Pragmatic Innovations in Post-Acute and Long-Term Care Medicine
Feasible new, practical products or approaches intended to improve outcomes or processes in post-acute or long-term care

A Successful Diabetes Management Model of Care in Long-Term Care Facilities

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A B S T R A C T

The management of diabetes in long-term care (LTC) facilities requires facility staff to perform most self-care activities on the behalf of the residents. A practical model of care to improve diabetes management was developed and implemented at 6 LTC facilities in the Northeast United States between 2009 and 2012. The components of the program included (1) developing an individualized education curriculum and educating LTC interdisciplinary staff; (2) educating patients and caregivers; and (3) developing a clinical care algorithm. Over 500 staff members were educated and achieved competence. There were 1031 residents screened for risk of hypo- or hyperglycemia on admission, and 245 residents (24%) experienced hypoglycemia and 240 residents (23%) experienced hyperglycemia. Hypoglycemia episodes resolved without recurrence in 73%-90% cases because of interventions initiated by LTC staff. The implementation of a practical model of diabetes management in LTC facilities can improve staff education and lead to improved diabetes management.

Keywords: Diabetes management program, diabetes education, long-term care

The prevalence of diabetes in long-term care (LTC) facilities is estimated to be 26.4%, with a cost of 18.6 billion dollars in 2013.[1,2] Patients residing in LTC are usually dependent on the facility staff for their diabetes self-management tasks including medication management, insulin dosing and injections, insulin-carbohydrate matching, and physical activities.[3] Recently, several guidelines for diabetes management in LTC have recommended better education of the staff members.[4–7]

In this article, we describe a practical model of care that included developing and integrating individualized education for different interdisciplinary staff members at LTC, and established a clinical care algorithm to manage diabetes in 6 LTC facilities. We also developed a patient and caregiver education program.

Innovation

Six LTC facilities in northeast United States contracted with a tertiary care diabetes center to develop and implement Diabetes Specialty Services in LTC (subacute and nursing home) settings between 2009 and 2012.

Implementation

The key components of the program were as follows:

Education for the Diabetes Management Team

A specific curriculum was developed for each member of the LTC multidisciplinary team as shown in Table 1. Each facility designated a full-time diabetes care coordinator (DCC) with nursing background to lead this program. A certified diabetes educator from the diabetes center provided in-house training for the DCC along with all the educational materials and protocols.[8] Competency assessments were performed using test material created by the diabetes center at the beginning of the program and annually thereafter to ascertain minimum standards for all LTC staff. Clinician education for physicians, nurse practitioners, and clinical pharmacists at the LTC included an annual continuing medical education session led by a geriatric diabetologist with a focus on the unique challenges faced by older adults with diabetes and to provide an update on clinical guidelines.

Education for Patients and Caregivers

The DCC provided individualized diabetes education sessions to patients and their caregivers during their stay at the LTC facility and at discharge.

Clinical Care Management

All residents with a diagnosis of diabetes underwent an initial screening to assess the risk of hypoglycemia and hyperglycemia at

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Table 1
Individualized Education Topics Specific to Discipline

Staff	Topics Covered
All staff	• Why diabetes is a priority and the goals of the diabetes specialty services program • Signs and symptoms of hypoglycemia and hyperglycemia, and how older adults may present differently • The role of the Diabetes Care Coordinator • Shared responsibility for success of the program
Diabetes Care Coordinator	• Types of diabetes • Individualized glucose targets • Impact of food, physical activity, and medications on blood glucose • Glucose monitoring frequency • Treatment of hypoglycemia and hyperglycemia • Diabetes medications (orals, injectables, insulins), mechanisms of action and side effects • Education strategies for patients, families, and other staff members • Other community resources to improve diabetes management • Individualized discharge plans
Nurse	• Types of diabetes • Individualized glucose targets • Causes and intervention strategies for hypoglycemia and hyperglycemia • Diabetes medications (orals, injectables, insulins), mechanisms of action and side effects • Education strategies to teach insulin administration, safety precautions, glucose monitoring, sick day management, and foot care to patients
Certified Nursing Assistant	• Recognizing hypoglycemia symptoms and reporting per protocol • Routine diabetes foot care and reporting problems per protocol • Recognizing and reporting skin and dental problems • Encouraging and assisting with physical activity • Recording patient's carbohydrate intake
Dietician	• Developing meal plans that meet nutritional needs and satisfy patient preferences while taking into account diabetes medications • Types of diabetes • Individualized blood glucose targets • Meal plan strategies for patients with gastroparesis • Education strategies to teach patients and families about reading food labels
Physical Therapist	• Assessment of patient's balance and falls risk, and thorough foot assessment • Education strategies to teach patient importance of ongoing exercise

the time of admission to the facility. An algorithm for glucose monitoring was developed based on the initial risk assessment (Figure 1). Patients were considered at high risk if they answered "yes" to any of the risk factors (Table 2). The patients considered "high risk" were monitored more closely by performing frequent glucose checks (4 times a day) and conducting oral intake assessment for 5 days during their first week of admission. A data collection form was developed to monitor either an episode of hypoglycemia [fingerstick blood glucose <70 mg/dL (3.9 mmol/L)] or hyperglycemia [3 consecutive fingerstick blood glucose readings above 200 mg/dL (11.1 mmol/L]. Nursing staff members filled out a form that included the most likely reasons for hypoglycemic or hyperglycemic episodes, and intervention strategy based on the causes (Supplementary Table 1).

Evaluation

Over 500 members of the interdisciplinary team were educated about diabetes topics relevant to their fields of practice and achieved competence. The DCCs provided on average 12.5 education sessions per month for patients and caregivers in skilled nursing facilities, and 1.5 education sessions per month in nursing homes.

A total of 1031 residents were screened at admission. The residents in the in skilled nursing facilities comprised 45% to 86% of the cohort. There were 245 residents (23.8%) that experienced ≥1 episode of hypoglycemia and among them, 77 residents (31.4%) had their first episode of hypoglycemia <2 weeks of admission. Of those 245 residents, 66.5% had 1 event, 15.5% had 2 events, 7.8% had 3 events, 3.3% had 4 events, 2.4% had 5 events, and 4.5% had ≥6 events of hypoglycemia (Figure 2). There were 240 residents (23.3%) that experienced ≥1 episode of hyperglycemia and among them, 70 residents (29.2%) experienced their first episode of hyperglycemia <2 weeks of admission. Of those 240 patients, 63.7% had 1 event, 17.9% had 2 events, 7.9% had 3 events, 4.2% had 4 events, 1.7% had 5 events, and 4.6% had ≥6 events of hyperglycemia. The most common cause of either hypoglycemia or hyperglycemia was medication-related, and hypoglycemia episodes resolved in 73%–90% of cases without recurrence. Additional information about the causes of hypo and hyperglycemia are shown in Supplementary Tables 2–6.

Comments

We describe a novel practical model of care to improve diabetes management in LTC. The model focuses on individualized education of LTC staff on diabetes care in older adults and provides practical tools for clinical management that can be integrated into their protocols. The implementation of this model of care provided improved risk screening, targeted glucose monitoring, and early interventions to reduce and prevent episodes of hypoglycemia and hyperglycemia. It also increased the knowledge and confidence of healthcare providers, LTC staff, and educated patients and their caregivers.

Various guidelines and frameworks have recommended education of LTC staff in regard to diabetes management, especially understanding how different medications and insulins work,

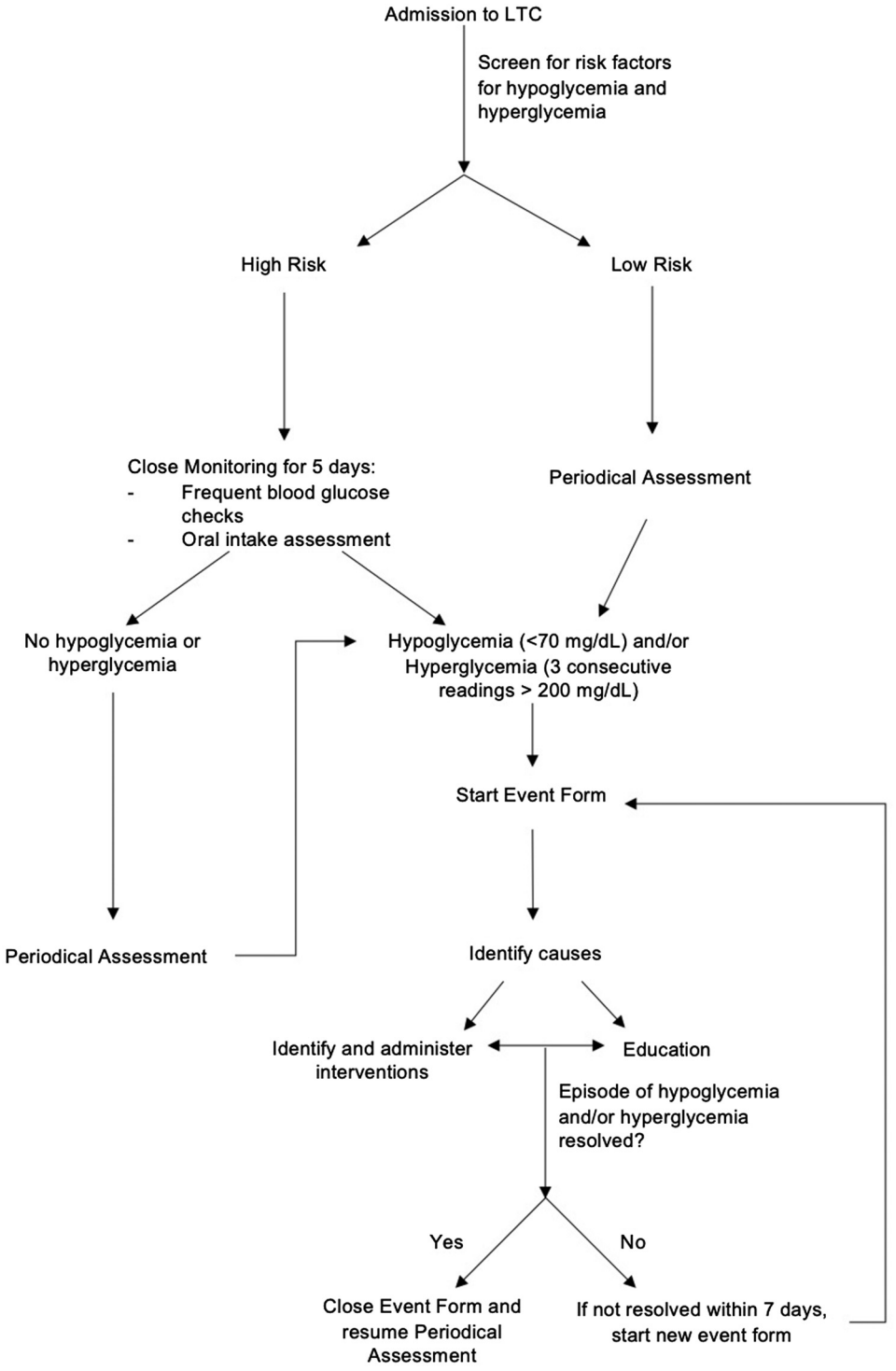

Figure 1. Clinical care algorithm for diabetes management. A downloadable PDF of this form is available at www.sciencedirect.com.

Table 2
Screening for Risk Factors for Hypoglycemia and Hyperglycemia on Admission to LTC

Risk Factors	Yes	No
HbA1c >8%		
HbA1c <6.5%		
Therapy with basal insulin		
Therapy with bolus insulin		
Use of sliding scale		
Insulin pump therapy		
Recurrent hypoglycemia or history of hypoglycemia unawareness		
Recurrent DKA or HHS or hyperglycemia requiring hospitalization		
History of large swings in blood glucose		
Current foot ulcer or poorly healing wound		
Current steroid therapy		
Current infection		
Tube feeding or parenteral nutrition		
Potentially inappropriate prescribed medications		
History of cardiovascular disease		
Chronic kidney disease or on dialysis		
Cognitive impairment		
Poor functional status		

DKA, diabetic ketoacidosis; Hb, hemoglobin; HHS, hyperosmolar hyperglycemic state.

individualized glucose goals, and managing glucose variability. However, the feasibility of implementing the recommendations can be difficult in LTC facilities.[7] The baseline knowledge of diabetes-related care is known to be variable among LTC staff.[9] Rapid turnover of the staff members presents another barrier and needs cyclical education plans.

The successful implementation of this program was dependent on several factors. First, the participating facilities recognized the need and invested resources to improve the care for older adults with diabetes. Next, nursing home leadership, administration, and staff showed a vested interest in the program and worked hard for improvement. Finally, the ease of access, and the regular collaborative meetings between the LTC facilities and the diabetes center to provide support were critical. Although in our study, this collaboration was performed locally, recent rise of long-distance virtual education programs can be used to support nursing homes in remote areas.[10]

We found that the majority of hypoglycemic episodes occurred during the first 2 weeks of admission. Therefore, screening for high risk patients at the time of admission to LTC facility and identifying prevention strategies for hypoglycemia and hyperglycemia based on risk factors can be an important step in this program. We avoided dependence on A1C as the outcome as A1C is not a reliable measure of glycemic control in frail nursing home patients, many of whom have recent acute illness or hospitalization.[4]

The limitation for this article includes lack of benchmark data before this program was initiated at the LTC facilities. As this program was not intended to be a research study, the data was collected by clinical care providers and staff, and may have resulted in missing some data points. However, this is also the strength of our article as it provides feasibility in the “real world” scenario. We also identify some potential barriers to implementing the program that include lack of nursing home leadership and support, lack of funding, and high staff turnover. It is important to recognize that this program can still be implemented without contracting with a diabetes center by using resources described in this article (and Supplementary materials) and having strong LTC and clinical leadership.

In summary, our model of care demonstrates that diabetes education and policy implementation can be adapted to the LTC setting to improve care and education. Future prospective studies are needed to assess if such diabetes management programs integrated into LTC facility protocols can improve outcomes compared with usual care.

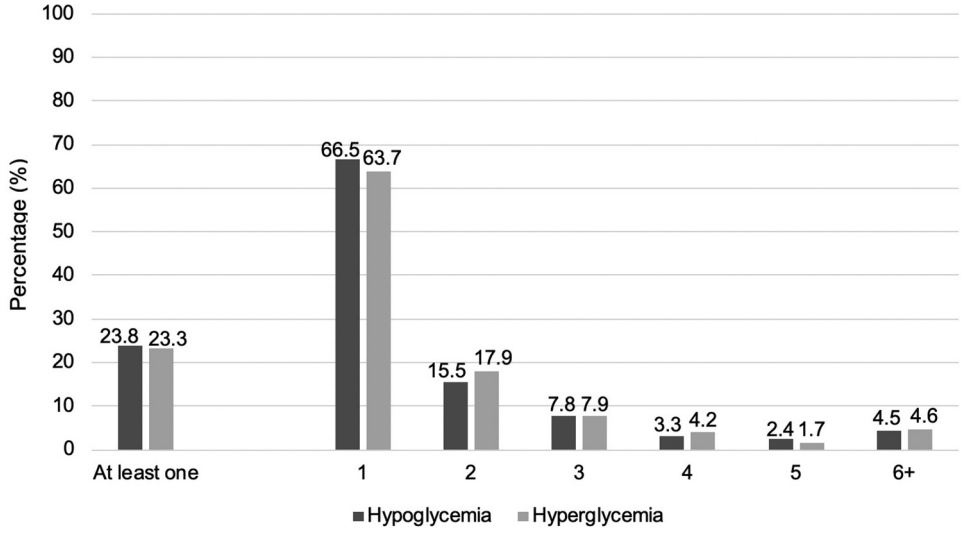

Figure 2. Percentage of hypoglycemic and hyperglycemic episodes in 6 long-term care facilities from 2009 to 2012.

References

1. Travis SS, Buchanan RJ, Wang S, Kim M. Analyses of nursing home residents with diabetes at admission. J Am Med Dir Assoc 2004;5:320–327.
2. Neuwahl S, Honeycutt AA, Poehler DC, et al. Diabetes-attributable nursing home costs for each U.S. state. Diabetes Care 2018;41:1455–1461.
3. Lekarcyk JA, Himmel L, Munshi M. Blood glucose monitoring and underlying question of hypoglycemia are both essential to preventing hypoglycemia in nursing home residents. Clin Diabetes 2013;31:28–30.
4. Munshi MN, Florez H, Huang ES, et al. Management of diabetes in long-term care and skilled nursing facilities: A position statement of the American Diabetes Association. Diabetes Care 2016;39:308–318.
5. LeRoith D, Biessels GJ, Braithwaite SS, et al. Treatment of diabetes in older adults: An endocrine society clinical practice guideline. J Clin Endocrinol Metab 2019;104:1520–1574.
6. Meneilly GS, Knip A, Miller DB, et al. 2018 Clinical practice guidelines: Diabetes in older people. Can J Diabetes 2018;42:S283–S295.
7. Sinclair AJ, Gadsby R, Abdelhafiz A, Kennedy M. Failing to meet the needs of generations of care home residents with diabetes: A review of the literature and call for action. Diabetes Med 2018;35:1144–1156.
8. Munshi M, Blair E, Ganda O, Gabbay RA. members of the Joslin Guidelines Committee. Guideline for the care of the older adults with diabetes. Am J Manag Care 2018;24:240–252.
9. Vincent C, Hall P, Ebsary S, et al. Knowledge Confidence and desire for further diabetes-management education among nurses and personal support workers in long-term care. Can J Diabetes 2016;40:226–233.
10. Bouchonville MF, Hager BW, Kirk JB, et al. Endo Echo improves primary care provider and community health worker self-efficacy in complex diabetes management in medically underserved communities. Endocr Pract 2018;24:40–46.

The pragmatic innovation described in this article may need to be modified for use by others; in addition, strong evidence does not yet exist regarding efficacy or effectiveness. Therefore, successful implementation and outcomes cannot be assured. When necessary, administrative and legal review conducted with due diligence may be appropriate before implementing a pragmatic innovation.

Supplementary Table 1
Example of Competency Checklist for the Nurse

Objectives	Completed
States blood glucose targets for patients with diabetes and actions to take when glucose outside of targets	
Differentiates type 1 from type 2 diabetes	
Recognizes diabetes medication options, rationale for use, contraindications, and major side effects	
Assess patient/family education needs based on teaching/learning concepts	
Demonstrates ability to teach/demonstrate patient insulin administration and safety precautions	
Demonstrates ability to teach/demonstrate patient glucose monitoring and glycemic goals	
Demonstrates ability to teach/demonstrate patient hypoglycemia recognition and treatment	
Demonstrates ability to teach/demonstrate knowledge of patient sick day guidelines	
Demonstrates ability to teach/demonstrate patient diabetes foot care	
Develops appropriate discharge plans for patients with diabetes	
Demonstrates ability to manage insulin infusion per protocol (if applicable)	
Score on post-test	

Supplementary Table 2
Possible Causes and Interventions to Address Hypoglycemia and Hyperglycemia

	Hypoglycemia		Hyperglycemia	
	Possible Causes	Interventions	Possible Causes	Interventions
Medication	• Too much basal insulin • Too much bolus insulin • Too much premixed insulin • Timing of insulin • Steroid taper without insulin adjustment • Too much oral agents • Medication administration error	• Adjust basal insulin • Adjust bolus insulin • Adjust oral agents • Simplify medication regimen if patient refuses injections or monitoring • Educate staff on avoiding medication error • Adjust medications for short trial period	• Refusal to take oral or insulin dose • Steroids • Too little basal or premixed insulin • Too little bolus • Inadequate oral agents • Medication error	• Start/adjust basal insulin • Start/adjust bolus insulin • Start/adjust oral agent • Simplify medication regimen • Educate staff on avoiding medication error
Activity	• Increased activity without insulin adjustment • Irregular activity pattern	• Adjust dose of medication for change in activity • Monitor blood glucose during sustained routine activity • Add snack before or during activity	• Decreased activity without insulin adjustment • Irregular activity pattern	• Encourage consistent activity • Encourage increased activity • Adjust dose of medication for change in activity
Meal	• Decreased carbohydrate in meals • Decreased parenteral/enteral intake • Inappropriate mealtime • Skipped meal • Missing or refusing snack • Impaired swallowing • Decreased appetite	• Implement 3-d meal intake survey • Add appropriate snack • Change content of meal if possible, to patient's preferences • Coordinate timing of insulin and meals • Give insulin at end of the meal	• Increased carbohydrate content of meals • Inappropriate snacks • Inadequate insulin for parenteral/enteral feeding • High calorie, high carb drinks/supplements • Nonadherent to meal plan • Outside food	• Implement 3-day meal intake survey • Try consistent carbohydrate intake to avoid large glucose peaks • Educate family and caregivers regarding food brought into the facility • Replace high carb drinks and snacks with alternatives • Coordinate the timing of insulin and meals
Other	• Dialysis • Terminal illness • Significant life event or deterioration of chronic medical condition • Recent hospitalization • Unrealistic glucose target/goals • HbA1c <6.5% • Hypoglycemic unawareness	• Increase monitoring of blood glucose • Screen for cognitive dysfunction, low eGFR, depression, hepatic dysfunction • Adjust glycemic targets to appropriate values	• Dialysis • Acute illness or infection • Terminal illness • Unable to decrease hyperglycemia without hypoglycemia • Significant life event or deterioration in chronic medical condition • Family refusal of medications • Recent hospitalization	• Increase monitoring of blood glucose • Adjust glycemic targets to appropriate values

eGFR, estimated glomerular filtration rate; Hb, hemoglobin.

Supplementary Table 3
Possible Causes of 93 Hypoglycemic Events in 1 LTC Facility from 2009 to 2011

Possible Causes	Percentage (%)
Medication-related	
Too much basal insulin	46%
Too much premix insulin	3%
Too much bolus insulin	24%
Timing of insulin	1%
Too much of oral hypoglycemic agent	8%
Meal-related	
Decreased oral intake	23%
Decreased carbohydrate content in meal	17%
Missing snack	4%
Refusing snack	1%
Decreased appetite	4%
Activity-related	
Increased activity without adjusting insulin	1%
Other	
Recent hospitalization	5%
Dialysis	5%
Deterioration of chronic medical condition	3%
Hypoglycemia unawareness	1%

Supplementary Table 4
Interventions to Address Hypoglycemic Events in 1 LTC Facility from 2009 to 2011

Interventions	Percentage (%)
Medication-related	
Adjust basal insulin	55%
Adjust bolus insulin	34%
Adjust oral hypoglycemic agent	8%
Adjust meds for a short trial	1%
Meal-related	
Add snack	8%
Change meal to patient preference	12%
3-d Oral intake assessment	1%
Activity-related	
Add snack before or during activity	5%
Other	
Increase glucose monitoring	3%
Screen for depression	1%
Emergency department visit/hospitalization	1%

Supplementary Table 5
Possible Causes of 82 Hyperglycemic Events in 1 LTC Facility from 2009 to 2011

Possible Causes	Percentage (%)
Medication-related	
Too little basal or premixed insulin	44%
Too little bolus	21%
Not enough oral hypoglycemic agent	15%
Steroids	7%
Meal-related	
Snacks	11%
Outside food	4%
Parental or enteral feedings	5%
Nonadherence to meal plan	2%
Acute illness	
Infection	9%
Other	
Unable to decrease hyperglycemia without hypoglycemia	11%
Recent hospitalization	2%
Deterioration of chronic condition	5%
Terminal	1%
Dialysis	6%

Supplementary Table 6
Interventions to Address Hyperglycemic Events in 1 LTC Facility from 2009 to 2011

Interventions	Percentage (%)
Medication-related	
Adjust basal insulin	60%
Adjust bolus insulin	32%
Adjust oral hypoglycemic agent	24%
Simplify diabetes regimen	1%
Educate staff	1%
Meal-related	
Educate family	12%
Coordinate timing of meals, snacks, and diabetes medications	2%
Other	
Increase glucose monitoring	13%
Emergency department visit/hospitalization	6%