

In Brief

Multiple staff members and departments have a responsibility for various aspects of nutrition therapy for glycemic management in the hospital setting. Implementation is initiated by physicians, nurse practitioners, and physician's assistants and planned and operationalized by registered dietitians. Meals are delivered by food service staff, and nurses monitor and integrate glycemic control components into patients' medical treatment plan. Although nutrition therapy is recognized as an important aspect of care in the hospital setting, it can also be challenging to appropriately coordinate meals with blood glucose monitoring and insulin administration. This article addresses current mealtime practices and recommendations to improve these processes in acute care.

The Mealtime Challenge: Nutrition and Glycemic Control in the Hospital

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Management of diabetes and hyperglycemia has become an important quality care indicator in the hospital setting. Multiple health care organizations offer guidelines for glycemic control, including recommendations for medical nutrition therapy (MNT) and consistent-carbohydrate meal plans.¹⁻⁴ Additionally, the appropriate timing of nutrition delivery, point-of-care (POC) blood glucose monitoring, and insulin therapy in the hospital is recognized as a crucial step in the safe and effective care of patients.^{3,5}

Although these goals are essential to reducing harm and improving outcomes, how to achieve them can be a challenge for hospitals. A quality improvement approach with strong administrative support and a multidisciplinary steering committee is needed to improve the quality of patient care.^{2,3,6}

This article summarizes nutrition therapy goals and recommendations for glycemic control in noncritically ill, hospitalized patients; reviews the rationale for consistent-carbohydrate meal plans and liberalizing the "diabetic diet;" and describes successful mealtime practices to improve coordination of meal delivery with blood glucose monitoring and insulin administration. Results from an informal survey of inpatient diabetes educators and registered dietitians

(RDs) regarding current hospital meal service practices are also included.

Nutrition Therapy in the Hospital

MNT is a well-recognized component of diabetes management, and experts agree that it should be integrated into the glycemic management of hospitalized patients.^{1,2,4} MNT is the legal definition of nutrition counseling provided by an RD.⁷ The term applies to the nutrition care process, which includes assessment of nutrition status; provision of nutrition interventions such as diet modification, counseling, or specialized nutrition therapy; and monitoring and evaluation.⁸ RDs knowledgeable in glycemic management are the preferred health care team members to provide diabetes MNT.⁷ Because of limited hospital staffing of clinical dietitians, MNT provided by an RD is generally only available by consultation or to patients identified to be at high nutritional risk. The broader term "nutrition therapy" will be used in this article to include other aspects of nutrition care provided by various health care professionals during hospitalizations.

Glycemic control is the primary nutrition goal for hospitalized patients with diabetes. Additional nutrition therapy goals include promoting optimal caloric and nutrient intake to meet metabolic needs; aiding in recovery from illness, surgery, and disease; and allowing for food preferences related to patients' personal, cultural, ethnic,

Table 1. Key Nutrition Recommendations for Diabetes and Glycemic Control in the Hospital

Topic	Details
Nutrition therapy	Implementation of nutrition therapy improves the care of patients with diabetes and hyperglycemia during hospitalization. RDs who are knowledgeable about glycemic control are the preferred team members to provide MNT. ¹⁻⁴
Consistent-carbohydrate meal plan	<p>The consistent-carbohydrate meal plan is the established standard for hospitalized patients with diabetes and is useful to improve the accuracy of mealtime insulin administration.^{1,4}</p> <ul style="list-style-type: none"> • Evidence does not support the use of “no concentrated sweets” or “no sugar” diets. Sucrose-containing foods may be incorporated into a consistent-carbohydrate meal plan.⁷ • The “ADA diet” is not current practice and should not be used. It may unnecessarily restrict calories and patients’ preferred foods. Since 1994, ADA has not recommended a specific type of diet or macronutrient distribution.⁹
Liberalized diets	Inadequate nutrition intake is common in hospitalized patients. To improve oral intake and enhance patients’ satisfaction, liberalized diets without caloric restriction (e.g., a general diet with consistent amounts of carbohydrate), room service on demand, and increased availability of foods that meet personal, cultural, or religious food preferences have been implemented in some acute-care facilities. ⁹
Coordination of meal delivery	Diabetes educators and RDs are key interdisciplinary team members to improve coordination of meal delivery, insulin administration, and POC blood glucose monitoring to optimize glycemic control. ¹⁰

and religious beliefs. Additionally, an individualized discharge plan should be developed for self-management training and follow-up.^{1,3,4} Key recommendations for meal planning to meet patients’ nutrient requirements and improve glycemic control in the hospital setting have been identified (Table 1).^{1-4,7,9,10}

Consistent-Carbohydrate Meal Planning

Because of the limited available evidence identifying ideal meal plans for hospitalized patients, expert consensus has been the basis for current recommendations. Because carbohydrate intake provides the primary nutritional effect on blood glucose, consistent-carbohydrate meal planning has evolved as the accepted standard for glycemic control. These meal plans offer a practical method of serving food to patients, while potentially improving glycemia. Specific calorie levels are not recommended; rather, a consistent amount of carbohydrate is offered at meals and snacks from day to day. For convenience of implementation, many facilities provide consistent-carbohydrate meal plans with specific calorie levels that may not address the actual caloric needs of a given patient. To meet nutrient requirements, the majority

of carbohydrate offered should be from whole grains, fruit, legumes, vegetables, and low-fat dairy foods, when possible.

Sucrose-containing foods can be offered on this meal plan, and including them may help an individual meet caloric intake goals and provide for individual food preferences.¹¹ Misunderstanding of the inclusion of sucrose-containing foods remains common. Some patients, providers, and hospital staff may think that patients are not on a “diabetic diet” unless sucrose is restricted. Additionally, patients and families may lack understanding of the meal plan, potentially leading to excesses in calorie and carbohydrate intake from foods brought in from outside the facility or further restriction when well-meaning family members remove food from the meal tray.

Strategies for success with consistent-carbohydrate meal planning

A key teaching point for hospital staff is that the amount of carbohydrate eaten, rather than the sugar content or the percentage of the meal eaten, has the greatest impact on blood glucose. If the only parameter monitored at the facility is the percentage of the meal eaten, over- or underestimation of total carbohydrate consumed might

lead to increased glycemic variability. With appropriate training, nursing assistants and meal service representatives can play a role in increasing the accuracy of carbohydrate estimation. Bedside tray delivery provides opportunities for communication with patients and family members about the carbohydrate content of menu items or snacks.⁹ With appropriate insulin dosing and administration, snacks do not have to be automatically included in the nutrition plan for patients on basal insulin therapy. Inclusion of snacks should be based on patients’ preferences and nutrition goals.¹²

Guidelines should be in place to address the involvement of patients and their family members in self-care tasks such as blood glucose monitoring, reporting carbohydrate intake to staff members, and appropriately notifying staff members about food brought in from outside the hospital. Nurses and nursing assistants can help to educate patients and their families by taking advantage of teachable moments during patient care. Resources for carbohydrate estimation should be readily available to staff and patients. Having the carbohydrate content of foods noted on the menu assists patients with selecting the appropriate foods and can be used by nursing staff as a teaching tool to help

patients better understand the concept of carbohydrate counting. When patients gain a better understanding of which foods contain carbohydrate, appropriate substitutions can be made more easily to meet individual preferences. Including the carbohydrate content of foods on the general diet menu, not solely on a diabetes-specific menu, allows for a wider variety of food substitutions. Patients' glycemic goals are more likely to be achieved when patients, nurses, and meal service staff understand carbohydrate counting and the rationale behind the meal plan.⁹

Nutrition Status in Acute Care

Barriers to adequate nutrition intake in the hospital setting are many and include altered appetite, medical conditions causing difficulty or inability to eat, NPO (nothing by mouth) status, nausea and vomiting, gastrointestinal complaints, increased nutrition needs because of illness and catabolic stress, foods different from home, unfamiliar meal patterns, restrictive or inappropriate diet orders, missed or delayed meals because of scheduled procedures, hospital mealtime processes, and failure to meet patients' personal or cultural food preferences.^{4,12-14} With all of these potential barriers, it is not surprising that malnutrition is common in acute care. A recent observational study¹⁴ found that 44–59% of hospitalized patients with type 1 or type 2 diabetes and receiving subcutaneous insulin ($n = 434$) ate < 50% of offered meals. Eighteen to 34% of patients ate no food at all. Only 12–25% ate all of the food offered. These findings are consistent with literature regarding hospital plate waste and malnutrition.¹⁵⁻¹⁷ Poor oral intake also may contribute to hypoglycemia when mealtime insulin dosing is not adjusted appropriately. For patients who have a poor appetite, administering mealtime insulin immediately after meals may allow for better matching of insulin to carbohydrate actually consumed, decreasing the risk for hypoglycemia. During hospitalization, insulin doses may vary significantly from patients' usual insulin regimen not only because of changes in patients' normal eating routine, but also because of medications, the stress of illness, surgery, or other procedures.^{12,18}

Therapeutic diets are intended to help treat disease states, improve

metabolic control, and promote positive health status. To meet therapeutic requirements, these diets may be more restrictive than necessary, especially for older, malnourished, and acutely ill patients who are self-limiting their food intake. Diets that are overly restrictive may unintentionally lead to decreased food intake, weight loss, and under-nutrition, which is the opposite of the desired effect. Allowing patients to eat a more liberalized meal plan may help improve their nutrition status.

Patients who are not eating well should be identified and referred for consultation with an RD for nutrition assessment and intervention. Patients who are not able to meet their nutrition needs on the ordered diet may benefit from nutrition supplements or nutrition support such as enteral nutrition. A variety of disease-specific enteral formulas for glycemic control are available and typically have lower carbohydrate and higher monounsaturated fat levels than standard formulas.⁴ The variable effects of enteral nutrition on postprandial glucose and patient outcomes have been reported in the literature and are beyond the scope of this article.¹⁹⁻²² Further research is needed to recommend the use of diabetes-specific enteral formulas for hospitalized patients with hyperglycemia.²¹ Regardless of the type of enteral supplement provided, the importance of timely glucose monitoring, proactive insulin adjustment, and frequent reassessment of patient status is crucial to preventing iatrogenic hypo- and hyperglycemia and to maintaining adequate glycemic control.

Challenges of Coordinating Meal Delivery, Glucose Monitoring, and Insulin Administration

There is an increasing awareness of hospital patients as customers. Hospitals have a strong focus on customer service with the advent of public reporting of patient satisfaction scores. As a result, many facilities have transitioned to meal delivery services such as room service, through which patients have flexibility in ordering meals and choosing the time they would like to eat. Room service, or "on demand" meal service, may increase patient satisfaction and provide cost savings while improving food quality.¹³ Many hospitals have implemented this type of meal service and made it available

to patients with diabetes, which has created additional challenges in coordination of meals with insulin therapy and blood glucose monitoring.^{23,24} Nurses are essential to the process; however, they may not be supported by optimal procedures or fully understand the effect that appropriate meal and medication timing can have on metabolic control.²³

Strategies for Improving Mealtime Processes

Providing the best patient care requires an organizational culture of inter-professional teamwork and communication. Processes that promote standardization and reliability, which support nurses in providing timely care, may aid in patient outcome improvement.^{25,26} Several hospitals have reported success with quality improvement initiatives to improve the coordination of timing of meals, blood glucose monitoring, and insulin delivery.

As part of an initiative aimed at reducing hypoglycemia, one acute care hospital implemented a multidisciplinary approach.²⁷ The scheduled times for mealtime insulin were changed on the medication administration record to coincide with meal service, with a message to "administer within 10 minutes of meal." Additionally, the pharmacy department provided the food service department with a list of patients taking mealtime insulin. Food service staff flagged trays for patients receiving insulin, called the units when meals were leaving the kitchen, and notified nurses when meals arrived on the unit and also when a tray remained on the cart because a patient was not in the room at delivery time. Blood glucose monitoring was completed after the first notification of trays leaving the kitchen. Nurses were then able to administer mealtime insulin with tray delivery.²⁷ The mealtime improvement process contributed to the overall system goal of reducing hypoglycemia.

Another academic teaching hospital utilized a time-in-motion study and discovered that staff members were testing blood glucose ranging from 166 minutes before to 98 minutes after meals.²⁸ The hospital adopted interventions to standardize clinical processes, including meal delivery time, and implemented a nurse-driven process to coordinate glucose monitoring, meal delivery, and insulin

administration. The time difference between blood glucose monitoring and bedside meal delivery decreased from an average of 44 minutes to an average of 14 minutes. Patients receiving insulin within 30 minutes of blood glucose monitoring increased from 39 to 97%.

A study at an academic medical center²⁹ examining the time between blood glucose monitoring, insulin administration, and the morning breakfast meal revealed that insulin was given 93 ± 53 minutes after blood glucose monitoring. Breakfast was provided 73 ± 37 minutes after insulin delivery. Eighty percent of patients whose breakfast was delivered > 45 minutes after insulin had prelunch glucose values > 180 mg/dl. A significant reduction was seen when patients received insulin < 45 minutes before breakfast, with 43% experiencing prelunch blood glucose levels > 180 mg/dl.

A recent pilot program at a university-affiliated hospital³⁰ informed nurses of the exact time of meal tray delivery to patients and reduced the period between insulin dosing and meal consumption by half. To accomplish this, meal service staff handed a card to unit secretaries identifying patients with diabetes who had received their meal. The secretaries then notified the nurses. Improvement was seen in on-time mealtime insulin administration, and glycemic control improved with no increase in hypoglycemia.

To ensure accurate mealtime insulin dosing, it is important to include communication with patients and families, meal service representatives, and nursing staff. In addition, ongoing education for staff, patients, and family members to increase understanding of the facility's meal system is recommended to improve coordination of these glycemic management components. Because of their specialized knowledge and skills, RDs and inpatient diabetes educators are the team members best suited to oversee staff training and education to improve the coordination of meal consumption, glucose monitoring, and insulin administration.

Understanding hospital-specific nursing and pharmacy policies for the definition and time frame of "a.c." (ante cibum, or premeal) orders for medications and procedures may also be helpful to guide mealtime practices

and adherence to hospital standards of care. Coordination and communication among health professionals across disciplines is a shared responsibility to avoid the "silo effect," which occurs when hospital departments do not communicate with and make decisions independent of each other.²⁶ Ongoing collaboration between hospital nutrition services, nursing leadership, pharmacists, and physician champions is vital to developing sustainable and reproducible processes. Ideally, each facility should choose a preferred, standardized approach based on its unique needs.⁴

Several organizations and authors have recommended quality improvement interventions to address mealtime processes.^{2,18,31-35} These strategic approaches include:

- Reduce the time between blood glucose monitoring, insulin administration, and meals; consider a goal of < 30 minutes
- Adapt practice to recheck blood glucose if a meal is not delivered within 30 minutes of the first glucose check
- Provide the food service department with a list of patients taking mealtime insulin so tray delivery can be communicated to nurses
- Reduce the number of staff involved in POC glucose monitoring, insulin administration, and meal tray delivery (e.g., have nurses who are responsible for insulin administration also perform the blood glucose monitoring or have nursing assistants who are responsible for glucose monitoring also deliver meal trays)
- Provide safeguards to prevent patients from being deprived of food and nutrition after receiving mealtime insulin (e.g., when they are sent for dialysis, medical procedures, or testing at the normal mealtime)
- Stock appropriate snacks on the unit for nurses to offer patients arriving between mealtimes or as nighttime snacks as needed
- Ensure that patients' insulin regimen incorporates their prandial carbohydrate intake
- Modify insulin order sets to address times when patients' meals are interrupted
- Reassess insulin requirements after any change in nutrition status or diet orders (e.g., progression in

food texture from clear liquid to regular meals)

- Encourage patient participation in insulin administration and management where appropriate

Trends in Meal Service in Acute Care

An informal survey was developed by the authors (D. Ryan, C. Swift, unpublished observations) to provide a snapshot of current hospital meal service practices. The survey questions focused on 1) how diets are ordered, communicated, and delivered and 2) what processes are in place for coordinating meal delivery with POC blood glucose monitoring and insulin administration. One hundred surveys were completed. A link to the survey "Meal Service for Inpatients with Diabetes (Non-Critical Care)" was posted in January 2014 on the online communities of the Diabetes Care and Education dietetic practice group of the Academy of Nutrition and Dietetics and the inpatient management community of interest of the American Association of Diabetes Educators and distributed via email to clinical nutrition managers of Touch Point Support Services, a hospital food service provider. Members of these groups include, among others, dietitians, nurses, diabetes educators, and clinical pharmacists who actively participate in online professional networks focused on diabetes care. Limits were not set on the number of participants per facility, so there may have been multiple respondents from a single facility. Questions included multiple choice, multiple answer, and open text formats.

Half of the respondents indicated that they worked in a community hospital. Other settings included academic/teaching hospitals (21%), urban settings (13%), and rural settings (21%).

Nearly all (88%) of the respondents reported that consistent-carbohydrate meal plans are offered at their facilities and that carbohydrate content of foods was included on patient menus or meal tickets (90%). A surprising finding was the wide variation in carbohydrate calculations for insulin dosing. Whereas 100% of respondents indicated that they count starchy foods, 38% also include nonstarchy vegetables, 37% include condiments, and 16% include protein (e.g., meat, fish, and poultry).

More than one-third (37%) reported that room service is available, and the most commonly identified staff members to deliver meals were food service associates (84%). Forty-two percent of respondents indicated that food service associates directly notify nurses of meal delivery. Other nurse notification systems included nursing unit clerks (16%), mealtimes posted on the unit (25%), and visual notification (“when they see the trays are on the unit”) (34%).

Seventy-five percent indicated that there is no formal process to identify when patients miss a meal. Respondents who did report a more formal system shared a variety of communication techniques, including writing on meal tickets, documentation in electronic and paper charts, having nurses collect the meal trays of patients on carbohydrate-consistent diets, having food service and nursing assistant associates trained to evaluate carbohydrate percentages eaten, and including family and patients to inform nurses about unconsumed foods.

Regarding diet orders, consistent-carbohydrate diets were identified most often (53%) for patients with diabetes. Diet orders for “ADA diets” (37%), as well as “no concentrated sweets” (23%), persist in some facilities. Some facilities indicated that consistent-carbohydrate meals are delivered regardless of the type of “diabetic diet” ordered.

Diet Orders: An Area of Opportunity

Although evidence suggests that some changes in meal service are taking place to improve inpatient glycemic management, many hospitals still seem to rely on efforts to make changes fit into their existing clinical practices. This is evident when it comes to diet orders and how they are carried out. In a 2002 editorial,³⁶ Hirsch asked, “Is it realistic to think we can successfully put the ‘1800-calorie ADA diet’ to rest forevermore?” Unfortunately, more than a decade after this editorial was published, this outdated diet order is still entered and provided in many facilities. Other hospitals have implemented consistent-carbohydrate meal plans with specific calorie levels that are, in effect, “ADA diets” that have just been relabeled. The caloric needs of hospitalized patients with diabetes vary significantly, so calories should

not be automatically restricted solely based on a “diabetic diet” order.

There are too few inpatient clinical dietitians to assess the caloric needs of all patients with diabetes. Allowing nursing staff the autonomy and resources to be able to offer food substitutions and to recalculate mealtime insulin dosing based on patients’ preferred foods may help patients meet their nutrition needs and improve their satisfaction with meals. It is also important for nursing staff to help identify patients who need additional nutrition assessment by an RD.

Summary

In the acute care setting, meal delivery and mealtime nursing activities are interwoven and interdependent. Multiple staff members and departments have responsibilities for various aspects of nutrition therapy for glycemic management in the hospital setting. Implementation is initiated by physicians, nurse practitioners, or physician’s assistants and planned and operationalized by RDs. Meals are delivered by food service staff members, and nurses monitor and integrate glycemic control components into patients’ medical treatment plan. Teamwork, communication, and administrative support are needed to meet the challenge of providing safe and effective glycemic control in the hospital setting.

Additional research is needed to identify the best strategies for coordinating these efforts toward improved patient outcomes. Research is also needed to determine optimal meal-planning practices for hospitalized patients with diabetes and hyperglycemia. Exploring available options to implement consistent-carbohydrate meal plans and offer more liberalized diets is encouraged.

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