A Program to Train Inpatient Pediatric Nurses in Insulin Pump Use

Supporting diabetes self-care can improve patient safety and family satisfaction.

According to 2002–2003 data from the SEARCH for Diabetes in Youth Study, approximately 15,000 new cases of type 1 diabetes are diagnosed annually in the United States in youth under the age of 20. Those patients with type 1 diabetes have a lifelong need for exogenous insulin to survive. The landmark Diabetes Control and Complications Trial, conducted between 1983 and 1993, provided evidence that keeping blood glucose levels as close to a normal range as possible can greatly improve metabolic control and prevent or at least delay numerous diabetes-related complications.

To achieve this level of “tight” glucose control requires frequent testing of blood glucose and subcutaneous delivery of insulin by means of multiple daily insulin injections (using a syringe or insulin pen) or insulin pump therapy (sometimes called continuous subcutaneous insulin infusion). Although estimates vary, most sources confirm our experience that the use of insulin pumps by children in the United States continues to increase. Since children using pumps are being seen with more frequency in acute care settings, inpatient pediatric nurses need to know how they’re used and how to support patients and their families in their diabetes self-care.

INSULIN PUMP THERAPY

Insulin pumps deliver rapid-acting insulin in small basal and bolus doses at short intervals throughout the day, a manner that isn’t feasible using multiple insulin injections by syringe or insulin pen, both of which tend to be used to deliver somewhat larger doses of insulin less frequently. While good blood glucose control can be achieved using either method of insulin delivery and also depends on many other factors, such as diet, individual metabolism, exercise, and regular blood glucose testing, insulin pump therapy more closely resembles the insulin delivery patterns of the healthy pancreas than insulin injections do.

The pump itself is a small, beeper-sized device that’s worn outside the body and connected to it by a soft tube through which the insulin flows to a thin plastic cannula inserted subcutaneously, usually in the abdomen, upper buttocks, or thigh. The pump uses only rapid-acting insulin, which has optimal absorption. Generally, patients that switch to insulin pump therapy from standard injection regimens tend to find that they require less insulin. The insulin pump can be adjusted to deliver basal doses to meet individual requirements such as metabolic patterns, exercise schedules, and fasting states. As with insulin doses delivered by syringe or insulin pen, insulin pump bolus doses are entered and delivered for meals and snacks or to correct for hyperglycemia. The insulin pump can improve glucose control in some patients; its other...
Exemplar 1. Vicki Hotvedt, BSN, RN, CPN; Transplant Program

As a diabetes resource nurse for our floor, I thought it would be important to sign up for the insulin pump class. My initial goal was to become more familiar and competent with insulin pumps so as to better assist patients and families who use them. Many of our transplant patients, especially those with cystic fibrosis, have cystic fibrosis–related diabetes. . . . We’ve also been admitting more short-stay patients with insulin pumps. My second goal was to build the confidence and knowledge to teach my colleagues the necessary skills in managing insulin pumps.

When I arrived at the first of my two classes, I was handed a bag of supplies that included syringes, lancets, and alcohol wipes. I also had a blood glucose meter in front of me. We were going to experience firsthand the use of the insulin pump and I was excited to glimpse how our patients live every day. The class began with an informative PowerPoint presentation about diabetes. We reviewed and discussed carbohydrate counting, traditional injections versus pump therapy, differences between basal and bolus insulin, and the different kinds of insulin we’d use.

Then three different types of insulin pumps were distributed. We were taught to load our pumps with medication (saline, in our cases) and then program the pumps with specific basal rates, based on our individual weights, for administration all day long. Next, we programmed our correction factors (the amount one unit of rapid-acting insulin will lower blood glucose in mg/dL, to an identified blood glucose goal or target) and the ratio of carbohydrates to insulin (the amount of carbohydrates, in grams, that one unit of rapid-acting insulin will “cover”). I connected the pump to my abdomen via thin infusion set tubing and I was ready to go. I continued to wear the pump for two more days and endured countless finger sticks and constant awareness of my carbohydrate intake. In order to make this experience as realistic as possible, I also changed the needle site for the pump and pretended to have a very high blood glucose level, even with the pump attached, which then required me to have an additional subcutaneous injection via vial and syringe.

Despite knowing that my “diabetes” and the use of an insulin pump would be short lived, I was changed by this experience. In acute care nursing, we become so familiar and skilled with helping patients through a crisis that sometimes we lose sight of what it’s really like to manage a chronic disease outside of the hospital. After the weekend, I was happy to return the pump to the DNE and renew my “grazing” eating habits.

I now feel very comfortable and confident when working with patients, their families, and my colleagues whenever an insulin pump is involved. My skills were put to the test the day following my training. One of the nurses on our unit had two patients, each with a different type of insulin pump. Because I’d actually worn both types of pumps, I was able to help my colleague not only with these specific pumps but also with other aspects, such as carbohydrate counting and correction factors.

potential benefits include a reduced risk of hypoglycemia, as well as relatively easy adjustment of the basal dose before and during exercise. Its disadvantages include that it’s attached to the body continuously; the effort and cost of maintenance; the possibility of diabetic ketoacidosis if insulin delivery is stopped because of malfunction, removal, or misuse; and a small risk of infusion site infection.

Insulin pump use in children.

As insulin pump technology has improved, the safety and efficacy of its use with children and adolescents has also increased. More families are now choosing insulin pump therapy because they feel that, despite the need for more frequent checking of blood glucose levels, this method provides greater flexibility than multiple daily injections in relation to sleeping and eating.

The daily demands of managing type 1 diabetes can markedly alter the lives of individuals and their families, giving them the sense that most people don’t understand the physical, psychological, and social burden of this disease. Having gained a hard-won awareness of the complexity of managing type 1 diabetes, many hospitalized patients and their families find it difficult to shift responsibility and control of insulin administration over to hospital staff. Parents of children who use insulin pumps may prefer not to change to an alternative insulin delivery system that has its own set of challenges.

Given the level of family involvement we’ve seen in patients’ diabetes self-management, we’ve come to realize that it may not be enough to simply train pediatric inpatient nurses in the mechanics of using insulin pumps. Effective training works best when it includes an experiential component that better prepares nurses...
to support a collaborative diabetes care relationship and family-centered care model in the acute care setting.

What we’re seeing at Children’s Hospital Boston. The outpatient diabetes program at Children’s Hospital Boston (CHB) estimates that approximately 35% of the pediatric diabetes population currently followed in clinic is on insulin pump therapy. This number is steadily increasing. As the safety of these devices has improved, more pediatric endocrinologists have supported transition to their use. Between October 2005 and September 2009, the inpatient volume of children at CHB on insulin pumps increased over 1000%, from nine unique patient admissions to 109 unique patient admissions. In addition, recovery room records from April 2008 through March 2009 show 73 patients with diabetes who required subcutaneous insulin; of these, 31 (42%) used insulin pumps as their home regimen—many of whom continued to wear their insulin pumps before, during, and immediately following surgery.

THE INSULIN PUMP PRACTICUM AT CHB
The inpatient diabetes program at CHB has developed from part-time coverage to a full-time, comprehensive, inpatient, interdisciplinary, consultative practice model. The program’s development has included expanded inpatient diabetes nurse educator (DNE) coverage and the creation of innovative education and training for patients and staff, quality improvement and patient safety initiatives, and community education.

The inpatient diabetes program has adapted an experiential training program to meet the needs of inpatient nurses throughout the hospital. The experiential learning concept for insulin pump training is adapted from both saline pump start programs for patients new to pumps and classes provided for community clinicians and educators learning about pump therapy prescribed to their patients. The inpatient training program identified the following initial goals:

- to improve patient and family satisfaction using a collaborative family-centered care model to support continuity of home insulin pump therapy during hospitalization
- to meet the identified education needs of inpatient nursing staff while continuing to provide safe care for the hospitalized child on an insulin pump

To further promote patient safety, the inpatient diabetes program has developed a patient care policy on insulin pump therapy, a collaboration letter to inform patients and families of staff responsibilities related to management of insulin pumps during hospitalization, and electronic documentation and order sets for all insulin delivery.

Implementation. A pilot training program was initiated in September 2006, with a small group of inpatient nurses participating. The program was developed to educate nurses on the care of patients with diabetes using insulin pumps, including the insulin delivery system, pump programming, and the medical management of diabetes using insulin pumps. The program was designed to provide nurses with the knowledge and skills necessary to safely and effectively manage patients with insulin pumps in the hospital setting.

Exemplar 2. Carla Odiaga, MSW, BSN, RN, LCSW, CPN; Inpatient Medicine

The whole thing started when I responded to a request for volunteers to become insulin pump “super users” of a sort, since we were seeing insulin pumps more often on our unit. In class, I was guided through the process of figuring out my correction factor and carbohydrate ratio—an exercise which made these numbers really make sense to me for the first time. We each used our own values to program our first pump. We practiced some settings, set our basal rates, gave ourselves normal saline boluses, and received instructions about simulating various common diabetic scenarios, including low or high blood sugar, testing for ketones, and sick day management. We were to pretend we had type 1 diabetes—doing finger sticks at least four times a day and applying carbohydrate ratios and corrections appropriately. What follows are some summarized excerpts from the journal I kept.

I was thinking about how irritated I felt about having to wear this pump for a while, even though I knew it was a temporary thing, and how resistant I felt even after realizing I had volunteered to do this. I can barely imagine what it would be like to have this sprung on me uninvited! And to have it be forever! I have the advantage of being a little older, and have some experience with managing changes, knowing I’ve been able to adjust to difficult things before. I can’t imagine how I might have reacted if I were diagnosed at 14, for example. . . .

It turns out that there’s a lot to carry around! And it’s better to have it all with you, just in case. I unexpectedly ran into a friend while I was out this morning and was “unable” to join her for lunch. I’d been out for a few hours, didn’t have my glucose meter or carbohydrate-counting book with me, and even if I could give myself a pump bolus, I wouldn’t know how much insulin it should be.

Although I volunteered to learn more about insulin pumps to be a greater resource to other nurses, in the end, I think I learned some things from the experience of being on the pump that will help me be a better nurse to many of my patients as well.
of nurses from three different inpatient units that typically have a higher volume of patients with diabetes. With the goal of maintaining all admitted patients on their home insulin pumps, we initially assigned patients who were admitted on insulin pumps to one of these three units. As the volume of patients using pumps increased, along with the complexity of these patients’ medical and surgical needs, assigning patients to just these units was no longer feasible.

With the support of the staff development department, the inpatient diabetes program expanded the insulin pump training to make it accessible to all inpatient and specialty area nurses throughout the institution. The DNEs have developed the content and educational materials for the classes, which are offered quarterly with nursing contact hours. Since the training requires a considerable commitment, enrollment is encouraged but still voluntary. Nevertheless, since the program’s expansion in 2007, the quarterly classes have been fully enrolled.

What participants learn. The didactic content of the practicum is provided in eight hours over two days and incorporates the following objectives:
• to provide the bedside nurse with the basic concepts behind insulin pump technology along with sufficient skills to safely manage insulin pumps in the inpatient setting
• to develop unit-specific nursing resources to provide continuity and support the care and management of patients with diabetes on insulin pumps throughout the hospital
• to enhance the nurse’s knowledge and connection with the patient by simulating the patient experience

The training includes an overview of insulin therapy options, specifics of insulin pump therapy, nursing responsibilities for inpatient care, assessment and documentation, troubleshooting skills, hands-on demonstrations, pump self-insertion, and time for practicing other diabetes self-care skills. Insulin pumps filled with saline are inserted subcutaneously and participants wear the pumps, check their blood glucose levels, count carbohydrate intake, administer bolus doses of saline, and document their self-care on a daily log sheet.

Participants experience this approximation of “living with diabetes” for up to a week, incorporating diabetes management into both their work and home schedules. Often, as suggested by the three first-person accounts by training program participants that accompany this article (see Exemplars 1, 2, and 3; exemplars are written by every staff RN as part of their annual review process, and these accounts are used with the authors’ permission), the experimental component of the training made the greatest impression on participants and provided them the deepest insight into what type 1 diabetes self-care really involves.

Exemplar 3. Debra Walton, MBA, BSN, RN, CPN; Postanesthesia Care Unit

There’s been a significant increase in the number of patients with diabetes cared for on the PACU. Since most PACU nurses had expressed a concern with their lack of knowledge and skills about newer approaches to diabetes management, I identified five nurses to become the diabetes resource team on the PACU.

This team received extra training on current approaches to diabetes treatment. Each nurse took the insulin pump practicum offered by the DNEs, in which the nurses wore two different insulin pumps (receiving saline instead of insulin) for several days. Our goal was to increase their understanding of current diabetes management, carbohydrate calculations, correction dosing for elevated blood sugars, and the functionality of two insulin pumps. The nurses gained a better appreciation for what the patient and family must manage daily. They also felt more proficient regarding care and more appreciative of patient and family participation and the fact that each patient manages this condition differently.

When available, this team of nurses is responsible for patients with diabetes on the PACU. Their care is very specialized and individualized, which can make it hard for nurses to maintain proficiency in all the duties required of PACU nurses. To address this issue we have limited our diabetes resource team to five to six members, who partner with the DNEs in caring for recovering patients with diabetes and who also keep up their proficiency as the management of such patients continues to change. Other PACU nurses with an interest in diabetes are also encouraged to take the insulin pump practicum, thereby ensuring that we have a staff with advanced education in this patient population.

EVALUATION

The insulin pump practicum has been offered hospital-wide since the fall of 2007; currently 97 participants, representing three disciplines across seven nursing programs, have completed the training. Ongoing program evaluation measures three key factors, including...
• tracking insulin medication errors related to insulin pumps in order to evaluate whether the knowledge and skills provided are sufficient for safe management of these pumps in the inpatient setting. Although the number of patients using insulin pumps has steadily increased, the number of documented medication errors involving insulin pumps among inpatients

ongoing development of unit-specific resource staff to offer shift support. For example, the postanesthesia care unit limits the number of staff nurses trained in insulin pump management to less than 10. These nurses are scheduled to cover all shifts; because their numbers are limited, they see more volume and keep their skills current.

Looking forward

Efforts to maintain staff knowledge about insulin pump use are ongoing and include

• an online NetLearning insulin pump module for quick and easy review.

Although insulin pump use at CHB has increased, errors involving insulin pumps have decreased.

at CHB has decreased: in 2008, there were nine; in 2009, six; and in 2010, only two.

• assessing patient and family satisfaction in the continuity and quality of care related to diabetes management in order to understand how patients and families feel about the improvement efforts. Although we’d planned to survey families, we have no formal data collection tool in place as yet, and have relied largely on verbal anecdotal results from patient and family feedback, most of which has been quite positive.

• assessing participating staff satisfaction and perception of enhanced knowledge and skills. Class evaluations have been consistent, with more than 90% of participants reporting an increased comfort level and ability to apply this experiential knowledge in the care and management of inpatients using insulin pump therapy.

Looking forward

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• an online NetLearning insulin pump module for quick and easy review.

• sorting patients on insulin pumps to units on which more resources exist to support insulin pump management and more nurses have been trained in such management. For example, of the four general medicine units at CHB, only two will regularly admit patients on insulin pumps. The same is true of the general surgical units.

• expanded DNE coverage to provide daily consults for patients on insulin pumps and the staff responsible for their care.

Nurses often best acquire new skills and become comfortable with them through a variety of learning formats, including hands-on demonstration and direct experiential exercises. The training program we’ve described in this article gives nurses a deeper, more nuanced understanding of diabetes management and the role and use of technology such as the insulin pump. As evidenced by training program evaluations and by participant exemplars such as those accompanying this article, nurses have found that their increased knowledge and skills have helped them to better understand the challenges of families living with diabetes, more easily connect with families, and provide families with higher quality of care. Ultimately, such benefits make nurses themselves more satisfied with their work. ▼

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References


