

# Hypoglycemia Management Using a Bundled Care Approach

## A Quality Improvement Project

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2.0  
Contact  
Hours

### ABSTRACT

**Background:** Hypoglycemia is a leading cause of preventable hospitalization, and can increase morbidity, mortality, and length of hospital stay. Up to 35% of diabetic patients experience severe hypoglycemia during hospitalization; this concerns veterans, as 25% have been diagnosed with diabetes.

**Local Problem:** A medical-surgical unit in a Veterans Affairs facility saw increased hypoglycemic episodes, with 26.8 episodes per 1000 patient days. Staff noted knowledge deficits with how to manage hypoglycemia episodes.

**Methods:** A pre-/post-implementation quality improvement project was conducted over 8 weeks.

**Interventions:** An implementation bundle was used to improve hypoglycemic episodes, including patient and staff education, coordination between meal delivery and insulin coverage, and developing a hypoglycemia protocol.

**Results:** Hypoglycemia rates significantly decreased to 10.27 per 1000 patient days ( $P = .001$ ), and occasions where insulin was given with food increased significantly to 76.2% ( $P < .001$ ).

**Conclusions:** A bundled approach was effective in decreasing hypoglycemia episodes and improved consistent management of hypoglycemia.

**Keywords:** education, hypoglycemia, intervention, patient education, quality improvement

Hospital-acquired hypoglycemia is a significant complication affecting hospitalized patients with diabetes. A blood glucose of less than 70 mg/dL is considered clinically significant hypoglycemia.<sup>1,2</sup>

Complications associated with hypoglycemia vary but can include seizure, loss of consciousness, altered T-wave morphology, increased coagulation, inflammation, atherothrombotic responses, endothelial dysfunction, and death.<sup>3,4</sup> Hypoglycemia can increase mortality by 7% compared with nonhypoglycemic patients, and up to 35% of diabetic patients experience severe hypoglycemia during hospitalization.<sup>5</sup> Hypoglycemia can directly and indirectly impact the patient, family, facility, and community both financially and psychologically.<sup>6</sup> One in 4 veterans

is diagnosed with diabetes.<sup>7</sup> Therefore, the risks of hypoglycemia are high among veterans. This project was implemented in a Veterans Affairs (VA) hospital acute care unit, where an average of 25 to 30 hypoglycemia episodes occurred per month. These many episodes were a cause for concern and required intervention.

Management of hypoglycemic episodes requires an interdisciplinary approach, including nurses who can anticipate and manage episodes. When hypoglycemia is poorly managed, patient length of stay can increase by as many as 3 days, adding further risk for infection and financial burden for patients.<sup>5</sup> A multi-pronged approach or bundle is recommended to decrease hospital-acquired hypoglycemia.<sup>2,5,8-11</sup> Using SQUIRE guidelines,<sup>12</sup> this article describes the implementation of a bundled approach to care for patients at risk for hypoglycemia in a VA hospital.

### AVAILABLE KNOWLEDGE

A careful search of the literature revealed themes in hypoglycemia management that were used to comprise the bundle used in this project. The themes were: the importance of using standardized treatment protocols,<sup>6,10</sup> the value of educating patients about warning signs of hypoglycemia as a preventive intervention,<sup>10-16</sup>

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educating nurses to identify high-risk patients for hypoglycemia proactively,<sup>5,8-11</sup> and ensuring coordinated meal delivery and nutritional insulin coverage.<sup>5,8,10</sup>

Standardized treatment protocols have improved the early detection and management of severe hypoglycemic episodes, leading to reductions in incidence and inpatient mortality rates.<sup>8,10</sup> Maynard et al<sup>10</sup> recommended that hospitals invest in mentoring staff and using protocol-driven order sets to standardize care. Standardization helps avoid unnecessary delays in treatment, leading to faster euglycemia (blood glucose > 100 mg/dL) levels and improved finger stick recheck times. Impaired patient awareness is another main contributor to hypoglycemia.<sup>15</sup>

Therefore, educating patients about the warning signs of hypoglycemia is essential to prevent hypoglycemia. A multicenter 30-year nonexperimental study called the Diabetic Control and Complications Trial and the Epidemiology of Diabetes Intervention and Complications confirmed the benefit of targeted patient education to reduce hypoglycemia.<sup>13</sup>

Nurses' knowledge to anticipate hypoglycemia episodes based on individual patient's risk factors is another essential element to prevent hypoglycemia.<sup>5,8,10,13,16</sup> Therefore, the education of nurses was a critical component of the hypoglycemia prevention bundle. Lack of coordination in meal delivery and insulin administration accounts for most of hypoglycemia episodes in inpatient settings.<sup>5,10</sup> Prolonged fasting or the inability to have sufficient nutritional intake is common in acute care settings. Thus, hypoglycemia prevention must include a strategy to ensure coordination between meals and insulin delivery to prevent hypoglycemia.

## RATIONALE

On average, between 25 and 30 hypoglycemia episodes occurred per month on this unit, which was significant and required intervention. The Institute of Healthcare Improvement (IHI) recommends a "bundled" approach, or multiple small, evidence-based interventions used together to improve patient outcomes.<sup>17</sup> The facility lacked updated processes and policies related to hypoglycemia prevention and management, and the staff had a knowledge deficit in identifying individual patient risk factors for hypoglycemia. Patients frequently experienced rebound hyperglycemia due to overtreatment

during a hypoglycemia episode, which was attributed to a lack of standardized processes and follow-up of blood glucose. Further complicating matters, meal deliveries were not coordinated with scheduled insulin doses. These findings guided the author to bundle interventions as delineated by the IHI.

## SPECIFIC AIMS

This project aimed to implement an evidence-based hypoglycemia management bundle to standardize practice and improve the detection and management of hypoglycemia episodes. The specific aims were to:

1. Reduce the number of hypoglycemic episodes per month,
2. Increase the proportion of patients and staff educated about hypoglycemia signs and symptoms as well as risk factors,
3. Increase the frequency with which the hypoglycemia protocol was initiated,
4. Increase the proportion of 15-minute blood glucose recheck after an intervention, and
5. Increase the proportion of patients who received insulin with food.

## METHODS

This project was implemented in an acute care medical-surgical unit with 31-beds. This is a high-acuity unit due to the complexity of the patient population. Approximately 75% are surgical patients. The unit cares for patients with diverse diagnoses, including diabetes, heart failure, hypertension, orthopedic problems, and different cancers. The population of this project included patients and staff. There were approximately 50 registered nurses, with an average age of between 43 and 48 years and an average of 15 to 20 years of nursing experience. The nursing staff also included 2 licensed vocational nurses and 20 nursing assistants. Most patients on the unit were male, with an average age of 67 to 77 years.

## Framework/model

This project was guided by the knowledge-to-action (KTA) framework, which includes 2 components: knowledge and action cycles. Each cycle has phases that may overlap and can be iterative.<sup>18</sup> In the knowledge cycle, one finds the best evidence for an intervention. The action cycle includes a clear direction to implement the

project. The KTA framework also requires identifying barriers to implementation and strategies to overcome those barriers. Outcomes were evaluated using structured data collection. Ongoing monitoring of the project's sustainability was also part of this project, as delineated by the KTA framework.

## Intervention

The interventions were selected based on the identified deficiencies within the unit. A survey among staff, electronic health record (EHR) review, and individual face-to-face communications were used to identify the deficiencies. A bundled approach was adopted based on IHI recommendations. The bundle included 4 components:

1. Education to patients about hypoglycemia signs and symptoms
2. Education to nurses on how to anticipate or prevent hypoglycemic episodes based on patients' risk factors
3. Use of a protocol and special attention to blood glucose 15 minutes after an intervention to correct hypoglycemia
4. Ensuring that meal delivery and nutritional insulin coverage were coordinated

## Measures

Outcomes were assessed based on data 8 weeks before and 8 weeks after implementing the project. The preimplementation was from May 3 to June 27, 2021; implementation was from June 28 to July 4, 2021; and postimplementation was from July 5 to August 2021. Total hypoglycemia episodes were extracted from the EHR. Outcomes of the individual components of the bundle were measured using the following:

1. Documented evidence in the EHR that the patient was provided with the information on early warning signs of hypoglycemia,
2. Care plans related to hypoglycemia documented in the EHR reflect the nurses' knowledge to identify the risk factors of hypoglycemia in individual patients,
3. Documented evidence in the EHR on the use of the protocol guiding the nursing staff to recheck blood glucose 15 minutes after an intervention to correct hypoglycemia, and

4. Documented evidence of coordination between meal tray delivery and time of insulin administration in the EHR.

## Overcoming barriers

The primary problem to be resolved for this project was the lack of coordination between scheduled insulin administration and food intake. The main barrier was the lack of a sufficient supply of bedtime snacks, especially over the weekend and night shift. Nurses were forced to administer insulin without the proper nutrition available to prevent hypoglycemia. An interdisciplinary meeting with the nutrition service helped the unit change their supply orders to ensure adequate snacks to offer with insulin doses. The nutrition department agreed to monitor the supply and demand of the unit closely. In addition, the unit created a hypoglycemia kit as a backup for times when no food or snacks were available. This kit contained nonperishable food and drinks that the charge nurse managed. Finally, the evening and night supervisors were notified that they could order meal trays or snacks for late-night admissions. These small changes resulted in a dramatic improvement in coordinating mealtimes with insulin administration.

To address the barrier of staff knowledge deficit, the first week of the project was dedicated entirely to staff education. Education included content on hypoglycemia risk factors, symptoms, management, and prevention strategies. Education was done through electronic media, interactive educational sessions, formal and informal system reminders, and systematic efforts to encourage the adoption of the project through leadership support. Education was provided to staff on each component of the bundle. Champions and the project lead were available throughout the project as a resource. Daily huddles and one-to-one interaction were the most used methods for ongoing education and project monitoring. To address the barrier of the patient's knowledge deficit, patient education was provided upon admission and as needed with printed materials and electronic media as preferred by individual patients.

## Analysis and ethical considerations

Nominal data were collected 8 weeks pre- and post-implementation using an audit tool. The audit tool included each component of the bundle

and the number of hypoglycemic episodes. Data were analyzed using the  $\chi^2$  and Poisson exact test. This project was approved by the health system’s Institutional Review Board.

RESULTS

After implementation, there was a significant decrease in hypoglycemic episodes from 26.78 to 10.27 episodes per 1000 patient days,  $P < .001$ . The frequency with which patients received education increased from 0.5% ( $n = 2$ ) to 100% ( $n = 411$ ),  $P < .001$ . Initiation of the hypoglycemia protocol increased from 9.4% to 82.4%,  $P < .001$ . The proportion of hypoglycemic episodes where a 15-minute blood glucose recheck occurred increased from 9.4% ( $n = 3$ ) to 82.4% ( $n = 14$ ),  $P < .001$ . For patients who experienced hypoglycemic episodes, there was a significant increase in documented occasions where insulin was given with food, from 0.7% ( $n = 2$ ) to 76.2% ( $n = 128$ ),  $P < .001$  (Table).

DISCUSSION

Patient education was provided through electronic media and by utilizing printed materials. A systematic review<sup>5</sup> and a 30-year nonexperimental study<sup>13</sup> confirm the benefits of patient education to prevent hypoglycemia. Patient education as part of a bundled approach is established by other research as well.<sup>10</sup> We observed reduced hypoglycemic episodes after patient education was implemented. We did not validate that each patient actively viewed or read the materials provided. Future projects might involve a form of validation of the efficacy of patient education so that optimal methods can be used.

Staff education in anticipating hypoglycemia by identifying individual risk factors and clear guidance to manage hypoglycemia once it occurs is an integral part of hypoglycemia prevention and management.<sup>5,8-13,19</sup> The author also found staff anticipation of hypoglycemia based on the

individual risk factors was very helpful in preventing and managing hypoglycemia.

Rechecking blood glucose is essential to prevent secondary hypoglycemia or hyperglycemia, followed by an intervention,<sup>16</sup> a finding that was affirmed in this project. The requirement for a 15-minute blood glucose recheck initially caused some confusion among staff because of an institutional policy requiring staff to immediately recheck any critical blood glucose level ( $<50$  mg/dL), which is in place to validate glucometer accuracy. Some staff mistakenly thought the immediate recheck was a suitable replacement for the 15-minute recheck. This problem was addressed with ongoing staff education. Our finding that assuring adequate nutrition before delivering insulin aligns with the current literature.<sup>5,10</sup> Keeping an emergency hypoglycemia kit was simple and inexpensive and could be implemented in any setting.

Limitations

This project had limitations. The project was only evaluated 8 weeks post-implementation; a longer follow-up period may yield different results. Additionally, this was conducted at 1 unit in a single hospital system, which may limit its generalizability.

CONCLUSIONS

Hospital-acquired hypoglycemia is a significant complication affecting diabetic patients during their hospital stay. This project implemented a hypoglycemic bundle focused on educating patients and nurses, using a hypoglycemia protocol, and ensuring a coordinated effort for meal delivery. Implementing this bundle led to a significant reduction in hypoglycemic episodes. Other units and institutions should consider implementing a similar bundle to improve outcomes in patients with diabetes.

Table. Overview of Outcome Measures				
Outcome	Preimplementation	Postimplementation	$\chi^2$	$P$ Value
Hypoglycemia episodes per 1000 patient days	26.78	10.27	...	.001
Patient education	0.5% (2/371)	100% (411/411)	774.02	<.001
Protocol initiated immediately	9.4% (3/32)	82.4% (14/17)	...	...
15-min blood glucose recheck	9.4% (3/32)	82.4% (14/17)	26.10	<.001
Insulin given with food	0.7% (2/294)	76.2% (128/168)	301.46	<.001

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