

Improving Glycemic Control in the Acute Care Setting Through Nurse Education


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Published In/Presented At

Najarian, J., Bartman, K., Kaszuba, J., & Lynch, C. (2013). Improving glycemic control in the acute care setting through nurse education. *Journal of Vascular Nursing*, 3(4), 150-157. doi:10.1016/j.jvn.2013.04.004.

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Abstract

Patients with a primary or secondary diagnosis of diabetes present unique challenges during an inpatient hospital stay to treat an acute or chronic illness. Upon review of current hospital practice, an interprofessional team embarked on a performance improvement project to improve outcomes for the complex medical-surgical diabetic patient. The methods detailed in this manuscript - a comprehensive education plan, preceptorship and peer accountability, active engagement and support by the unit nursing leadership team, and interprofessional collaboration - offer strategies any organization can implement to positively impact diabetes care.

Improving Glycemic Control in the Acute Care Setting Through Nurse Education

Introduction

Diabetes is the fastest growing chronic disease in the United States (US). According to the Centers for Disease Control, there are an estimated 25.8 million persons living with diabetes and 79 million persons with pre-diabetes.¹ If current trends continue, it is projected that by the year 2050, one in three people will have diabetes. Costs for acute, inpatient diabetes care accounted for half of the 174 billion dollar total medical expenditures of the disease.² Additionally, one in ten health care dollars is spent on diabetes.³ In the past decade, research has demonstrated that achieving glycemic control during acute illness, with or without a diabetes diagnosis, improves a variety of clinical outcomes, with associated financial benefits.⁴⁻⁸

At Lehigh Valley Health Network (LVHN), an academic community Magnet® designated hospital in southeastern Pennsylvania, 29 % of inpatients carry a primary or secondary diagnosis of diabetes. For many years, our network demonstrated a commitment to the care of patients with diabetes or hyperglycemia through a variety of programs in both the acute and outpatient settings. In 2004, in response to acute care glycemic control research, a multi-disciplinary Diabetes Management Quality Improvement Team (DM QIT) was formed and continues to present. Figure 1 details the purpose and functions of the team. This manuscript details how LVHN staff members on a 30-bed medical-surgical unit (4K), specializing in vascular and colon-rectal surgery patients, embraced the evolving clinical practice guidelines for diabetes management established by the DM QIT and achieved and sustained outcomes that exceed national

benchmarks for hyperglycemia (blood glucose {BG} > 180mg/dL) and hypoglycemia (BG < 70mg/dL) rates.

Evidence Review

Hyperglycemia in acute illness has been shown to increase mortality, whether or not the patient had a diagnosis of diabetes.⁹ Initial inpatient studies focused on improved clinical outcomes of critically ill patients with a variety of conditions, including coronary artery bypass surgery, general surgery, acute myocardial infarction, acute ischemic stroke, head trauma, and mechanical ventilation.¹⁰⁻²³ While only a few of these studies were controlled randomized clinical trials, results were compelling enough that in 2004, national experts from the American Association of Clinical Endocrinologists (AACE) developed initial recommended goals for inpatient glycemic targets. These recommendations suggested that the upper limits of glycemic targets in the intensive care population should be 110 mg/dl, and for non-critically ill patients a pre-prandial glucose of 110 mg/dl and a maximum glucose of 180 mg/dl.²⁴

In 2006, the American College of Endocrinology (ACE) and the American Diabetes Association (ADA) performed an updated evidence review and joined forces to issue a call to action consensus statement which provided additional recommendations to improve hospital inpatient glycemic control.²⁵ As a result of these and other subsequent expert statements, hospital personnel across the US were challenged to make changes in the traditional care delivered to patients with diabetes or hyperglycemia. Based on continued and mounting evidence, revised glycemic targets for inpatient care now focus

on avoiding hypoglycemia and set more liberal pre-prandial blood glucose targets at less than 140 mg/dl. Maximum random glucose value recommendations remain at less than 180 mg/dl.^{26,27}

Since persons with diabetes consume an estimated 22% of all hospital inpatient days,³ improving the quality of diabetes management became an important, but challenging, focus for hospital systems on many levels. No single protocol has been deemed superior,²⁸ so approaches to achieve goals vary. Regardless, the newer methods and medication formularies to address inpatient hyperglycemia are more complicated than in the past. A recent study suggests knowledge related to insulin use among attending physicians, residents and nursing professionals is low, which is concerning given the high incidence of diabetes and potential adverse patient outcomes.²⁹

Although guidelines for recommended glycemic targets have been the emphasis of inpatient diabetes literature over the past few years, until recently there was little reported and collated outcome data for hospitals regarding the established goals. A survey published in 2009 of 126 US hospitals to gain data on glycemic controls was the first attempt to establish a national benchmarking process. Results identified hospital hyperglycemia (> 180 mg/dl) and hypoglycemia (< 70 mg/dl) prevalence rates for both intensive care unit (ICU) and non-ICU settings. Overall rates of hyperglycemia in non-ICUs were 31.7% and for hypoglycemia 3.5%.³⁰

Creating the Passion for Excellence in Glycemic Control

Setting the Stage

The LVHN mission is to provide high quality patient care driven by education and research. As the early evidence unfolded related to the importance of glycemic control, 4K staff members engaged in a performance improvement (PI) project that demonstrated a relation between improved glucose control through intravenous (IV) infusion and a significant reduction in infections.³¹ This 2001 – 2002 PI project was very progressive. At that time, and even today, IV insulin infusion protocols were and are not common practice in the majority of US hospitals, especially in the medical-surgical inpatient setting.

During this initial PI project, 4K staff was hesitant about using IV insulin infusion due to the increased patient acuity and associated workload in the medical-surgical setting. However, the positive results demonstrating reduced infections validated the literature evidence first hand, prompting acceptance for IV insulin infusion. Achieving optimal glycemic control became a patient care priority, ingrained in the 4K culture. Following the PI project, as more evidence evolved regarding the importance of inpatient glycemic control, we expanded and revised our glycemic care protocols.

These protocols, in place throughout the network since 2008, include IV infusion and subcutaneous (SQ) insulin standardized order sets. The IV infusion order set uses Columnar Insulin Dosing Charts developed by the Georgia Hospital Association Research and Education Foundation Partnership for Health and Accountability

(GHAREF-PHA) Stockton Diabetes Special Interest Group to achieve and maintain a target blood glucose range between 90 and 140 mg/dl (Figure 2).³²

Subcutaneous order sets utilize basal insulin in conjunction with bolus insulin based on carbohydrate consumption and individual insulin sensitivity factors, versus the long-standing practice of sliding scale insulin administration. The physician identifies a specific SQ dose for the designated patient, considering the patient's individual response to insulin, including factors such as body weight, renal disease and infection.

Strategies and Interventions

As the above protocols were implemented throughout our network, 4K staff members developed a renewed passion for optimum glycemic control. Four distinct components were and continue to be instrumental in their continuing success: a comprehensive education plan; preceptorship and peer accountability; active engagement and support by the unit nursing leadership team; and, interprofessional collaboration.

Comprehensive Education Plan

Three learning opportunities exist for staff to develop the skills to achieve glycemic control. The first includes electronic learning modules. Formerly, the content of one of the modules was an eight hour, didactic continuing education offering. Titled, "Advancing Diabetes Care in the 21st Century," it was offered quarterly to all nursing staff throughout the Network. Recognizing the challenges for staff nurses to attend a full day classroom educational program, in 2009 the course was converted into an electronic

format. Figure 3 details this program's content outline. Successful completion earns 2.5 continuing nursing education credits. While neither course was and currently is mandatory for all Network nurses, completion by 4K registered nurses (RNs) was and continues to be required.

In 2008, when the IV infusion and subcutaneous insulin standardized order sets were instituted, electronic learning modules for each order set were developed. Content includes the rationale and specific procedures associated with IV and subcutaneous insulin administration. Figures 4 and 5 detail, respectively, the content outline for these offerings. Both modules are required by RNs throughout the Network as the initial learning resource for these skills. Average time to complete each offering is 60 minutes. The 4K unit-based educator, who oversees staff member competency attainment, has the ability to review time spent by the learner on each module, as well as test scores. This information may be useful for future coaching and remediation.

Six weeks prior to implementation of the new insulin order sets, as a supplement to the electronic learning modules, 90-minute workshops were offered by Network diabetes education specialists. All inpatient unit-based educators were required to attend a workshop, with the intent that they, in turn, would disseminate learnings to their staff. Recognizing the magnitude of the insulin order set implementation, 4K leaders believed their staff's knowledge would be enhanced by staff members attending the workshops themselves, versus the 'train the trainer' method used by other units.

In addition to the aforementioned electronic learning modules, two other modules related to diabetes management were subsequently designed: one details the Network's hyperglycemia management clinical practice guidelines; the second reviews the concepts of carbohydrate counting. These modules are also required for 4K staff during their orientation.

Following completion of the various learning modules, the second opportunity for a staff member to promote optimum glycemic control is a medication validation process with the unit based educator, prior to experience with a staff nurse preceptor. The staff nurse, with the educator, administers medications to her four or five primary patients. During this experience, the educator assesses all aspects of medication administration, including, but not limited to, application of knowledge gained from the diabetes related learning modules. Normally, this experience is completed in one, eight-hour shift.

The third opportunity associated with glycemic control competency is a two-hour workshop for the staff member, conducted by the unit educator. The workshop teaching strategy incorporates simulated case scenarios associated with IV insulin infusion, focusing on titrating IV insulin based on changing blood glucose levels. Figure 6 shows three practice examples. Nurses are introduced to available tools which assist with decision making and troubleshooting, including a standardized algorithm, columnar dosing grid, and 'Frequently Asked Questions' fact sheet. Special considerations, such as hyperglycemic events and total parenteral nutrition, are also reviewed.

Preceptorship and Peer Accountability

A second strategy for staff to gain competency and comfort with glycemic control principles is preceptorship with peer accountability. A formal preceptor program has been in place within LVHN for over 25 years. The role of the preceptor is crucial to successful adaptation of the nurse to a new work environment and development of the associated dimensions of competent performance: critical thinking, technical and interpersonal relation skills.³³

The 'Preceptor Preparation Program' is eight hours in length, with continuing nursing education credits awarded upon successful completion. Only those staff members who have attended the program may serve in the preceptor role. The program reviews the organization's educational framework of competency-based education and self-directed learning. Preceptors develop skills in prompting the learners to identify their learning needs, formulate goals, and select resources for learning.

The unit-based educator assigns learners to a preceptor, considering a match between learning preferences and preceptor teaching methods. Consistent assignment of the learner with the preceptor is intended to build a relationship based on trust.

Preceptors on 4K pay special attention for opportunities to review care of assigned patients with diabetes, engaging the learner in in-depth case study discussions. The preceptor asks probing questions of the learner, assessing critical thinking skills and prompting analysis to see the 'whole picture.'

When a patient requires IV insulin infusion, the preceptor and learner each independently determine and verify the dose based on current blood sugar using the Columnar Insulin Dosing Charts. Following demonstration of competency by a learner, hospital policy does not require a second verification of IV insulin dosing; however, on 4K, staff members hold one another accountable for a second confirmation of the dose. This verification occurs upon initiation of the infusion, any change to the rate, hanging a new IV bag, patient transfer to or from another unit, or change of the primary RN. Such attention to detail is one more example of the passion by 4K staff to deliver excellent diabetes care.

The preceptor and learner review progress at the end of each day, with informal goals identified for subsequent days. More formally, a weekly meeting occurs between the preceptor, learner, and unit-based educator. Strengths and areas for growth and development are discussed and lead to mutually determined goals for the upcoming week. If, during the weekly meeting, opportunities associated with diabetes patient care are noted, the unit-based educator provides case scenarios associated with the particular need for the preceptor to review with the learner. Recognizing that optimum learning takes place in a supportive, non-threatening environment with associated feedback,³⁴ the remedial case study review builds upon the level of trust established between the preceptor and learner, with the ultimate outcome being confidence and demonstrated competency.

Active Engagement and Support by the Unit Nursing Leadership Team

Leadership engagement and support is mandatory for any project to succeed. The 4K leadership team consists of the unit director, patient care specialist (PCS) and the patient care coordinator (PCC). The director manages all material, financial and human resources; the PCC provides direct patient care and, with the director, manages day-to-day operations; and, the PCS serves as a unit-based educator.

For the past several years through the present, 4K leaders assured all unit nurses participate in every available educational opportunity, those designated as mandatory and optional. Strategically planning attendance at didactic sessions and time to complete self-learning opportunities guarantees the learner has scheduled coverage to be relieved of patient care responsibilities.

Upon initiation of the revised glycemic care protocols in 2008, the leadership team rotated responsibility to be available as a resource 24 hours per day, seven days per week. Each member of the team was 'on call' for one week at a time. Staff was responsible to contact the on-call leader whenever new IV or subcutaneous insulin physician orders occurred. The leader methodically and in great detail reviewed the order and confirmed dosing. The accessibility and active involvement by the leadership team members validated correct dosage calculation; as important, it sent the message to staff members that leadership recognized the more intensive work load and was willing to do their part to support the staff. Their actions demonstrated the Magnet™ model component of Transformational Leadership, specifically, conveying a strong sense of advocacy and support for staff.³⁵

For many years, the 4K PCC has been and remains a member of the LVHN DM QIT. As a front-line direct caregiver, she was aware of questions and issues for clarification that arose during implementation of the IV infusion and subcutaneous insulin standardized order sets. She shared these with the DM QIT, prompting appropriate responses. This individual is passionate about optimum care for the patient with diabetes, serving as that necessary champion for cutting edge and enhanced patient care.

A final strategy utilized by the unit leadership team is to regularly feature glycemic control information via monthly staff meetings, educational bulletin boards and newsletters. These methods allow staff to see the outcomes associated with their actions to improve glycemic control, fostering a sense of empowerment and confidence to influence practice,³⁶ further stimulating forums in which staff discuss questions, concerns, and ideas for continuous improvement. At the same time, glycemic control remains ‘on the front burner,’ avoiding complacency and instead, fostering not just competency, but an ardor for the subject.

Interprofessional Collaboration

Practicing as a collaborative team is not an option at LVHN; it is an expectation of all staff members. During the site visit associated with the organization’s third designation as a Magnet hospital, the appraisers stated, “The physician/nurse relationship is one step above collaboration; it is truly collegial” (Personal communication on February 24, 2011).

To promote interprofessional collaboration for the patient with diabetes, it is important that all disciplines are aware of and knowledgeable about interdisciplinary clinical practice guidelines. To assure this knowledge for the physician population, attending hospitalists and new residents are oriented to the team approach for care of a patient with diabetes. A Network diabetes education specialist facilitates didactic sessions lasting one to two hours, reviewing the following topics: IV and SQ insulin order sets; diabetes medications and their pharmacological properties; and, clinical practice guidelines for hypoglycemia and hyperglycemia. The physicians are given pocket cards detailing insulin and oral medication profiles and inpatient dosing strategies. This same information is available as a reference on the hospital intranet and within the computer order entry system.

Interprofessional rounds occur daily on 4K at the patient's bedside. Team members include the patient and family, primary RN, attending physician, case manager, physical therapist, registered dietician, and 4K leadership team member. This collaborative effort promotes camaraderie as each team member offers information for the patient's plan of care. An 'all voices heard' approach results in professional relationships built on trust and mutual respect.³⁵ As necessary, the RN is empowered to initiate a discussion of glycemic control therapy if other team members do not propose the same.

Unlicensed assistive personnel, termed technical partners (TPs), are an integral part of patient care on 4K. Their scope of responsibility includes point-of-care glucose testing,

with the associated expectation to report results in a timely manner. On a daily basis, at the beginning of each shift, the 4K RN reviews key elements influencing glyceemic control for their mutual patients.

Outcomes

Since implementation of the revised glyceemic care protocols in 2008, the Network's DM QIT reviews unit glucose control data using a software program that pulls all point-of-care blood glucose values from a data warehouse. Comparative unit data is reviewed quarterly. Consistently, for the past three years, 4K patients had the lowest hyperglycemia rate (BG > than 180mg/dl) compared to Network medical-surgical and step-down units which utilize the IV titration and SQ order sets. In addition, the 4K rate is better than the published benchmark cited earlier in this manuscript. (See Table I) For the same time period, the hypoglycemia rate for 4K patients was lower than the benchmark and majority of the comparative units. (See Table II)

Lessons Learned

A recommendation based on our experience is to always be cognizant that insulin is a "high alert medication,"³⁷ and to never become complacent, despite planned and well developed initial strategies related to glyceemic control. Vigilant monitoring for compliance must be ongoing and at the forefront of continuous improvement efforts.

This leads to another learning, related to insulin timing and dosage. Within our organization, meals are served at the time requested by the patient, versus a consistent

time for all patients on a designated unit. We quickly realized that a process had to be designed to assure that glucose monitoring, insulin administration and meals were appropriately timed and coordinated. Regarding insulin dosing, it is important to recognize there will be ongoing knowledge gaps by licensed, independent providers. One action we have recently taken is to require diabetes pharmacology education by designated providers via electronic learning modules.

A final caution relates to the arrival each year of new resident physicians. Though glycemic control educational opportunities are communicated, attendance may not be a priority despite their best efforts. To address this issue, support from the residents' supervising physicians must be garnered for accountability to participate in the offered education and demonstration of competency.

Implications for Clinical Practice

Newer methods and medication formularies to address inpatient hyperglycemia are more complicated than in the past. According to a study, physician, resident, and nursing knowledge may not be adequate to ensure appropriate diabetes management.³¹ All of these issues, exacerbated by the rising incidence and costs of diabetes care, challenge staff within hospital systems to implement best practice strategies that result in improved and sustainable changes to the care of patients with diabetes. The methods detailed in this manuscript - a comprehensive education plan, preceptorship and peer accountability, active engagement and support by the unit nursing leadership team, and interprofessional

collaboration - offer strategies any organization can implement to positively impact diabetes care.

Summary

As outlined in the evidence review, improving glucose control in hospitalized patients improves clinical outcomes. Staff members on our 30-bed medical-surgical unit successfully implemented IV insulin protocols which helped us to achieve and sustain lower rates of hyperglycemia (BG > 180mg/dL) and hypoglycemia (BG < 70mg/dL) compared to national benchmarks and similar units within our own network.

Our focus on comprehensive education, as well as preceptorship and peer accountability, are key elements to enhance staff knowledge regarding the importance of glycemic control and safely implement best practice strategies that are not commonplace. To change practice, supporting education through active leadership engagement and interprofessional collaboration has proven successful in our setting. Leadership accessibility and focus, characteristics of transformational leaders,³⁵ serve to energize staff and validate that all team members are working on common goals for improved patient care. The ultimate outcome is an inherent culture and passion for diabetes care that is unique and has sustained our results over time.

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Table/Figure Legends

Figure 1. Diabetes Management Quality Improvement Team: Purpose and Functions

Figure 2. Columnar Insulin Dosing Chart

Figure 3. Electronic Learning Module Content Outline – Diabetes for Nurses

Figure 4. Electronic Learning Module Content Outline – Glucose Control: Utilization of LVHN IV Insulin Order Sets

Figure 5. Electronic Learning Module Content Outline – Achieving Glucose Control with the Insulin Subcutaneous Order Set

Figure 6. IV Insulin Infusion Scenarios – Practice Examples: Modified Atlanta Protocol

Table I. 4K Hyperglycemia (BG >180 mg/dL) Rate Comparisons

Table II. 4K Hypoglycemia (BG 70 mg/dl) Rate Comparisons