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Standardizing Naturalistic Teaching Opportunities for Problem-based Learning in Diabetes Education: A Quality Improvement Project

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Standardizing Naturalistic Teaching Opportunities for Problem-based Learning in Diabetes Education: A Quality Improvement Project

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A DNP project submitted in partial fulfillment of the requirements for the degree of Doctor of Nursing Practice

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This is to certify that the DNP Project Final Report by

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has been approved by the DNP Project Team on

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Abstract

Significance and Background:

Poor diabetes management is linked to serious long and short-term health complications. Despite this, medication adherence is a significant problem in adolescents with type 1 diabetes. Management is further complicated by low socioeconomic status, even when mitigated by free healthcare, highlighting health literacy as a culprit of disparities. Evidence shows that a common barrier for adolescents is proficiency in dose determination. Carbohydrate counting is an integral skill, necessary for attaining glycemic control. At a homecare agency serving adolescents with poorly controlled diabetes by providing oversight of medication administration and education, it was noted that patients continued to struggle with carbohydrate counting and appropriate coverage of food relative to other aspects of dose determination due to infrequently eating at nursing visits. However, patients who benefited from agency-provided food through initiatives addressing food insecurity experienced the opportunity for increased education relating to carbohydrate counting and anecdotally demonstrated improvements in proficiency and subsequent gains in diabetes control.

Purpose:

A quality improvement team within the homecare agency met with a goal of improving diabetes education using the Model for Healthcare Improvement framework. Relevant evidence was synthesized and showed that education which utilized multiple, short education sessions and problem-based learning improves diabetes education in this population.

Intervention:

It was determined that formalizing food-provision and problem-based learning as a diabetes educational approach, already informally occurring at this agency, into three of the patient's normal nursing visits would allow for improved equity and quality of the education and allow for more formal assessment of the benefits of the change.

Evaluation:

Patient satisfaction data was taken as a primary outcome measure and showed that all patients found this was a helpful educational approach and would recommend it to other patients with type one diabetes. Process measures of glycosylated hemoglobin and pre- and post- diabetes self-efficacy scales were also tracked showing changes in line with the literature.

Discussion

The findings of this PDSA cycle demonstrate that this intervention is an evidence-based improvement on current diabetes education in homecare and can be used to help address health disparities in diabetes outcomes.

Keywords: diabetes, education, adolescent, problem-based learning

Significance

Morbidity of type 1 diabetes has been increasing across the United States. Prior to the identification of human insulin analogs in 1922, type 1 diabetes, a diagnosis made predominately in children, was seen as terminal illness (Quianzon & Cheikh, 2012). Today, people with type 1 diabetes can avoid poor outcomes with close management of diabetes, central to which is precision in carbohydrate counting and insulin coverage for all carbohydrates. Poor diabetes management is linked to serious health complications in both the long and short term (Datye et al., 2015). A person with type 1 diabetes that is extremely poorly managed can suffer serious, acute outcomes such as diabetic ketoacidosis, cerebral edema, and resulting death. A patient who has fewer missed doses of insulin but is still not adhering to their plan is likely to experience target organ damage, microvascular damage, and neuropathies. Specifically, the later patient may go on to experience health conditions in their early adulthood that are typically seen in geriatrics, such as kidney damage requiring transplant, significant cardiovascular and vision problems, and erectile dysfunction. Despite this, medication adherence remains a common problem, with less than 21% of patients with type 1 diabetes attaining adequate diabetic management (Stanger et al., 2013). Diabetes management is further complicated by low socioeconomic status, even when mitigated by free healthcare, highlighting health literacy as a culprit of health disparities. Evidence shows that a common barrier to diabetes medication adherence is a patient's understanding of their medications, interpretation of blood sugar, and insulin dose determination. As a result, adolescents take their insulin less frequently than prescribed and often determine their dose incorrectly (Hoffman, 2002). Carbohydrate counting at mealtime as it relates to dose determination is especially problematic for adolescents (Spiegel et al., 2012). Ultimately, missed insulin doses have a profound negative effect on metabolic control in type 1 diabetes (Olinder et al., 2009). To summarize, patients with type 1 diabetes rely on regular insulin administration as a life sustaining intervention. However, dose determination for insulin which involves carbohydrate counting can be extremely difficult for adolescents as it often involves math skills such as addition (of

total carbs), subtraction (of dietary fiber), multiplication (when eating more than one serving), fractions (when servings are given as fraction and/or when eating a fractional serving), and division (with the carbohydrate ratio). Food label literacy is also a prerequisite for carbohydrate counting and some, or all, of these mathematical processes may be required at every meal and snack for accurate dose determination. Absence of a strong support system, and guardians who are able and willing to support adolescents with dose determination makes this task all but impossible for adolescents to accomplish independently. This often leads to a poor outcome and a future rife with the burdens of managing multiple chronic health problems rather than pursuit of interests and dreams. The interactions between community support, health literacy, past educational success of both parent and child, and long-term health outcomes for patients with type 1 diabetes are so strong and interwoven that it proves to be one of the clearest pictures of a social determinant of health.

Local Problem and Internal Evidence

Recognizing that patients without caregivers who are able or willing to support their diabetes management still maintain a right to access appropriate support in dose determination of life-saving insulin, in Connecticut, these patients are referred to visiting nursing agencies, typically for once or twice daily nursing check-ins. At a small home healthcare agency in CT, a small population of adolescents with poorly managed type 1 diabetes receive visiting nursing services to supervise medication administration, education, and oversight of diabetes management. This patient population typically lives in inner cities and experiences complicating factors such as limited social and parental support, financial hardship, food insecurities, and sometimes family effects from addiction or mental health issues. Patients are prompted to take insulin during these nursing visits under orders of their endocrinology providers. The primary focus at visits is to maximize the amount of supervised insulin at all visits by encouraging food intake, supporting carbohydrate counting and subsequent increased insulin administration, and providing diabetes education. This is a ***standard of care*** at this agency in collaboration with the patients' endocrinologists and is a progressive practice that

addresses disparities in health and has been adopted in Connecticut. While the patients are usually compliant with the administration of long-acting insulin, participating in abstract education, and administration of short-acting insulin if indicated for a correction (a bolus of "catch up" insulin that can be taken without food to reduce blood sugar), patients rarely are willing to eat during visits, which limits education related to carbohydrate counting, and limits the amount of supervised insulin they are able to administer during visits. Insulin for carbohydrate coverage will often be forgotten outside of visits or taken without adult supervision.

However, when asked, patients often appear embarrassed of the kind of food they have in their home, simply don't have much food available in their home, or are uninterested in engaging in meal planning or preparation with nursing. An education model that increases participation in carbohydrate counting, meal planning, and short-acting insulin administration would benefit this population greatly. An effective educational intervention would encourage participation, ameliorate food scarcity during visits, and show patients that insulin plans can work even with their preferred foods that often make up a significant portion of their diets.

To further summarize, under normal, standard practice at this homecare agency, adolescents with poorly controlled diabetes are referred by their provider for visiting nursing services. Patients receive visits at some frequency, often daily, for the supervised administration of long and fast-acting insulin in their home. Nurses support patients with dose determination to help increase the amount of supervised insulin patients receive and help with their understanding of dose determination and other aspects of diabetes management. All patient's insulin dosages and plans are different and are determined by their provider, as are safety parameters. This is a standard of care at this homecare agency, and without these services, patients are at significant risk for hospitalization or death. Blood sugar, carbohydrates to be eaten, and last insulin dosages are the primary factors in dose determination – though only total carbohydrates to be eaten need to be determined to administer insulin for carbohydrate "coverage". A problem was identified at this agency where patients seldom cover carbohydrates at visits, which means they have less opportunity for nursing-supervised insulin dose

determination and less educational opportunity to participate in this more difficult aspect of dose determination under guidance. An example of this problem is as follows.

> Scenario one: At a nursing visit, a patient's blood sugar is found to be 249. The patient states he didn't eat breakfast and won't eat lunch, so he does not need to cover for carbohydrates. The patient administers 5 units of insulin per his plan to correct his blood sugar under the supervision of the nurse, and the nurse leaves. After the visit, the patient then drinks a glass of milk and eats a donut totaling 40 grams of carbohydrates. Three hours after his nursing visit, his blood sugar is 410, significantly outside the target range. Over time, blood sugars in this range cause irreversible damage to target organs, microvascular tissue, and nervous tissue.
>
> Scenario two: At a nursing visit, a patient's blood sugar is found to be 249. The patient states he skipped breakfast but is about to have something to eat. He then drinks a glass of milk and eats a donut totaling 40 grams of carbohydrates, which he counted with his nurse. The nurse helped him calculate his dose, 5 units to correct his blood sugar according to his plan, and then an additional 4 units for his carbohydrates. His provider orders the insulin to be covered at a ratio of 1 unit of insulin to 10 carbohydrates. The patient administers a total of 9 units under the supervision of the nurse. Three hours after his nursing visit, his blood sugar is 120, within the target range. He also had a greater understanding of carbohydrate counting.

Both scenarios fall under standard practice at this homecare agency however, scenario one versus scenario two occurs much more commonly. Many patients are happy to correct their blood sugar but refuse to discuss their meal choices or count carbohydrates. Many patients at this agency do not have supervision for any insulin administrations outside of nursing visits or under nursing care at school. ***This means that these adolescents are either taking insulin alone without understanding for their meals or not covering for meals at all***. Both scenarios are dangerous as there is a risk of hypo or hyperglycemia with inaccurate dose determination. Additionally, a person with type 1 diabetes who never covers carbohydrates with insulin will

never gain glycemic control. It has been noted that some patients with limited food resources at home will agree to have the home-health nurse in their home and complete their visit. However, they then will immediately eat at a friend or family member's house where there is greater access to food. Other patients are often embarrassed of the types of foods they tend to eat and do not want to share their choice with a healthcare provider (such as four hot pockets and a soda as a breakfast choice, which is a real-world example from clinical experience). Furthermore, because misconceptions exist between type 1 and type 2 diabetes, even among many healthcare workers, these patients often state they or their parents believe there are foods they can never eat or that they cannot have a normal diet. This leads to the stigmatization of food which can cause severe consequences. Adolescent patients who feel they need to sneak food do not have an opportunity for supervised insulin administration by an adult or nurse.

External Evidence

Studies show that paternalistic education models are ineffective in addressing medication adherence problems (Coulter, 1999). Instead, flexible, realistic eating plans are shown to increase medication adherence and self-management in adolescents with diabetes (Borus & Laffel, 2010). Additionally, adolescents with diabetes favor practical and realistic diabetes education (Chaney et al., 2012). Despite their effectiveness, few educational models focused on regime-related compliance issues in adolescents with type 1 diabetes (Datye et al., 2015). Monetary incentives are currently used widely to increase adherence in people with diabetes with some success (Stanger et al., 2013). However, evidence in the field of applied behavior analysis shows that naturalistic reinforcers are more likely to improve behavior in children (Schreibman et al., 2015). Additionally, problem-based learning has been tied to better learning outcomes for students (Yew & Goh, 2016). Problem-based learning/teaching has shown to be effective with education in chronic diseases, including diabetes (Williams & Pace, 2009). Finally, problem-based learning has been applied to adolescents with type 1 diabetes within the literature with some positive outcomes (Schlundt et al., 1999).

Internal Evidence

Within this homecare agency, which serves almost exclusively patients relying on Medicaid, food insecurity is a somewhat common occurrence in patients with and without diabetes. Every effort is made to connect families to available resources, but sometimes there is a delay in access, and food insecurity may persist despite support. Mental health issues, drug abuse, lack of a working phone line, and lack of internet access or transportation can delay or deter access to food resources in this patient population. Furthermore, most adolescents cannot grocery shop for or cook dinner even when appropriate financial supports exist.

Both formally and informally, nurses commonly do what they can to ameliorate these barriers. Formally they do so through agency-wide food drives which benefit patients, or they pick up and deliver school lunches. Informally they address this issue occasionally through personally bringing groceries or meals. This is a common occurrence at this agency and falls within the standard practice. It was anecdotally observed that some patients who benefitted from agency food provision at nursing visits who had type 1 diabetes increased their opportunity to participate in carbohydrate counting, optimized their supervised administration of insulin at some visits, increased in their understanding of their plan, and demonstrated a subsequent lowering of glycosylated hemoglobin. This raised the question, could standardization of this intervention and formal incorporation of this intervention into standard education benefit all patients with type 1 diabetes receiving visiting nursing services?

Focused Search Questions

With these considerations, the following PICO questions are proposed:

1. In adolescents with type 1 diabetes receiving visiting nursing services (P), does pairing education with patient selected favorite foods (I) to increase the patient's willingness to participate in education regarding carbohydrate counting and dose determination (O)?
2. In adolescents with type 1 diabetes (P), does problem-based learning (I) compared with standard, traditional, education improve self-efficacy with insulin dose determination?

Evidence Appraisal, Summary, and Recommendations

A search was conducted of the CINAHL database, the PubMed database, and the Cochrane database of systematic reviews. The keywords searched were “diabetes,”” “pediatric,” “adolescent,” “incentive,” and “problem-based learning”. Searches were limited to the date range of 2010-2020, and articles were required to be written in English. Articles pertaining to interventions used to increase patient adherence and understanding in poorly controlled diabetes in pediatric patients were reviewed. Due to a lack of literature on the topic, a secondary reference hand searching technique was also used, prioritizing literature related to the improvement of diabetes education in adolescents.

Both randomized controlled trials and systematic reviews are appropriate for answering this type of question. However, given the lack of abundant evidence at this level, lower levels of evidence were included. Five studies were chosen based on relevance to the subject matter, ranging in quality from level I to level VI, and were formally appraised and shown in Appendix A. A level of evidence synthesis table is shown in Appendix B and an outcomes synthesis table is shown in Appendix C.

The results of the literature search and analysis demonstrate a lack of robust literature in the area of diabetes education in adolescents. However, existing evidence favors several general educational approaches that improve diabetes education in this population. Familial involvement, use of rewards, short and repeated teaching sessions as opposed to fewer long sessions, and use of problem-based learning are all strategies identified in the literature as conferring some level of benefit over the standard practice in diabetes education (see Appendix A). A practice change that incorporates some or all these educational approaches would be supported by existing evidence in the literature.

Phase 2: Project Planning

Project Goals

1. Develop and implement an evidence-based practice change based on problem-based learning related to carbohydrate counting that improves diabetes education for adolescents with T1DM receiving visiting nursing services.

Framework

The IOWA framework for evidence-based implementation was utilized to organize and conduct the intervention for this project (Cullen et al., 2022). Additionally, the Institute for Healthcare Improvement (IHI) Model for Improvement for quality improvement and systems process improvement was utilized with the Plan-Do-Study-Act (PDSA) cycle to guide the adoption of potential systems change. The IHI model consists of three questions, targeting the aim, measurement, and change, followed by a four-component cycle of PDSAs, where each step informs the next (*Maternal Child and Health Bureau | MCHB*, n.d.). Predictions of the next cycle are then made with information gained from the previous cycle. The IHI model exhibits parsimony, logical adequacy, and is testable with empirical data as demonstrated and described in this educational-based EBP-QI project (Langley et al., 2009).

Context

{REDACTED} is a licensed homecare agency in Cheshire, CT. However, the agency provides healthcare services to patients across Connecticut. The quality improvement project will be implemented within patient homes of patients already receiving services for diabetes management, where the care currently is provided. Participants will include adolescents with type 1 diabetes receiving visiting nursing services, are on multiple-dose insulin therapy (MDI), and who self-inject insulin.

Intervention/Practice Change

The Model for Healthcare Improvement includes three key beginning questions consisting of, “What are we trying to accomplish?” “What changes can we make that will result in an improvement?” and “How will we know if the change is an improvement?” These three initial questions are followed by a plan-do-study-act cycled approach that allows for an

organized approach to practice change. The quality improvement team at [REDACTED] Homecare met to discuss potential improvements to make in the diabetes education provided at their agency using this framework.

What are we trying to accomplish?

The specific aim of this initial PDSA cycle was to implement a problem-based learning education intervention **to improve upon current in-home diabetes education** as it relates to carbohydrate counting in adolescents with type 1 diabetes receiving homecare services.

What changes can we make that will result in an improvement?

Literature review findings as they relate to the local problem were discussed with the quality improvement team at [REDACTED] Homecare. This team focused on how to incorporate evidence-based practice into the context of the homecare practice setting with a goal of improving diabetes education for adolescents with type 1 diabetes receiving homecare services, noting that the evidence supports an intervention that involves multiple short teaching sessions and problem-based learning. Furthermore, internal evidence from practice experience which showed that providing food at visits had anecdotally improved educational opportunities been considered in the decision-making process.

A decision was made to formally incorporate problem-based learning coupled with food provision across multiple teaching visits. While these interventions were occurring asynchronously and without standardization as part of standard practice at this agency already, it was determined that formalizing this diabetes education approach and integrating it into three, already scheduled nursing visits would allow for improved equity and quality of the care patients receive and allow for more formal assessment of the benefits of the change. A schedule of three nursing teaching visits with one nurse case manager would allow for an opportunity to evaluate this practice change for the first PDSA cycle. Using one nurse to complete this initial cluster of teaching visits would allow for a reduced teaching burden to nurses in the first cycle of the PDSA and would maintain consistency of care. To teach patients how to use their carbohydrate ratio with foods they normally eat, patients would be allowed to choose their own

foods to be provided at eat visit. However, in order to create opportunities to instruct patients on different presentations of foods, which require different approaches to carbohydrate counting, different categories of foods would be provided at each visit. It was determined that one visit should involve a prepackaged snack containing one serving as this is a common presentation of food and adolescents commonly eat snacks between meals. It was determined that a second visit should involve a cereal, which involves using measuring cups and often involves fractional serving size on the label and doubling or in some cases tripling the serving size. Finally, eating restaurant style food typically requires using internet resources and/or carbohydrate estimators and is an important skill in carbohydrate counting so it was determined that a third visit should involve a restaurant-style prepared meal.

How will we know whether the change is an improvement?

An important part of quality improvement is determining if the change is an improvement on existing practice. While this educational approach is supported by evidence findings, appropriate data collection is necessary to ensure the change provides benefit and that the execution aligns with current practice findings. A data collection plan was developed for this change initiative and broken into three categories.

Descriptive Data

It was determined that descriptive data would be taken including current patient age, gender, diagnosis, and length of nursing services. Collection of this kind of data can help the quality improvement team ensure that this change is not more or less helpful to one group and can give context that informs later PDSA cycles. This data is all routinely taken as part of the electronic healthcare record.

Primary Measures

Primary measures to determine if the change was an improvement were identified including answers to two yes/no questions, “Did you find this teaching helpful?” and “Would you recommend this intervention to other patients with diabetes?” as well as two open-ended questions including, “What did you like about the activity” and “what didn’t you like about the

activity?" These questions were chosen to elicit information about patient/customer satisfaction with the services and to offer an opportunity for self-advocacy and feedback which could inform later change and improvement. A change intervention that resulted in positive feedback and results in these satisfaction metrics would be considered an improvement on current practice.

Additional Data

While existing literature did not demonstrate that any of these improvements in educational approaches elicited a reduction in glycosylated hemoglobin, glycosylated hemoglobin is a metric closely monitored by the patient's endocrinologist as a metric of glycemic control. It is also routinely closely monitored and documented by visiting nursing services. As a standard of practice, all changes made to any patient's plans are considered in the context of the question, "what will be the effect on this patient's glycosylated hemoglobin levels?" For that reason, it would be in poor practice not to consider this metric, not as a metric of success of this problem-based learning educational intervention, but rather as a clinical practice metric that ensures this nursing service is meeting its primary endocrinologist-determined goals, that this practice change does not interfere with that goal, and to determine if the change even potentially supports that goal. Along these same lines, increasing frequency of counting carbohydrates to dose determine for insulin administration and reducing missed insulin doses is also seen as an endocrinologist-determined nursing goal. Using a Likert scale to assess patient-reported frequency of use of this practice can help ensure that this change does not interfere with and even potentially reveal benefits to patients in meeting their provider-determined homecare admission goals. These are to be viewed as safety metrics.

Additionally, literature surrounding these education improvement strategies do show improvement in diabetes self-efficacy scores. For this reason, a pre- and post-test diabetes self-efficacy scale were chosen to be used to ensure that the same benefits seen in the evidence are also being achieved when the practice change is enacted.

PDSA Cycle

In the first step of the PDSA approach to evidence-based practice implementation, the "plan phase," objectives for that cycle are determined, predictions are made, a data collection, and data analysis plan is identified, key stake holders are identified and involved, potential barriers, resources, and ethical considerations are evaluated.

PDSA step one: Plan

Objective

The objective of this PDSA cycle was to enact the identified three-visit standardized teaching model into practice.

Plan for Data Collection

Data was determined to be collected at previously scheduled nursing visits with the patient's nurse case manager at the first and final of the three visits. Data would be collected on paper and input into excel without patient identifiers. Paper documents would be destroyed once all data collection was complete, and kept at the homecare agency, out of access of others prior to that time. Anonymized data would be retained for up to one year following the completion of the practice change initiative for reference. The data is to be kept on [REDACTED]'s server. The QI team and [REDACTED], the homecare agency administrator would retain access to the data.

Plan for Data Analysis

Statistical analysis of descriptive participant information and survey data as mentioned above will be conducted by Austin McCaslin, and under supervision of Anna Goddard, PhD, APRN at Sacred Heart University. After data entry in Microsoft Excel, descriptive analysis and summary of variables related to the average pre-post glycosylated hemoglobin scores, pre-post self-efficacy scores measured by SED and the percentage difference, the average self-efficacy sub-scores pre-post and the % difference, and patient satisfaction through comments and feedback post education would be included.

Key Stake Holders

The QI team identified and proposed the change to key stake holders including [REDACTED, owner of [REDACTED] Homecare, [REDACTED] Reed, BSN, the nurse administrator, [REDACTED], the clinical supervisor and project mentor. Other identified stakeholders in this practice change include [REDACTED] diabetes program at [REDACTED], visiting nurses, patients, and their guardians.

Barriers

Incorporating EBP into clinical settings is crucial for improving our healthcare system (DeNisco, 2021). Two barriers to the implementation of EBP are lack of leadership buy-in and negative attitudes toward EBP. Allowances of time and funding to support an organizational change, as well as flow-down of the perceived value/priority of the change all have significant impact on whether a change can effectively occur. These cannot occur properly without buy-in from leadership and an understanding of the true investment. The ability to demonstrate to leadership that costs in the time and funding to implement a change can result in saved costs elsewhere, improved patient satisfaction, or avoided expenses related to patient complications can be a powerful motivator (Melnyk & Fineout-Overholt, 2019). Additionally, the current movement toward value-based reimbursement creates a great environment to incentivize the implementation of EBP, because it ties quality and outcome metrics reimbursement for healthcare (*Highlights | CMS*, n.d.). Demonstrating ways that investing more in the quality of care supported by EBP can improve the outcomes and therefore potentially improve reimbursement and increase patient referrals can be a motivating factor for leadership. These benefits of implementing this quality improvement was presented to upper management, and the decision was made to go forward with the implementation process.

Another barrier to the implementation of EBP is negative attitudes toward EBP. This can occur in settings where EBP projects are frequent, but the staff is disconnected from the development process, staff can become hardened toward EBP and lack dedication in its implementation. Fortunately, in small homecare agencies, improvement projects are few and far between. This is expected to reduce this barrier of implementation in this practice setting.

Shared ownership of the organizational change project is key to effectively implementing. This can be attained by cultivating change mentors and champions, including all levels of staff in development stages, and attaining leadership buy-in before presenting to other members. Offering opportunities from staff to share in feedback can increase ownership.

Finally, considering, communicating, and compensating staff for any increase in workload due to the change in advance can lead to improved reception of EBP initiatives (Melnyk & Fineout-Overholt, 2019). If the change is to be sustained long-term, it must be considered as part of a long-term work increase. This will require cost evaluation, research regarding potential changes in insurance billing options if adapted long term and buy-in from stakeholders.

Resources

Resources include time for development, implementation, data collection, analysis, as well as the cost of food. These resource costs are shown in **Table 1** below.

Table 1

Cost projection and analysis

Development			
Resource	Cost	Estimate	Final Cost
EBP committee meetings	Time		
Presentations to stake holders	Time		
Development of procedures	Time		
Promotion of change/ creating awareness	Time		
Implementation			
Staff training	Time		
Data collection	Longer visits	Approximately 10 extra minutes per visit	This was not formally tracked but there was no noted appreciable increase in time spent in visits
Food	Cost of food, time to purchase food	Purchasing food can add an additional 10 minutes, a target of $15-20 per participant allotted for food across three visits	Time to purchase food was longer than expected, up to 45 min per shopping trip, though clustering of shopping reduced some of the burden. The

		average cost per patient was ultimately under the estimate, rounded to $12 per patient on average.
Data management and entry	Time	
	Analysis	
Data processing	Time, SPSS software license	SPSS use was free with a free trial
EBP committee meetings to discuss results	Time	
Internal and external dissemination	Time, cost of travel if presenting at conference or other healthcare facilities	

Timeline

A timeline was established highlighting key milestones of implementation of the evidence-based practice which can found in Table 2 below.

Table 2

Timeline

March-April 2021
Complete project proposal draft
April- May 2021
Complete official DNP project proposal and present to stakeholders January-February 2020 revise project proposal as needed Identify & obtain the required ethical review and approval needed
June 2021-March 2022
Implement project Track any deviations from project plan and make changes if needed
March 2022
Data reduction and Statistical analysis Synthesize new learning Formal write up and presentation development
March-April 2022

Present final DNP project

Submit final DNP project

Disseminate Results

Review for Ethical Consideration

Because this educational intervention falls within standard practice, is evidence-based, and is limited to a formalization of practice interventions that were already being implemented both informally and formally within the practice setting, the responsible bodies at [REDACTED] Homecare determined that this change practice was ethnically sound, allowed for potential benefits with few risks beyond data confidentiality, and approved the practice change. The SHU DNP QI checklist was conducted, and this project met criteria for QI (See Appendix D). Because IRB approval is typically required for publication of this type of data related to patient care, IRB approval was sought outside of the homecare agency where this practice was implemented and instead in the academic setting of the author's school (Sacred Heart University). However, the IRB application at SHU was withdrawn. Upon recommendation by Sacred Heart University's IRB, reapplication for IRB approval once the change was completed would be more appropriate. This would ensure that ethical standards were met in case publication is pursued.

Phase 3: Implementation

Using the PDSA approach to quality improvement implementation, the chosen evidence-based change was implemented within the context of the second step, "Do." During this step the planned change was executed and deviations from that plan were tracked.

PDSA Step 2 – Do

Execution

The educational change approach was enacted by a single nurse case manager. The educational opportunity was offered to all patients with type 1 diabetes who self-inject insulin that are within that nurse's patient panel and the expectations were set with patients and guardians.

Three visits were completed asynchronously at times convenient for the patient, their families, and at times that worked within the nurse's visitation schedule. Guardians were always present for the first visit to learn about the education related to insulin coverage for "real-world" food choices. The educational intervention was also integrated into subsequent regularly scheduled visits. Patients were asked to complete a survey about the educational intervention at the first and last visit.

Deviations

One deviation occurred. The clinical manager/practice mentor at the organization determined the plan for patients to choose their preferred "real-world" food ahead of time was too labor intensive for staff. To accommodate this, a bin of snacks and cereals for patients to choose from was utilized (populated with patient identified favorites). This allowed less preparation time for the nurse and allowed patients to change their mind at the last minute. Anecdotally, it was noted that patients seemed to enjoy shopping in these bins as evidenced by smiling and laugher when doing so.

Phase 4: Evaluation

Using the PDSA approach to evidence-based change implementation, the implemented plan was evaluated during the third step titled, "study." During this step, collected data is analyzed and interpreted. Outcomes are evaluated to establish whether they meet the predetermined qualifications as an improvement to standard practice. Generally, the data set can be evaluated to determine if any other information can be gleaned to inform a future PDSA cycle during this step.

PDSA Step 3- Study

Results

The results from the identified outcome measures help the quality improvement team to know whether the change was an improvement over standard practice. Outcomes related to process measures help the quality improvement team know whether the change was executed in a way that is consistent with the literature.

Demographics

A total of 10 patients participated in the problem-based learning intervention put forth for this educational change practice. The average age of participants was 13.5, with the youngest being 11 years old and the oldest, 17 years old. Five females and five males participated in the intervention. All patients who began the intervention completed the intervention, but not all patients offered the opportunity chose to participate.

Primary Outcomes

All patients reported that they found the problem-based learning educational intervention helpful and would recommend this educational intervention to another patient with type 1 diabetes. No patients reported drawbacks to this intervention, and all comments written were positive ones. These comments are summarized **Table 3**. This was an expected outcome as it was expected that patients would find the educational practice change helpful and that comments would generally be positive. This data helps the quality improvement team know that the practice change was an improvement in terms of patient/customer satisfaction, which was a primary metric and addresses the underlying project goal of improving satisfaction and engagement of diabetes education.

Table 3

Participant post-test comments

Participant Comments:
"Eating snacks, getting help with diabetes."
"FOOD!"
"It was fun."
"It helps me understand wha' I'm doing wrong and what I have to do differently, and I learned more on carb counting, helpful"
"I got taught the process of counting carbs."
"Taking the time to do it together."
"I got to eat food and had decent fun while doing it."
"Practice doing it out together."
"Food, breaking it down."

Process Measures

Self-efficacy. Figure 1 shows the mean pre- post-test mean SED levels, including subscale values. Examination of the figure shows that the overall mean SED value, and all subscale values, were higher post-test. Table 4 shows a tabulated summary of the SED values. The overall average SED score increased from 136.8 to 151.6, an increase of 11 percent. The average SED-D score increased from 90 to 103, an increase of 14.4 percent. The average SED-M score increased from 18 to 19, an increase of 5.6 percent. The SED-G score increased from 24 to 26, an increase of 8.3 percent.

Figure 1

Mean SED pre- and post-test values, including sub-scales

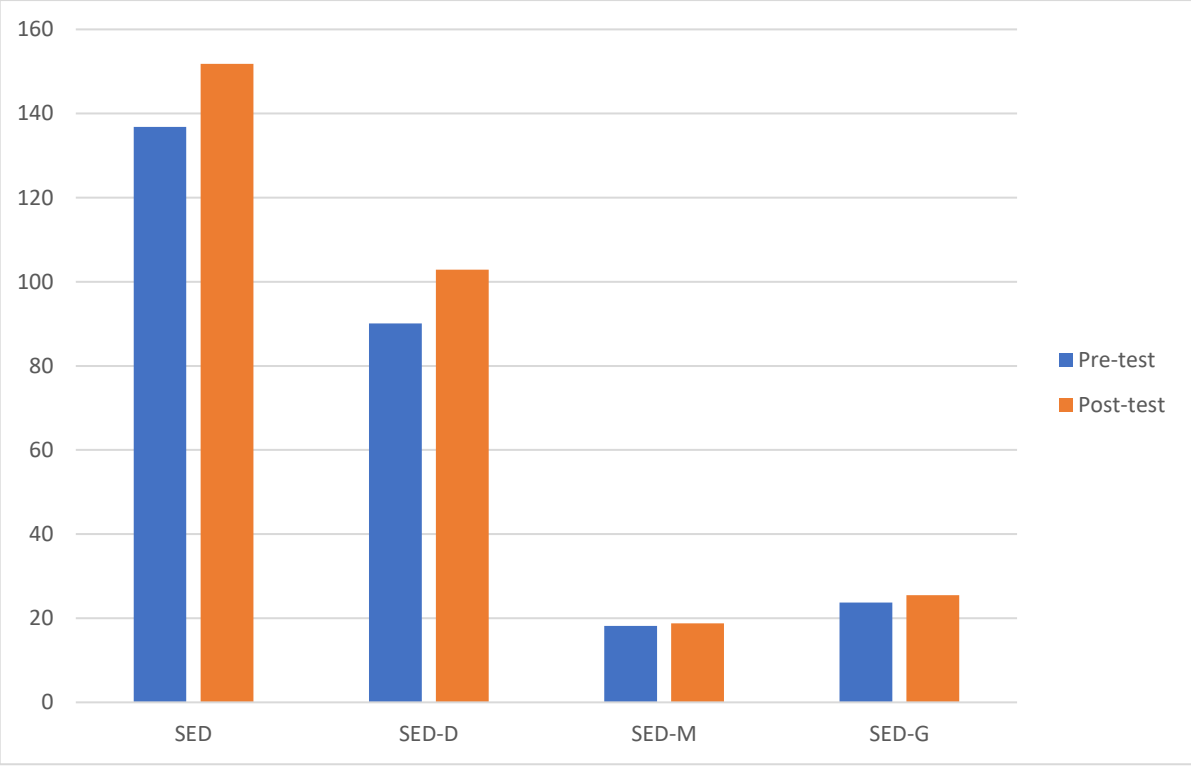


Table 4

Summary of changes to SED and subscales

Measure	Pre-test	Post-test	% Difference
SED	136.8	151.8	11.0
SED-D	90	103	14.4
SED-M	18	19	5.6

SED-G	24	26	8.3

Mean Pre/Post glycosylated hemoglobin. Error! Reference source not found.Figure 2 shows the change in mean glycosylated hemoglobin level. As shown in the figure, the mean glycosylated hemoglobin decreased over the course of the intervention from 11.48 to 10.85. Table 5 shows the tabulated summary of changes to glycosylated hemoglobin. Examination of Table 5 shows there was an overall average 5.5% decrease in glycosylated hemoglobin.

Figure 2

Mean of glycosylated hemoglobin pre-test and post-test with error bars

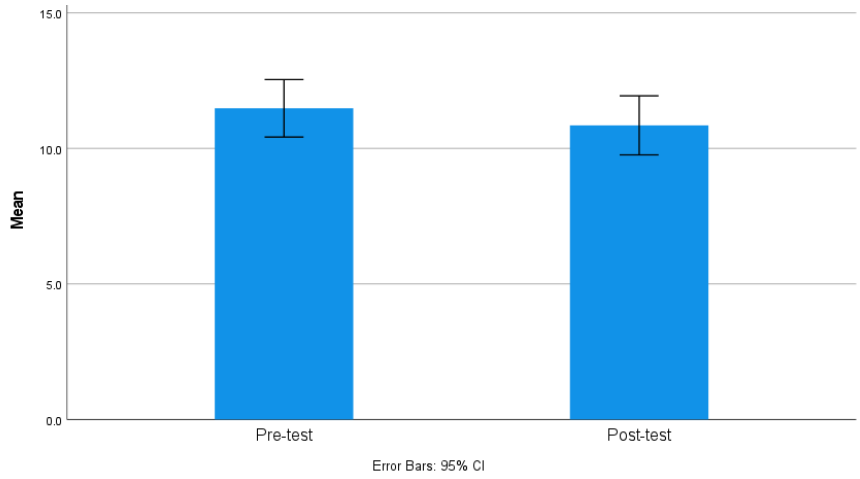


Table 5

Summary of changes to glycosylated hemoglobin

Measure	Pre-test	Post-test	% Difference
Glycosylated hemoglobin	11.48	10.85	5.5

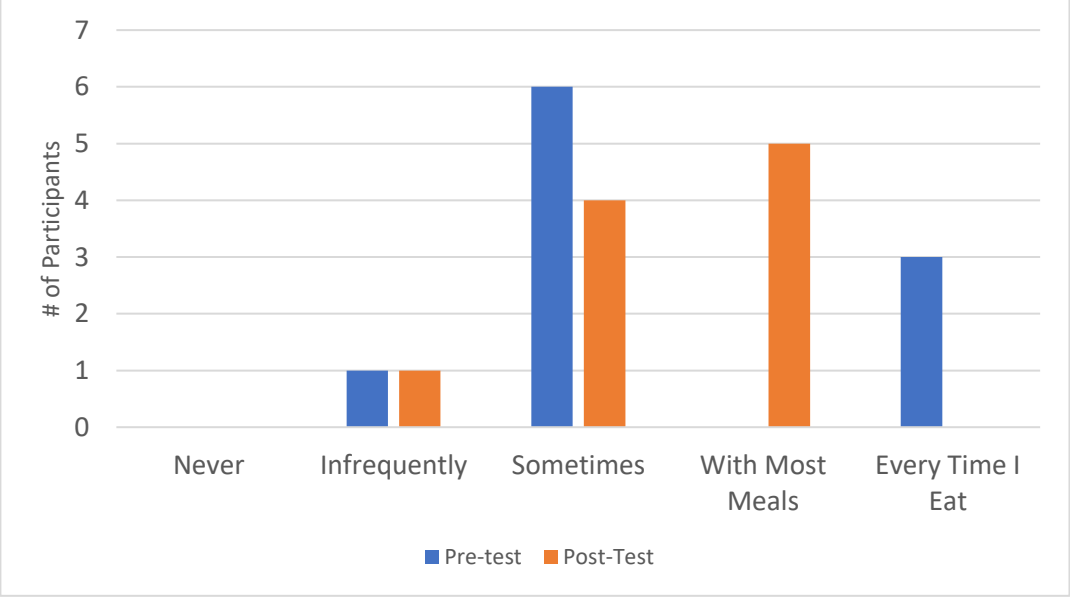
Patient Reported Frequency Changes

Patients were asked to report before and after participating in the intervention how often they count carbohydrates for insulin dose determination. This question was formulated on a Likert scale including the options “Never, Infrequently, Sometimes, With Most Meals, Every Time I Eat.” “Never” correlated to 1 on the Likert scale, “Infrequently” correlated to 2 on the

Likert scale, “Sometimes” correlated to 3 on the Likert scale, “With Most Meals” correlated to 4 on the Likert scale, and “Every Time I Eat” correlated to 5 on the Likert scale. **Figure 3** shows the reported frequency of checking carbohydrate levels on pre- and post-test surveys. There were zero “Never” responses either pre- or post- test. There was one “Infrequently” response pre-test and one “Infrequently response post-test. There were six “Sometimes” responses pre-test and four “Sometimes” responses post-test. There were zero “With Most Meals” responses pre-test and five “With Most Meals” responses post-test. There were three “Every Time I Eat” responses pre-test and zero “Every Time I Eat” responses post-test. The average value of the Likert scale went from 3.5 pre-test to 3.4 post-test, with both average values correlating to approximately midway between “sometimes” and “with most meals.” However, the mode response changed from “sometimes” to “with most meals.”

Figure 3

Reported frequency of counting carbohydrates at mealtime pre-and post-test



Phase 5: Practice Integration

In the last step of the PDSA cycle, “act,” plans to standardize the improvement can be discussed. Additionally, directions and approaches for future cycles to continue improving on the processes can be put forth. Incorporation of successes, failures, and even new concerns can be brought up from the previous cycle.

PDSA Step 4- Act

Evaluation of PDSA cycle

The primary outcome was driven by patient feedback. Because all patients reported they found the educational intervention helpful and all patients reported they would recommend the intervention to another patient with type 1 diabetes, this educational approach is seen as an improvement on current processes. Additionally, the open-ended patient feedback supports this conclusion. Overall glycosylated hemoglobin decreased and self-efficacy, as measured by the SED, increased. Both decreases in glycosylated hemoglobin and increases in self-efficacy are considered positive outcomes. Since the outcomes in these process measurements improved, it is believed the intervention was conducted in a way consistent previous research. In terms of reported frequency of calculating carbohydrates for dose determination, the average remained approximately halfway between “sometimes” and “with most meals,” and the mode response changed from “sometimes” to “with most meals.” Given the highly qualitative nature of the question, a very small decrease in the average frequency of calculation at meals may be seen as insignificant. The change in average was driven in large part by a decrease in the selection of the response “every time I eat.” It is possible that patients who participated because more aware of missed dosages throughout the course of this educational intervention. It is encouraging however, that the mode response increased from “sometimes” to “with most meals.” Overall a lack of a significant change in this measure indicates that the intervention did not interfere with goals set by the patient’s endocrinologist.

The goal of improving patient education in the homecare setting for patients with type 1 diabetes who self-inject insulin on the topic of carbohydrate counting by pairing patient preferred foods with problem-based nursing education was found to be an improvement on current practice as evidenced by positive patient satisfaction feedback. For this reason, it was agreed upon by stakeholders that the practice change, in some form, should be incorporated into standard treatment of all patients going forward.

However, while the patients benefited from and enjoyed the educational intervention, it was determined by stakeholders that the cost to the agency and time inputs from nursing must be reduced in future cycles and as the change is rolled out throughout the agency.

Next Steps

Some suggested future changes to address time included utilizing prepopulated bins with assortments of snacks, cereals, and easy meals. This reduces the time of shopping, which was high, and allows for flexibility in scheduling as preparation time is also reduced. Additionally, the most expensive food item that was offered at this visit was a restaurant-style prepared food. The idea was discussed that easy-to-make meals could be incorporated into the bins including prepackaged easy meals such as "cup of noodles." This would provide nurses with an opportunity to provide a meal to practice carbohydrate counting with but not place a significant cost burden on the agency.

Phase 6: Dissemination

Internal Dissemination

Internal dissemination of new learning regarding best practices is extremely important as it creates awareness about a change within an organization. Communication with administrators and senior-level sponsors about positive results promotes positive sentiments toward future EBP changes. Disseminating pilot and milestone results about ongoing EBP can increase excitement and interest throughout the healthcare setting to motivate increased staff involvement in the change, desire to sustain the difference, and to participate in future EBP efforts. Internal dissemination of the results of this project were communicated to leadership and administration through presentations to leadership. An important aspect of dissemination strategies is that they must fit their context to be effective (Brownson et al., 2018). Because homecare involves a very independent and decentralized workforce, internal dissemination of the results of this project can be effectively communicated to staff with posters and infographics which allow for asynchronized viewing from any location. Infographics regarding the project findings were disseminated to staff nurses and nurses who were invited to receive

training and supplies to become champions of a modified version of the educational intervention which will be adapted as standard practice at this institution.

External Dissemination

The goal of external dissemination is to communicate the results of the quality improvement project to facilitate the incorporation of new learning into other similar practice settings. To facilitate the incorporation of new knowledge in similar practice settings, results were communicated in a formal educational session with another visiting nursing agency that provides visiting nursing services for adolescents with type 1 diabetes adolescents in the Hartford area. The results will also be considered for social media dissemination by the nursing agency. Additionally, a poster presentation and discussion as part of the NU820 Evidence-Based Practice class will be completed.

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Appendix A: Evidence Appraisal

Citation	Conceptual Framework	Design/ Method	Sample/Setting	Major Variables Studied and Their Definitions	Outcome Measurement	Data Analysis	Findings	Level of Evidence/ Quality	Quality of Evidence: Critical Worth to Practice
Author Year Title County Funding	**Theoretical basis for study**		**Number Characteristics Exclusion criteria Attrition**	**Independent variables IV1 = IV2 = Dependent variables**	**What scales used - reliability info (alphas)**	**What stats used**	**Statistical findings or qualitative findings**	**Level =**	**Strengths Limitations Risk or harm if implemented Feasibility of use in your practice**
Article 1									
Williams, B., & Pace, A. E. (2009). Problem based learning in chronic disease management : a review of the research. Pat ient education and counseling, 77(1), 14–19. https://doi.org/10.1016/j.pec.2009.03.004	N/A	Search included databases Cumulative Index to Nursing and Allied Health Literature (CINAHL), EMBASE, HealthStar, Medline and PubMed. with the keywords PBL, patient education, or patient learning and chronic disease or self-management. Studies were reviewed by both authors for relevance	34 abstracts were reviewed based, 13 were selected. Studies were included that used problem based learning, focused on patients rather than practitioners, and were not commentaries.	IV1= Use of problem-based learning in education for self-management of a chronic disease DV1= improvement in disease measurement metrics (varied with disease process) – HbA1C is typically used for diabetes DV2= improvement in self-efficacy DV3 = improvement in disease management knowledge	Systematic review	N/A	P-values were reported for individual studies. Most studies reported statistically significant gains in practical knowledge of disease self-management when problem-based learning is used rather than a control group with lecture based instruction. No studies showed that problem-based learning was a less effective teaching tool than traditional teaching methods	Level I/Medium quality	Strengths: Structured review of available evidence. Individual papers were of varying quality, but in general were able to show that trends favor using problem-based learning for diabetes education. Limitations: Random sampling was impossible for all studies as researchers depended on participants responding to some form of solicitation to participate in the studies. This may have impacted results. Since no papers showed a negative effect of problem-based learning, there does not appear to be a risk of implementing it as an educational measure. This could easily be implemented in practice.

Article 2									
Borus, J. S., & Laffel, L. (2010). Adherence challenges in the management of type 1 diabetes in adolescents: prevention and intervention. *Current opinion in pediatrics*, *22*(4), 405–411. https://doi.org/10.1097/MOP.0b013e32833a46a7	N/A	Literature review- examined relevant research on barriers to glycemic control for adolescents and explore effective interventions.	Papers are focused on barriers to glycemic control in adolescents with type 1 diabetes and overcoming those barriers.	IV = interventions to overcome barriers to diabetes self-management for adolescents DV = improvements in diabetes management measured by HbA1C and diabetes knowledge	Literature review	Various measures of outcomes were used in the studies reviewed, many used A1C, but many measured self-efficacy, mental health status, or knowledge by various instruments.	Adolescents face a number of factors unique to their age group which make diabetes management difficult, including social pressure, increased risk-taking behavior, and short-sighted outlook. Several interventions show promise in alleviating these barriers, including increased positive family involvement, motivational interventions, and more realistic approaches to eating. Results are summarized in several sections – the importance of familial involvement was underscored. Motivational interviewing, focusing on patients going to endocrinology appointments through better communications about schedules, making plans for realistic diets of teens, and communication via text message all show some level of promise.	Level 5/ medium quality	The study is a good summary of several different interventions. This paper is a good resource for a hand search both upstream and downstream. None of the interventions described are risky, as all focus on having teens adhere to their management plan, and none are shown to be worse for adherence than doing nothing.
Article 3									
Chaney, David, Coates, Vivien, Shevlin, Mark, Carson, Dennis, McDougall, Andrea & Long, Arlene. (2012). Diabetes education:	N/A	Interviewed focus groups to determine preferences in diabetes education. Focus groups consisted of teenagers from hospitals in Northern Ireland who had type 1 diabetes and spoke English. Focus groups worked through a	21 adolescents from hospitals in Northern Ireland were interviewed. Participants responded to a postal mail invitation from their provider.	No intervention performed. DV = Preferences from adolescents in type of education	Qualitative assessment – no scales were used The paper gave several quotes from the focus groups to demonstrate specific thoughts or ideas.	N/A	The study found that teenagers wanted brief, repeated teaching sessions which incorporated practical training on insulin dosing for foods they typically eat that was engaging and held their interest.	Level VI – Medium quality	Strengths: Despite being purely observational, this study applies directly to my patient population and subject matter. There is very little research into what education adolescents with diabetes actualy prefer, and this paper offers a small window into that question. Limitations: Study participants are those who showed up to the focus group, those who did not come to the focus groups may have had different opinions. No data analysis is performed

what do adolescents want?. Journal of Clinical Nursing, 21, 216-223. https://doi.org/10.1111/j.1365-2702.2010.03692.x		list of questions pertaining to diabetes management and preferences in education.							
Article 4									
Schlundt, D. G., Flannery, M. E., Davis, D. L., Kinzer, C. K., & Pichert, J. W. (1999). Evaluation of a Multicomponent, Behaviorally Oriented, Problem-Based "Summer School" Program for Adolescents with Diabetes. Behavior Modification, 23(1), 79–105. https://doi.org/10.1177/0145445599231004	N/A	Participants were divided into two groups based on availability, randomization was not practically possible. Each group received 24 hours of diabetes and problem-solving training over 8 three hour sessions. The second group was considered a waitlist control group.	Participants were contacted by postal mail from their endocrinologist and solicited to participate in the study. 273 patients were invited, response rates were fairly low, and 20 participants were found for the study.	IV1 = Problem solving education provided over 8 sessions DV = Improvement in diabetes knowledge vs a waitlist control	Blood glucose levels were measured with electronic glucometers. Other outcomes were measured with the BULIT (eating disorder test), IMDSES (diabetes knowledge test), and PSI (problem solving ability test). Each was validated in other publications.	Means and standard deviations are presented for each test and subscale along with p-values for comparisons to the control group	No statistically significant changes were found in any of the scores, however all trends were in the positive direction. The authors noted the small sample size and large scatter contributed to difficulties in reaching statistical significance.	Level III - medium	While this study did not show statistically significant results, concepts from it could be used and details modified to possibly obtain statistically significant results. For example, in other literature it is indicated that 3 hours may be too long of a training session for adolescents as they tend to tune out when education is not engaging does not have an obvious application to their problems. The study was limited by its small sample size and non-random sampling. These limitations are common among studies of adherence in adolescents with type 1 diabetes.
Article 5									

Stanger, C., Ryan, S. R., Delhey, L. M., Thrailkill, K., Li, Z., Li, Z., & Budney, A. J. (2013). A multicomponent motivational intervention to improve adherence among adolescents with poorly controlled type 1 diabetes: a pilot study. Journal of pediatric psychology, 38(6), 629–637. https://doi.org/10.1093/jpepsy/jst032	N/A	Participants received 14 weeks of motivational interviewing/cognitive behavioral therapy and an incentive program which paid $10 for each week of having 6 checks of blood glucose levels each day (for at least 5 days in the week), with the amount increasing by $10 for each consecutive week of checks. Additionally, parents were compensated for giving reports on their child's diabetes at a similar level.	Participants were patients at the endocrinology department of Arkansas Children's Hospital. 17 participants were selected and 12 participants finished the 14-week intervention.	IV = A 14 week interventional program DV1 = Frequency of blood sugar checks DV2 = HbA1C level at the end of the study	Blood glucose monitors were checked either at weekly visits or uploaded via the internet. HbA1C values were checked before and after the intervention program.	P-values for HbA1C level for before vs. after the intervention were calculated as well as numbers of daily blood sugar checks.	A1C decreased by approximately 2.5% at the end of the study and remained about 2% lower in a three month follow-up (P<.001). Frequency days per week of blood glucose checks greater than six times per day increased from ~1.5 to ~5.5 (p<.001)	Level IV - medium	The study is one of few that shows improvement in A1C levels in patients. Additionally, it shows the strength of multifactor interventions on increasing adherence in adolescent with type 1 diabetes. I do not have the resources to repeat the level of incentives provided in this study. However, the general concept of incentivizing education can be incorporated**.**

Appendix B: Levels of Evidence Synthesis Table: PICO Question #1

PICO Question #1: In adolescents with type 1 diabetes receiving visiting nursing services (P), does pairing education with favorite foods (I) increase patient's willingness to participate in education regarding carbohydrate counting and dose determination (O)?

X (copy symbol as needed)	1	2	3	4	5
Level I: Systematic review or meta-analysis	X				
Level II: Randomized controlled trial				X	
Level III: Controlled trial without randomization					
Level IV: Case-control or cohort study					X
Level V: Systematic review of qualitative or descriptive studies		X			
Level VI: Qualitative or descriptive study, CPG, Lit Review, QI or EBP project			X		
Level VII: Expert opinion					

LEGEND

1= Williams et al., 2009. **2=** Borus et al., 2010. **3=** Chaney et al., 2012. **4=** Schlundt et al., 1999. **5=** Stranger et al., 2013.

Appendix C: Outcome Synthesis Table: PICO Question #1

↑, ↓, —, NE, NR, ✓ (select symbol and copy as needed)	1	2	3	4	5
HbA1C	↓	↓	**NE**	**NC**	↓
Self-Efficacy	↑	**NE**	**NE**	**NE**	**NE**
Diabetes Knowledge	↑	↑	**NE**	**NC**	↑
Mental Health Status	**NE**	↑	**NE**	**NE**	**NE**
Frequency of Blood Sugar checks	**NE**	**NE**	**NE**	**NE**	↑

SYMBOL KEY

↑ = Increased, ↓ = Decreased, — = No Change, NE = Not Examined, NR = Not Reported (introduced at beginning but never reported at the end)

LEGEND

1= Williams et al., 2009. **2=** Borus et al., 2010. **3=** Chaney et al., 2012. **4=** Schlundt et al., 1999. **5=** Stranger et al., 2013.

Appendix D: QI Checklist

Differentiating Quality Improvement and Research Activities Tool

Question	Yes	No
1. Is the project designed to bring about immediate improvement in patient care?	X	
2. Is the purpose of the project to bring new knowledge to daily practice?	X	
3. Is the project designed to sustain the improvement?	X	
4. Is the purpose to measure the effect of a process change on delivery of care?	X	
5. Are findings specific to this hospital?	X	
6. Are all patients who participate in the project expected to benefit?	X	
7. Is the intervention at least as safe as routine care?	X	
8. Will all participants receive at least usual care?	X	
9. Do you intend to gather just enough data to learn and complete the cycle?	X	
10. Do you intend to limit the time for data collection in order to accelerate the rate of improvement?	X	
11. Is the project intended to test a novel hypothesis or replicate one?		X
12. Does the project involve withholding any usual care?		X
13. Does the project involve testing interventions/practices that are not usual or standard of care?		X
14. Will any of the 18 identifiers according to the HIPAA Privacy Rule be included?	X	

Adapted from Foster, J. (2013). Differentiating quality improvement and research activities. Clinical Nurse Specialist, 27(1), 10–3. https://doi.org/10.1097/NUR.0b013e3182776db5

Appendix E: Project Poster

DR. SUSAN L. DAVIS, R.N., & RICHARD J. HENLEY COLLEGE OF NURSING
Sacred Heart University

Standardizing Naturalistic Teaching Opportunities for Problem-based Learning in Diabetes Education: A Quality Improvement Project

Austin McCaslin, RN; Anna Goddard, Ph.D., APRN, CPNP-PC; Erica Muller, BSN, RN

BACKGROUND/EVIDENCE

- Medication adherence is a common problem in adolescents with type one diabetes tied to long and short-term health complications. Difficulty with dose determination is a known barrier to medication adherence in adolescents.
- Evidence supports multiple short education sessions, realistic eating plans, problem-based learning, multifactorial approaches and use of naturalistic incentives.
- Anecdotally, patients who benefitted from agency food provision under normal practice had more opportunities to practice carbohydrate counting at visits and experienced subsequent improvements in glycemic control.

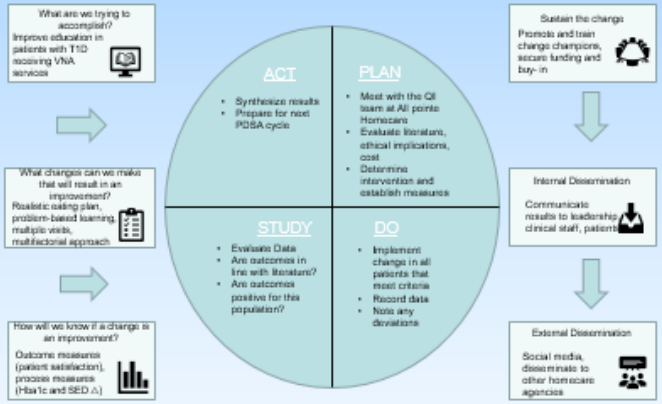
PROJECT GOALS

To improve diabetes education relating to carbohydrate counting in patients with type diabetes receiving homecare

INTERVENTION

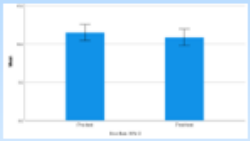
Standardizing this approach into three visits that combine interventions allows for improved equity among patients and allows for better evaluation of change.

IMPLEMENTATION

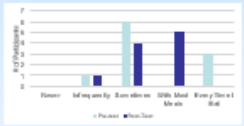


RESULTS

Pre- and Post- Glycosylated Hemoglobin



Item: "How often do you count carbohydrates to dose determine?"

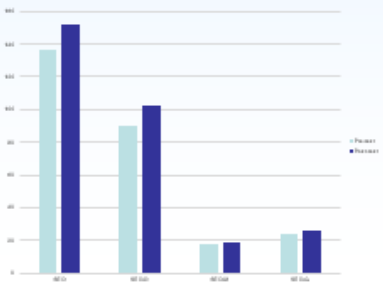


RESULTS

Open-ended patient feedback

Participant Comments:
"Eating snacks, getting help with diabetes."
"FOOD!"
"It was fun."
"It helps me understand what I'm doing wrong and what I have to do differently, and I learned more on carb counting, helpful"
"I got taught the process of counting carbs."
"Taking the time to do it together."
"I got to eat food and had decent fun while doing it."
"Practice doing it out together."
"Food, breaking it down."

Pre and Post Self-Efficacy Diabetes (SED) Scores



CONCLUSIONS

- This educational approach was an improvement on standard education practices, as all patients reported it was helpful, and would recommend continuing this approach.
- These results of the implementation are in line with findings from a critical appraisal and review of available literature.
- Leadership felt benefits were positive but the cost for full implementation was high given tight margins in homecare reimbursement.

NEXT STEPS

Sustain change by building up change champions, next cycle to evaluate less expensive models, communicate EBP efforts in homecare and funding needs to legislators in support of increases in reimbursement.

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