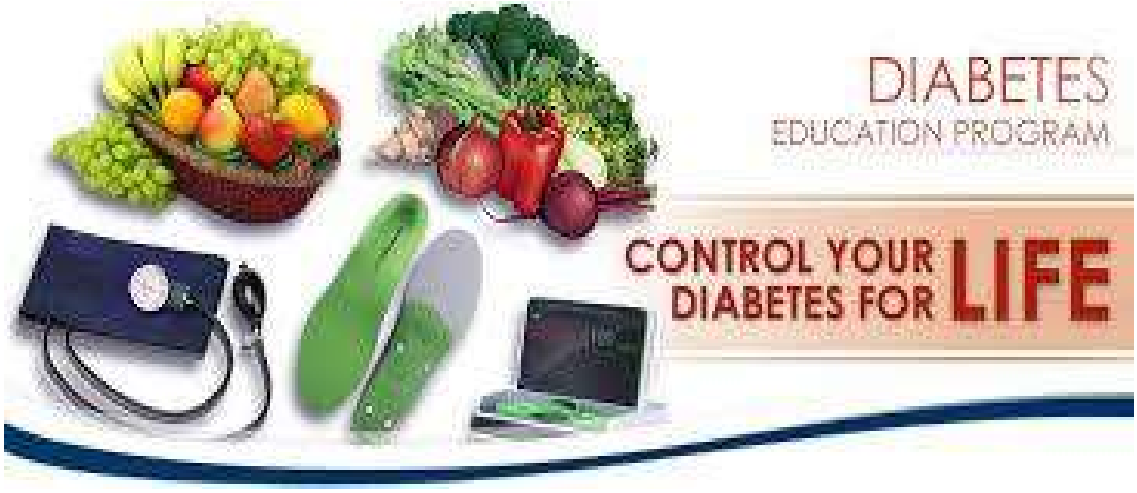
**Location of Research**: [redacted]

**Research project title**: The Effects of 1:1 Individualized Diabetes Self-Management Education and Support on Glycemic Control




**Description and Purpose of the research**: The research will evaluate the effect of 1:1 diabetes self-management education and support (DSMES) on reduction of HbA1c and hospital readmission rates of diabetic patients. For this pretest – posttest quasi-experimental pilot research project, participant will complete paper surveys (approximately 30 minutes) before and after the implementation of 1:1 DSME. Implementation will be done in approximately two 30-minute sessions in the hospital, followed by weekly and bi-monthly phone follow-up support over the next 3 months.

**Name and address of PI**: Dr. Kathy Gunkel; Department of Nursing, Rutgers University, Newark campus.

**Eligibility**:

- Must be 18 to 89 years old.

- Must be admitted with a diagnosis of uncontrolled diabetes and/or HbA1c > 7.5% and/or blood glucose > 200mg/dl or < 60mg/dl on admission.
- Must be alert and oriented times three, make decisions for self and able to read and understand English.
- Potential participants should be patients who will most likely be discharged to home.
- Do not have extensive co-morbid conditions.

**Duration of research**: Three to four months.

**Contact person**: Nwamaka H. Eguh; Phone [redacted]; email: [redacted]

Version 3
9/2/2019

## Appendix C

## DSME Intake Form

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Unique ID number: _____

Sex: ☐Male ☐Female ☐Transgender Age : _____

Ethnic Background: ☐White/Caucasian ☐Black/A-A ☐Hispanic ☐Native American ☐Middle-eastern ☐Asian ☐other _____

Last grade of school completed _____

Do you have any medication or food allergies? ☐Yes ☐No

List _____

Height: _____ Weight: _____

Any weight changes (up or down)? ☐Yes ☐No ☐Active Weight Loss? ☐Yes ☐No

If yes, please explain_____

Do you have any difficulty with: ☐hearing ☐seeing ☐reading ☐ speaking?

Explain any checked: _____

Years lived with diabetes _____

What type of diabetes do you have? ☐type 1 ☐type 2☐Pre-diabetes☐Gestational ☐Don't Know

Have you had previous instruction on how to take care of your diabetes? ☐Yes ☐No

If yes, How long ago? _____

Other Medical Concerns: _____

_____

Do you have any of the following:☐eye problems ☐kidney problems ☐numbness/tingling/loss of feeling in your feet ☐dental problems ☐high blood pressure ☐high cholesterol ☐sexual problems ☐depression ☐other_____

Please list any other medical condition_____

_____

Diabetes medication name(s), dose(s) and how often:_____

_____

_____

_____

_____

_____

_____

_____

Do you take your medications as prescribed? ☐rarely ☐sometimes ☐most of the time ☐always

Do you have prescriptions for diabetes medications that you have not filled? ☐Yes ☐No

Do you take other medication? ☐Yes ☐ No If yes, please list all other medications:

_____

_____

_____

Do you take any over the counter medications, vitamins, or supplements? ☐Yes ☐No

If yes, please list all over the counter medications:

_____

_____

Do you check your blood sugars? ☐Yes ☐No / Blood sugar range: (low)____ (high)____

How often: ☐Once a day ☐2 or more/day ☐l or more/Week ☐Occasionally

When: ☐Before breakfast ☐2 hours after meals ☐Before bedtime

Name of glucose meter: _____

In the last month, how often have you had a blood sugar less than 70?

☐Never ☐Once ☐One or more times/week.

From whom do you get support for your diabetes?

☐Family ☐Co-Workers ☐Healthcare Providers ☐Support Groups ☐No-one

☐Other_____

Do you have any cultural or religious practices or beliefs that influence how you care for your diabetes? ☐Yes ☐No Please describe: _____

How do you learn best? ☐Listening ☐Reading ☐Observing ☐Doing

What concerns you most about your diabetes?

_____

What is the hardest for you in caring for your diabetes?

_____

What are your most interested in learning from these diabetes education session(s):

☐Diabetes disease process ☐Nutrition Management ☐Physical Activity

☐Using medications ☐Monitoring ☐Preventing Complications

☐Behavior Change Strategies ☐Risk Reduction ☐Psychosocial adjustments

_____

Meal Plan

Do you have a meal plan for diabetes? ☐Yes ☐No

If yes, please describe: _____

Do you read and use food labels as a dietary guide? ☐Yes ☐No

Do you have any dietary restrictions? ☐Salt ☐Fat ☐Fluid ☐None ☐Other_____

Give a sample of your meals for a typical day:

Time: _____ Breakfast _____

Time: _____ Lunch_____

Time: _____ Dinner_____

Time: _____ Snack_____
Do you: do your own food shopping? ☐Yes ☐No. Cook your own meals? ☐Yes ☐No
How often do you eat out? _____
Physical Activity:
Do you exercise regularly? ☐No ☐Yes Type: _____
How often: _____
My exercise routine is: ☐easy ☐moderately intense ☐ very intense
Sick Days/Complications: Have you been given sick day guidelines? ☐Yes ☐No
Do you drink alcohol? ☐No? ☐Yes Type: _____
How many? _____☐per day ☐per week ☐per Month ☐occasionally
Do you use tobacco? ☐cigarette ☐pipe ☐cigar ☐chewing ☐none ☐Quit How long ago?
_____
In the last 3months, have you: ☐used the emergency room services ☐been admitted to a hospital?
Was the ER visit or hospital admission diabetes related? ☐Yes ☐No

*Note.* Adapted from, "Diabetes Self-Management Questionnaire" by Loma Linda University Diabetes Treatment Center, 2018, retrieved from https://lluh.org/sites/medical-center.lomalindahealth.org/files/docs/DTC-intake%20Self-Managment-health-questionaire.pdf?rsource=medical-center.lomalindahealth.org/sites/medical-center.lomalindahealth.org/files/docs/DTC-intake%20Self-Managment-health-questionaire.pdf

## Appendix D

### Revised Michigan Diabetes Knowledge Scale - True/False Version.

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Here are 20 statements about diabetes, some are true statements, and some are false. Please read each statement and then indicate whether you think it is true or false by putting a circle round either TRUE or FALSE. If you do not know the answer, please put a circle around DON'T KNOW.

| | |
|---|---|
| 1. The diabetes diet is a healthy diet for most people | TRUE / FALSE / DON'T KNOW |
| 2. Glycosylated hemoglobin (HbA1c) is a test that measures your average blood glucose level in the past week. | TRUE / FALSE / DON'T KNOW |
| 3. A pound of chicken has more carbohydrate in it than a pound of potatoes. | TRUE / FALSE / DON'T KNOW |
| 4. Orange juice has more fat in it than low fat milk. | TRUE / FALSE / DON'T KNOW |
| 5. Urine testing and blood testing are both equally as good for testing the level of blood glucose. | TRUE / FALSE / DON'T KNOW |
| 6. Unsweetened fruit juice raises blood glucose levels. | TRUE / FALSE / DON'T KNOW |
| 7. A can of diet soft drink can be used for treating low blood glucose levels. | TRUE / FALSE / DON'T KNOW |
| 8. Using olive oil in cooking can help lower the cholesterol in your blood. | TRUE / FALSE / DON'T KNOW |
| 9. Exercising regularly can help reduce high blood pressure. | TRUE / FALSE / DON'T KNOW |
| 10. For a person in good control, exercising has no effect on blood sugar levels | TRUE / FALSE / DON'T KNOW |
| 11. Infection is likely to cause an increase in blood sugar levels. | TRUE / FALSE / DON'T KNOW |
| 12. Wearing shoes a size bigger than usual helps prevent foot ulcers. | TRUE / FALSE / DON'T KNOW |
| 13. Eating foods lower in fat decreases your risk for heart disease. | TRUE / FALSE / DON'T KNOW |
| 14. Numbness and tingling may be symptoms of nerve disease. | TRUE / FALSE / DON'T KNOW |
| 15. Lung problems are usually associated with having diabetes. | TRUE / FALSE / DON'T KNOW |
| 16. When you are sick with the flu you should test for glucose more often. | TRUE / FALSE / DON'T KNOW |

| | |
|---|---|
| SKIP TO QUESTION 19 IF YOU DON'T TAKE INSULIN | |
| 17. High blood glucose levels may be caused by too much insulin. | TRUE / FALSE / DON'T KNOW |
| 18. If you take your morning insulin but skip breakfast your blood glucose level will usually decrease. | TRUE / FALSE / DON'T KNOW |
| 19. Having regular check-ups with your doctor can help spot the early signs of diabetes complications. | TRUE / FALSE / DON'T KNOW |
| 20. Attending your diabetes appointments will stop you getting diabetes complications. | TRUE / FALSE / DON'T KNOW |

*Note.* Adapted from "Tools for Health Professionals: Survey Instruments," by The Michigan Diabetes Research Center (MDRC), 2019, retrieved from http://diabetesresearch.med.umich.edu/Tools_SurveyInstruments.php#dkt

**Appendix E**
**Diabetes Self-Management Questionnaire (DSMQ)**

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| | **The following statements describe self-care activities related to your diabetes. Thinking about your self-care over the last 8 weeks, please specify the extent to which each statement applies to you.** | **Applies to me very much** | **Applies to me to a consider-able degree** | **Applies to me to some degree** | **Does not apply to me** |
|---|---|---|---|---|---|
| 1. | I check my blood sugar levels with care and attention. ☐ *Blood sugar measurement is not required as a part of my treatment.* | ☐3 | ☐2 | ☐1 | ☐0 |
| 2. | The food I choose to eat makes it easy to achieve optimal blood sugar levels. | ☐3 | ☐2 | ☐1 | ☐0 |
| 3. | I keep all doctors' appointments recommended for my diabetes treatment. | ☐3 | ☐2 | ☐1 | ☐0 |
| 4. | I take my diabetes medication (e. g. insulin, tablets) as prescribed. ☐ *Diabetes medication / insulin is not required as a part of my treatment.* | ☐3 | ☐2 | ☐1 | ☐0 |
| 5. | Occasionally I eat lots of sweets or other foods rich in carbohydrates. | ☐3 | ☐2 | ☐1 | ☐0 |
| 6. | I record my blood sugar levels regularly (or analyze the value chart with my blood glucose meter). ☐ *Blood sugar measurement is not required as a part of my treatment.* | ☐3 | ☐2 | ☐1 | ☐0 |
| 7. | I tend to avoid diabetes-related doctors' appointments. | ☐3 | ☐2 | ☐1 | ☐0 |
| 8. | I do regular physical activity to achieve optimal blood sugar levels. | ☐3 | ☐2 | ☐1 | ☐0 |

| | **The following statements describe self-care activities related to your diabetes. Thinking about your self-care over the last 8 weeks, please specify the extent to which each statement applies to you.** | **Applies to me very much** | **Applies to me to a consider-able degree** | **Applies to me to some degree** | **Does not apply to me** |
|---|---|---|---|---|---|
| 9. | I strictly follow the dietary recommendations given by my doctor or diabetes specialist. | ☐3 | ☐2 | ☐1 | ☐0 |
| 10. | I do not check my blood sugar levels frequently enough as would be required for achieving good blood glucose control. ☐ *Blood sugar measurement is not required as a part of my treatment.* | ☐3 | ☐2 | ☐1 | ☐0 |
| 11. | I avoid physical activity, although it would improve my diabetes. | ☐3 | ☐2 | ☐1 | ☐0 |
| 12. | I tend to forget to take or skip my diabetes medication (e. g. insulin, tablets). ☐ *Diabetes medication / insulin is not required as a part of my treatment.* | ☐3 | ☐2 | ☐1 | ☐0 |
| 13. | Sometimes I have real ‘food binges’ (not triggered by hypoglycemia). | ☐3 | ☐2 | ☐1 | ☐0 |
| 14. | Regarding my diabetes care, I should see my medical practitioner(s) more often. | ☐3 | ☐2 | ☐1 | ☐0 |
| 15. | I tend to skip planned physical activity. | ☐3 | ☐2 | ☐1 | ☐0 |
| 16. | My diabetes self-care is poor. | ☐3 | ☐2 | ☐1 | ☐0 |

*Note.* Adapted from, “The Diabetes Self-Management Questionnaire (DSMQ): Development and Evaluation of an Instrument to Assess Diabetes Self-Care Activities Associated with Glycaemic Control” by A. Schmitt, A. Gahr, N. Hermanns, B. Kulzer, J. Huber, & T. Haak, 2013, *Health and Quality of Life Outcomes, 11*(1), p. 138.