Managing Insulin Therapy in Special Situations

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The following program is a recorded presentation by Deborah Hinnen.

Deborah Hinnen, RN, ARNP, BC-ADM, CDE, FAAN has been a diabetes educator for over thirty years. As a clinical nurse specialist and education coordinator, she currently works at Mid America Diabetes Associates as coordinator of a multidisciplinary team. The centerpiece of their program is a three day comprehensive self-management course that serves nearly 1000 people with diabetes per year.

Ms. Hinnen is involved extensively with the American Association of Diabetes Educators, having served as their national President in 1993-94. She was awarded their prestigious Distinguished Service Award in the summer of 2001. She has also served on the national board of directors for the American Diabetes Association, and was an associate editor for *Diabetes Spectrum*. She continues to volunteer with many other organizations. Her faculty positions are with the Pharmacy Department at University of Kansas, Creighton and University of Nebraska and Graduate Nursing Department at Wichita State University and the Physicians Assistant Program at Wichita State. Ms. Hinnen was inducted as a Fellow into the American Academy of Nursing in 2003.

Her career has focused on diabetes patient and professional education with many publications in both areas. In addition to diabetes efforts, she served as a Trustee for Butler Community College, a college with seven sites and more than 14,000 students.

Objectives

- Identify both frequently occurring and uncommon special situations that necessitate individually tailored insulin regimens for persons with type 2 diabetes
- Describe how self-monitoring of blood glucose (BG) can lead to improved diabetes self-management
- Discuss the appropriate insulin and insulin delivery methods for persons with special situations
- Identify key resources that provide guidance for developing insulin regimens for persons with special situations

This knowledge-based program will provide participants with the skills necessary to manage special situations that may arise in patients using insulin therapy. By the end of this program, you should be able to:

- Identify both frequently occurring and uncommon special situations that necessitate individually tailored insulin regimens for persons with type 2 diabetes
- Describe how self-monitoring of blood glucose (BG) can lead to improved diabetes self-management
- Discuss the appropriate insulin and insulin delivery methods for persons with special situations
- Identify key resources that provide guidance for developing insulin regimens for persons with special situations

Defining Special Situations

- Most persons with type 2 diabetes encounter special situations that necessitate individualized insulin regimens to help prevent hyperglycemia and hypoglycemia
- Special situations may involve physical or educational disabilities, unpredictable schedules, and/or activities that affect insulin requirements
  - Exercise
  - Travel
  - Situations related to meal planning (eg, irregular mealtimes)
  - Cultural values or religious practices (eg, prolonged fasting)
  - Preparing for medical procedures or surgery
  - Emergencies (eg, natural disasters)

From time to time, most persons with type 2 diabetes encounter special situations that necessitate the use of individually tailored insulin regimens to help prevent hyperglycemic and hypoglycemic events. Therefore, it is important for health care providers to be prepared to help their patients handle these situations effectively.

These special situations may involve physical or educational disabilities, unpredictable schedules, and/or activities that affect insulin requirements.

Special situations that arise frequently involve exercise, travel, situations related to meal planning (such as irregular mealtimes and eating in restaurants), and cultural values or religious practices (such as prolonged fasting). Infrequent special situations are preparing for medical procedures or surgery, and emergencies, such as natural disasters.

This program does not deal with pregnancy.

SMBG and Special Situations

- Regular and accurate SMBG is essential for individuals with special situations
- Persons with special situations may need to perform SMBG more frequently than recommended by the ADA
- At regular intervals, health care providers should evaluate each patient's monitoring technique and his or her ability to use the data to adjust food intake, exercise, and drug therapy
- The accuracy of BG meters should be evaluated on a regular basis, especially if they are exposed to extreme conditions (eg, high altitudes)

ADA = American Diabetes Association;
SMBG = self-monitoring of BG.

ADA. *Diabetes Care.* 2010;33(Suppl 1):S11–S61.
Brubaker PL. *Diabetes Care.* 2005;28:2563–2572.

Regular and accurate self-monitoring of BG (SMBG) is essential for individuals with special situations. The American Diabetes Association (ADA) recommends that:

- SMBG should be carried out 3 or more times daily for patients using multiple insulin injections or insulin pump therapy
- For patients using less frequent insulin injections, noninsulin therapies, or medical nutrition therapy alone, SMBG may be useful as a guide to the success of therapy
- To achieve postprandial glucose targets, postprandial SMBG may be appropriate

However, in special situations, people who use insulin often need to perform SMBG more frequently than recommended in these guidelines.

Because the accuracy of SMBG is instrument and user dependent, health care providers should evaluate each patient's monitoring technique, both initially and at regular intervals thereafter. Since optimal use of SMBG requires proper data interpretation, patients should be taught how to use their data to adjust food intake, exercise, or drug therapy to achieve specific glycemic goals. These skills should be reevaluated periodically.

The accuracy of BG meters should be checked on a regular basis (at least annually). Meters should also be checked as soon as possible following exposure to extreme conditions, such as high altitudes or very low or high temperatures.

Storage, Use, and Disposal Guidelines

- Insulin should not be exposed to direct sunlight, heat sources, or excessive agitation and should not be left in a car or in checked baggage on an airplane
- It is important to follow manufacturers' recommendations concerning environmental conditions under which products should be stored and used
- Insulin should be inspected for signs of damage before each use
- All diabetes supplies should be disposed of safely, in accordance with local regulations

ADA. *Diabetes Care.* 2004;27(Suppl 1):S106–S109.
Kruger DF. *The Diabetes Travel Guide.* 2006.
Grimm JJ. *Handbook of Exercise in Diabetes*. 2002.

Insulin, test strips, and other diabetes supplies should be stored properly. This information should be reviewed with the patient, regardless of how long they have been using insulin.

Insulin should not be exposed to direct sunlight, heat sources, or excessive agitation and should not be left in a car or in checked baggage on an airplane. It should be kept at the manufacturers' recommended temperatures, as insulin that has been improperly stored should not be used unless absolutely necessary. Insulin should be visually inspected for signs of damage each time it is used, and damaged or questionable insulin should be replaced. Similarly, insulin pens and cartridges should be stored according to manufacturers' instructions.

Glucose monitors and test strips should be used within the manufacturers' recommended ranges for temperature (usually about 10°C–30°C [59°F–86°F]) and relative humidity (about 20%–80%). Manufacturers' recommendations concerning the reuse of syringes and needles should be followed.

Used syringes, pen needles, insulin pump infusion needles and lines, and other diabetes supplies should be disposed of safely, in accordance with local regulations.

Patients With Special Needs

- Many insulin delivery aids are available for people with visual or other impairments
  - Vial stabilizers
  - Syringe magnifiers
  - Nonvisual insulin measurement devices
  - Needle guides
- Using pen devices rather than syringes may improve the accuracy of insulin administration for individuals with neurologic deficits
- Prefilled syringes are helpful for persons who depend on others to draw their insulin

ADA. *Diabetes Care.* 2004;27(Suppl 1):S106–S109.
ADA. *Diabetes Forecast.* 2010;63:29–59.
Bartos BJ et al. *Diabetes Educator.* 2008;34:597–636.

Many insulin delivery aids, including vial stabilizers, syringe magnifiers, nonvisual insulin measurement devices, and needle guides, are available for people with visual impairments. Information about these products is available in the ADA's annual Consumer Guide, which is published in the January issue of *Diabetes Forecast*. Additional information is available online at forecast.diabetes.org. Another helpful resource is an article about assistive tools, services, and information that was written by Bartos and colleagues and published in *The Diabetes Educator* in 2008.

Using pen devices rather than syringes may improve the accuracy of insulin administration. Use of an insulin pen can be especially beneficial for individuals taking small amounts of insulin and those with neurologic impairments.

Persons who depend on others to draw their insulin may benefit from the use of prefilled syringes, which are stable for up to 30 days when refrigerated. If possible, the syringes should be stored with the needle pointing upward or lying flat so that suspended insulin particles do not clog the needle. The predrawn syringe should be rolled between the hands before administration unless the patient is receiving a rapid-acting insulin analog, short-acting insulin, or insulin detemir. Insulin glargine should not be predrawn. A quantity of syringes may be premixed and stored. The effect of premixing of insulins on glycemic control should be assessed by the health care provider, based on BG results obtained by the patient. When premixing is required, consistency of technique and careful SMBG are especially important.

Health Literacy

- Health literacy is the ability to read, understand, and act on medical instructions
- Limited health literacy is common among patients with chronic medical conditions, including type 2 diabetes
- Limited health literacy is associated with higher A1C levels and higher rates of diabetic complications than adequate health literacy
- Health care providers should assess the health literacy of their patients, either formally or informally
- Patients with limited health literacy who receive individualized diabetes education show improvements in self-management behaviors that are similar to or better than those of patients with adequate health literacy

Caballero AE. *Insulin.* 2007;2:80–91. Kim S et al. *Diabetes Care.* 2004;27:2980–2982. Schillinger D et al. *JAMA.* 2002;288:475–482. Schillinger D et al. *Arch Intern Med.* 2003;163:83–90.

Health literacy is the ability to read, understand, and act on medical instructions. Limited health literacy is common among patients with chronic medical conditions, including type 2 diabetes. Limited health literacy has been shown to be associated with higher A1C levels and higher rates of diabetic complications than adequate health literacy. Therefore, health care providers should assess the health literacy of their patients, either formally or informally. The short version of the Test of Functional Health Literacy in Adults, which can be completed in about 12 minutes, is the most frequently used formal assessment of health literacy. (This assessment can be obtained from Peppercorn Books and Press [e-mail: post@peppercornbooks.com].)

Patients with limited health literacy who receive individualized diabetes education have shown improvements in self-management behaviors that are similar to or better than those of patients with adequate health literacy. Furthermore, patients with limited health literacy whose health care providers assess their recall and comprehension of new concepts during outpatient visits have lower A1C levels than similar patients who are not assessed in this way.

Exercise

Now, let’s turn our attention to exercise.

Exercise

- The overall effects of exercise are increased sensitivity and glucose utilization, as well as decreased hepatic glucose production
- The ADA recommends aerobic and resistance exercise for many individuals with type 2 diabetes, including those receiving insulin therapy
- Modest amounts of regularly scheduled moderate exercise have consistently shown beneficial effects
- Just like persons without diabetes, many individuals with diabetes prefer to engage in exercise of high intensity or long duration, enjoy unplanned exercise, or participate in adventurous types of exercise
  - This usually requires modification of the treatment regimen

ADA. *Diabetes Care.* 2010;33(Suppl 1):S11–S61.

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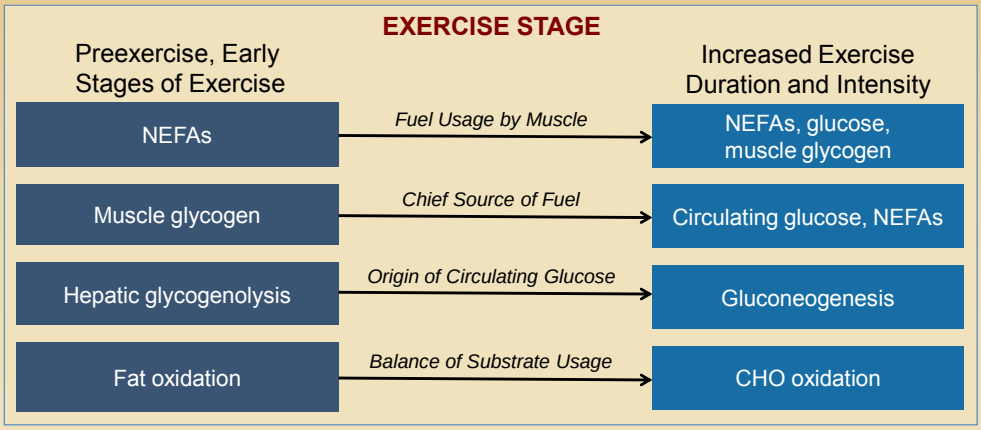
Fuel Metabolism During Exercise

Patterns of fuel metabolism change during periods of prolonged and intensive exercise



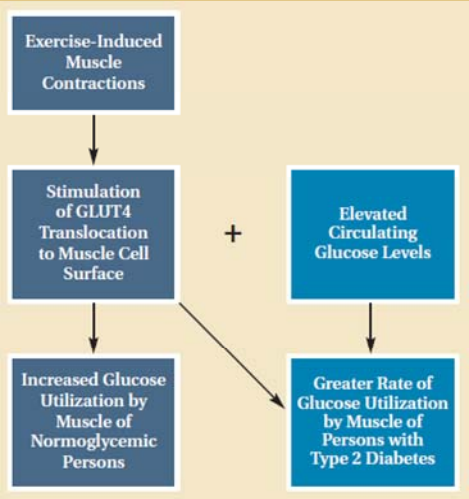
CHO = carbohydrate; NEFAs = nonesterified fatty acids.

Sigal RJ et al. *Diabetes Care.* 2004;27:2518–2539.

Research on the physiology of fuel metabolism and practical experience have led to the development of useful guidance for individuals with diabetes who wish to pursue intensive or unscheduled exercise. As this graphic shows, the physiology of fuel metabolism in persons without diabetes changes in several ways as exercise becomes more prolonged and intense. During exercise, the working muscle has a change in fuel source, from mainly nonesterified fatty acids (NEFAs) to a mixture of NEFAs, glucose, and muscle glycogen. The chief source of energy shifts from muscle glycogen to circulating glucose and NEFAs. The origin of circulating glucose changes from hepatic glycogenolysis to gluconeogenesis. As exercise intensifies, the balance of substrate usage shifts from fat oxidation to greater carbohydrate oxidation. The neuroendocrine system is the main regulator of fuel mobilization during aerobic exercise, and insulin secretion decreases while levels of glucagon, catecholamines, and other hormones increase during sustained exercise.

During moderate exercise, there is a close relationship between endogenous glucose production and increased muscle glucose uptake. The exercise-induced increase in glucagon stimulates glycogenolysis and gluconeogenesis. Glucagon also stimulates hepatic amino acid metabolism and fat oxidation, providing precursors for gluconeogenesis and energy to fuel it. The decrease in insulin is necessary for the full glycogenolytic response. If the liver did not release more glucose in response to exercise, hypoglycemia would result.

Insulin-Independent Muscle Glucose Uptake



- Individuals with type 2 diabetes retain the ability to translocate GLUT4 to the sarcolemma in response to exercise
- Recruitment of GLUT4 transporters, together with elevated circulating glucose levels, can lead to a greater rate of glucose utilization by the muscle of persons with type 2 diabetes

GLUT4 = glucose transmitter type 4.

Sigal RJ et al. *Diabetes Care.* 2004;27:2518–2539.

Exercise-induced muscle glucose uptake requires glucose delivery from the blood to the muscle, glucose transport across the muscle membrane, and glucose phosphorylation within the muscle. During exercise, blood flow (and consequently, glucose delivery) to working muscles increases greatly. Exercise increases glucose transport by stimulating translocation of glucose transmitter type 4 (GLUT4) to the muscle cell surface. Phosphorylation is the first step in glucose metabolism, and exercise stimulates muscle hexokinase II gene transcription.

Exercise increases insulin-dependent muscle glucose uptake. Although individuals with type 2 diabetes are usually insulin resistant, they are not resistant to the stimulatory effects of exercise on glucose utilization. Therefore, they retain the ability to translocate GLUT4 to the sarcolemma in response to exercise. (The sarcolemma is the membrane covering a striated muscle.) The recruitment of GLUT4 transporters, together with elevated circulating glucose levels, can lead to a greater rate of glucose utilization by the muscle of persons with type 2 diabetes compared with the muscle of normoglycemic persons.

Exercise and Metabolic Adaptations

- Major metabolic adaptations occur in individuals with type 2 diabetes who exercise regularly
  - Reduced insulin secretion by pancreatic beta cells leads to reduced basal and glucose-stimulated insulin levels
  - Exercise results in increased muscle GLUT4, which appears to contribute to the increased capacity for insulin-stimulated glucose transport (ie, improved insulin sensitivity) in persons who exercise regularly

Sigal RJ et al. *Diabetes Care.* 2004;27:2518–2539.

In individuals with type 2 diabetes who exercise regularly, 2 major metabolic adaptations occur.

First, reduced insulin secretion by pancreatic beta cells leads to reduced basal and glucose-stimulated insulin levels.

Second, both aerobic exercise and resistance training lead to increased muscle GLUT4, which appears to contribute to the increased capacity for insulin-stimulated glucose transport (ie, improved insulin sensitivity) in persons who exercise regularly.

Aerobic and Resistance Exercise

- Aerobic
  - Rhythmic, repeated, continuous movements of same large muscle groups for ≥10 min
  - Improves A1C and insulin sensitivity, increases VO_{2max}, reduces body fat, decreases overall CV risk, reduces CV and overall mortality
- Anaerobic
  - Activities that use muscular strength to move a weight or work against a resistive load
  - Improves A1C and insulin sensitivity, increases muscle mass and endurance, enhances weight loss, reduces body fat and increases lean body mass, reduces SBP and FFA concentrations

CV = cardiovascular; FFA = free fatty acid;
VO_{2max} = maximal oxygen uptake; SBP = systolic blood pressure.

Sigal RJ et al. *Diabetes Care.* 2004;27:2518–2539.

Aerobic exercise consists of rhythmic, repeated, continuous movements of the same large muscle groups for at least 10 minutes at a time. Examples include walking, bicycling, jogging, and continuous swimming. It is often called “moderate” when it is at 40% to 60% of maximal oxygen uptake (VO_{2max}; ~50%–70% of maximum heart rate) and “vigorous” when it is at more than 60% of VO_{2max} (>70% of maximum heart rate). In persons with type 2 diabetes, aerobic exercise improves A1C and insulin sensitivity, increases VO_{2max}, reduces abdominal visceral and subcutaneous fat, decreases overall cardiovascular risk, and reduces cardiovascular and overall mortality. These benefits may increase greatly in individuals who engage in extremely vigorous aerobic exercise (≥75% of VO_{2max}).

Resistance or anaerobic exercise consists of activities that use muscular strength to move a weight or work against a restrictive load. Examples include weight lifting and exercises using weight machines. It is often called “high” intensity if the resistance is 75% or more of the maximum that can be lifted at a single time (≥75% of 1-RM [repetition maximum]) and “moderate” if resistance is 50% to 74% of 1-RM. In patients with type 2 diabetes, resistance exercise improves A1C and insulin sensitivity, increases muscle mass and endurance, enhances weight loss, reduces body fat, increases lean body mass, and reduces systolic blood pressure and free fatty acid concentrations. More intense exercise is associated with greater benefits. To optimize the benefits of resistance exercise and minimize the risk for injury, initial supervision and periodic reassessment by a qualified exercise specialist is recommended.

ADA Recommendations: Exercise and Type 2 Diabetes

- People with diabetes should perform at least 150 min/week of moderate-intensity aerobic physical activity (50%–70% of maximum heart rate)
- In the absence of contraindications, people with type 2 diabetes should perform resistance training 3 times per week
- Patients at high risk for CAD should start with short periods of low-intensity exercise and increase the intensity and duration slowly
- Patients should be screened for uncontrolled hypertension, severe autonomic neuropathy, severe peripheral neuropathy, unstable proliferative retinopathy, and other barriers to exercise

CAD = coronary artery disease.

ADA. *Diabetes Care.* 2010;33(Suppl 1):S11–S61.

To improve BG control, reduce cardiovascular risk factors, promote weight loss, and improve well-being, the ADA recommends that people with diabetes perform at least 150 minutes per week of moderate-intensity aerobic physical activity (50%–70% of maximum heart rate). In the absence of contraindications, people with type 2 diabetes should perform resistance training 3 times per week. Adults over the age of 65 years and individuals with disabilities should follow these guidelines, if possible.

Patients at high risk for cardiovascular disease should start with short periods of low-intensity exercise and increase its intensity and duration slowly. However, routine screening of asymptomatic patients for coronary artery disease (CAD) is not currently recommended.

Health care providers should assess patients for conditions that might contraindicate certain types of exercise or predispose patients to injury, such as uncontrolled hypertension, severe autonomic neuropathy, severe peripheral neuropathy, unstable proliferative retinopathy, or other barriers to exercise. The patient's age and previous physical activity level should be considered when assisting the patient in developing an exercise program.

The 2004 ADA technical review on exercise in patients with type 2 diabetes is currently being updated.

Avoiding Exercise-Induced Hypoglycemia

- For unplanned exercise, consume extra CHOs (20–30 g/30 min of exercise) and decrease postexercise insulin dose, if necessary
- For planned exercise, decrease insulin dose before and after exercise
- Consume easily absorbable CHOs during exercise and an extra CHO-rich snack after exercise, if necessary
- Contact DESA for assistance in obtaining an individualized exercise self-management program
- Use basal-bolus or insulin pump therapy for exercise of prolonged duration and high intensity; sporadic exercise; or intensive physical training for competitive athletics

DESA = Diabetes Exercise and Sports Association.

Berger M. *Handbook of Exercise in Diabetes.* 2002.

Michael Berger, MD, has developed useful recommendations for avoiding exercise-induced hypoglycemia in insulin-treated patients. Individuals should measure BG approximately 15 minutes before and after exercise. BG should also be measured approximately once each hour during prolonged exercise (ie, ≥2 hr) of moderate or greater intensity. For unplanned exercise, patients should consume extra carbohydrates (eg, 20–30 g/30 min of exercise) and decrease the postexercise dose of insulin, if necessary. (The percentage by which the postexercise dose should be reduced should be determined by the individual, on the basis of SMBG.) For planned exercise, patients should decrease their insulin dosages before and after exercise, according to the intensity and duration of exercise and the patient's personal experience. Insulin dosage reductions may amount to 50% to 90% of daily insulin requirements. If necessary, patients should consume easily absorbable carbohydrates (such as a sports drink or fruit juice) during exercise and consume a snack with carbohydrates (such as a portion of a snack bar) after exercise.

Performing more frequent SMBG and having a postexercise snack are important precautions against the development of postexercise, late-onset hypoglycemia. Persons with type 2 diabetes are vulnerable to hypoglycemia 12 to 24 hours after exercise because the body is replenishing muscle glycogen stores during this time.

Individuals can contact the Diabetes Exercise and Sports Association (DESA; www.diabetes-exercise.org) for assistance in obtaining an individualized exercise self-management program.

Use of a basal-bolus insulin regimen or insulin pump therapy is important for individuals who engage in exercise of prolonged duration and high intensity, exercise irregularly, or participate in intensive competitive sports.

Insulin Pump Therapy and Intensive Exercise

- Insulin pumps can be removed for up to 1 hour without harmful consequences
- A bolus dose of insulin should be administered subcutaneously if the pump is disconnected for a longer period

Activity	Pump Protection
Most water activities	Use waterproof pump or waterproof case
Vigorous water sports	Remove pump
Contact sports	Use sports guard case or padding or place pump in protected location
Winter sports	Place pump under inner layer of clothing

Zinman B. *Handbook of Exercise in Diabetes.* 2002.

Insulin pump therapy provides great flexibility for adjusting meal doses and basal insulin requirements for exercise. For activities that involve excessive contact, movement, or sweating, patients can remove their pumps for short periods (up to 1 hour) without harmful consequences. Pump removal for a longer period requires subcutaneous administration of a bolus dose of insulin to cover the basal insulin missed during the disconnect time. Athletes acquire skill in modifying the pump's infusion rate for particular activities through frequent SMBG and experience.

Several types of pumps are waterproof or can be protected with a waterproof case, making them suitable for use during water activities. However, the pump should be removed during vigorous water sports, such as surfing or diving. Extra pump protection may be needed during contact sports such as football and basketball. Athletes can use a sports guard case or protective padding, or wear the pump in a position where it is protected, such as the small of the back. Because insulin can freeze when exposed to cold temperatures, the pump and tubing must be protected during winter activities. Wearing appropriate clothing and placing the pump under the inner layer of clothing next to the body provide the best protection from extreme cold.

Guidelines for Walking

- Effects of walking on BG levels depend on
  - Intensity and duration of walk
  - Timing of walk in relation to meals
  - Environmental conditions
  - Individual response (as determined by SMBG)

Typical Modifications to a Basal-Bolus Regimen

Type of Walk	Insulin Regimen	CHO Intake During Walk
Duration, <1 h Speed, <4 mph	Reduce premeal dose by 20%	0–10 g (total)
Duration, ≥1 h Speed, ≥4 mph	Reduce premeal dose by 20%–50% If taking basal insulin in the morning, consider reducing the dose if walk will last for >3 h	10–15 g/h

Colberg SR. *Diabetic Athlete's Handbook.* 2009.

Walking is an aerobic endurance activity. The effects of walking on BG levels depend on the intensity and duration of the walk, its timing in relation to meals, environmental conditions, and individual physiological responses, as determined by SMBG. Exercising in extreme environments increases both the metabolic rate and the body's reliance on carbohydrates. Warm or hot conditions may also speed up insulin absorption by increasing blood flow to the skin (for sweating and cooling purposes). Hot and humid conditions increase glucose use more than hot conditions alone, and wind chill exacerbates the effects of a cold environment.

The table on this slide shows typical modifications to a basal-bolus regimen. An individual who begins a walk more than 2 to 3 hours after a meal will need to make fewer regimen adjustments than a person whose exercise closely follows a meal. If the patient will be walking for less than 1 hour at a speed of less than 4 mph, the dose of rapid-acting insulin analog or regular human insulin may need to be reduced by up to 20% before the meal preceding the walk. Consuming up to 10 grams of carbohydrate during the walk might also be needed.

Patients taking a longer walk at a more vigorous pace might need to reduce their prandial insulin dose by 20% to 50% and to consume between 10 and 15 grams of carbohydrate per hour during the walk. Basal insulin needs are not generally affected by walking. However, a patient who takes a long-acting insulin analog or neutral protamine Hagedorn (NPH) insulin in the morning could consider reducing the dose if the walk will last for more than 3 hours.

Guidelines for Swimming

- Effects of swimming on BG levels depend on
  - Intensity and duration of swim
  - Timing of swim in relation to meals
  - Time of day (and degree of insulin resistance)
  - Individual response (as determined by SMBG)

Typical Modifications to a Basal-Bolus Regimen

Type of Swim	Insulin Regimen	CHO Intake
Short, intense sprints, racing for ≤200 m	Give small dose of rapid-acting insulin analog or short-acting regular human insulin if BG increases	No additional CHO
Swimming laps, other moderate-intensity swimming for <1 h	Mealtime insulin dose: reduce by 10%–30% before swim; reduce by 10%–25% after swim	0–20 g (total)
Prolonged (≥1 h) or multiple days of swimming	Mealtime insulin dose: reduce by 10%–30% before swim; reduce by 10%–25% after swim Evening basal insulin dose: reduce by 10%–20%	15–30 g/h; eat extra snacks, especially at bedtime

Colberg SR. *Diabetic Athlete's Handbook.* 2009.

Based on their effects on BG levels, there are 2 major categories of swimming: short, intense sprints and races of 200 m or less on the one hand and swimming of more moderate intensity and longer duration on the other. Sprints and other types of short-duration competitive swimming often raise BG levels, while other types of swimming reduce the levels.

With moderate-intensity, longer-duration swimming, the timing of the swim affects the extent to which BG is likely to drop. For example, persons who swim 2 to 3 hours after their last mealtime insulin dose generally have smaller BG reductions than those who swim soon after a meal. Persons who swim before breakfast and before administering their prandial insulin may need to take a small bolus dose of rapid-acting insulin analog or short-acting insulin, especially if their fasting BG (FBG) is at the high end of the target range. The rationale for this is that exercise raises BG levels in the presence of high BG and insufficient insulin.

The degree of insulin resistance also affects swimming-related BG changes. For example, individuals who are more insulin resistant in the morning than at other times of day may need to make a smaller modification to their insulin regimen if they swim in the morning.

This slide shows typical modifications to a basal-bolus regimen for different types of swimming. Of special note is the category of moderate-intensity swimming for less than 1 hour, since most patients with type 2 diabetes are likely to engage in this level of activity. Based on the results of SMBG, patients may need to reduce their prandial insulin doses before and after swimming. They may also need to consume up to 20 g of additional carbohydrate.

Guidelines for Weight Training

- Effects of weight training on BG levels depend on
  - Intensity and duration of training
  - Timing of training in relation to meals
  - Whether weight training is combined with aerobic exercise
  - Individual response (as determined by SMBG)

Typical Modifications to a Basal-Bolus Regimen*

Type of Weight Training	Insulin Regimen	CHO Intake
Duration <2 h	Minimal, if any, changes to prandial insulin dose at meal preceding weight training	0–10 g/h
Duration ≥2 h OR weight training ≤2 h after administration of prandial insulin OR weight training + aerobic exercise	Reduce prandial insulin dose by 10%–30% at meal preceding weight training	5–20 g/h
Weight training without aerobic workout, when insulin levels are low	Administer 0.5–2-unit bolus dose after workout if warranted by SMBG	No additional CHO

*Modification of the basal insulin dose is rarely needed.

Colberg SR. *Diabetic Athlete's Handbook.* 2009.

Weight training, which involves short, powerful repetitions, is a form of resistance exercise. In contrast to many types of aerobic exercise, weight training generally requires few modifications to the insulin regimen and meal plan. Factors that impact the effects of weight training on BG levels are the intensity and duration of training, the timing of training in relation to meals, whether training is combined with aerobic exercise (such as stationary cycling), and individual physiological responses.

The table on this slide shows typical modifications to a basal-bolus regimen for different types of weight training. In each case, modification of the basal insulin dose is rarely needed. If training is going to last less than 2 hours, minimal, if any, changes to the prandial insulin dose preceding weight training are needed. Intake of up to 10 g per hour of supplemental carbohydrate may be advisable.

If training will last at least 2 hours, take place less than 2 hours after administration of prandial insulin, or be combined with aerobic exercise, the prandial insulin dose at the meal preceding weight training should be reduced by 10% to 30%. The patient should consume carbohydrates at the rate of 5 to 20 g per hour.

A person engaging in weight training without an aerobic workout, when insulin levels are low, may need to administer a 0.5- to 2-unit bolus of insulin after the workout.

Case Study: Swimming

Patient	Cindy, 65 years old, 5-year history of type 2 diabetes Swims laps at gym for 45 minutes on Monday, Wednesday, Friday Swimming starts about 2.5 hours after Cindy begins lunch
Usual basal-bolus regimen	Long-acting insulin analog, bedtime: 30 units Rapid-acting insulin analog, prebreakfast: 8 units Rapid-acting insulin analog, prelunch: 10 units Rapid-acting insulin analog, predinner: 12 units
Modified basal-bolus regimen on swimming days	Long-acting insulin analog, bedtime: 30 units (no change) Rapid-acting insulin analog, prebreakfast: 8 units (no change) Rapid-acting insulin analog, prelunch: 8 units (20% reduction) Rapid-acting insulin analog, predinner: 10 units (~15% reduction) Snack after swimming: 20 g CHO + 1/2 liter water

Colberg SR. *Diabetic Athlete's Handbook.* 2009.

This case study gives an example of the way in which a basal-bolus insulin regimen can be modified for an individual who engages in moderate-intensity swimming for less than 1 hour on nonconsecutive days.

Cindy is 65 years old and recently retired. She has a 5-year history of type 2 diabetes. On Monday, Wednesday, and Friday afternoons she swims laps at the gym for 45 minutes. Her swimming session usually starts about 2.5 hours after Cindy begins her lunch.

Cindy uses a basal-bolus insulin regimen. She administers 30 units of a long-acting insulin analog at bedtime. Her usual doses of rapid-acting insulin analog are 8 units before breakfast, 10 units before lunch, and 12 units before dinner.

Based on her SMBG results, Cindy modifies her regimen on the days when she goes swimming. She reduces her dose of rapid-acting insulin analog by 20% before lunch and by about 15% before dinner. After completing her swim she has a snack consisting of 20 g of carbohydrate (80 calories), along with one-half liter of water to prevent dehydration. She also checks her BG level at bedtime in anticipation of postexercise, late-onset hypoglycemia.

Exercise: Take-Home Points and Key Resources

- Take-Home Points
  - Both aerobic exercise and resistance exercise benefit persons with type 2 diabetes (if they have no contraindications)
  - Effects of exercise on BG levels are influenced by the intensity and duration of exercise, timing of exercise, environmental conditions, and individual characteristics
  - Modifications to insulin regimens and meal plans should be based on SMBG results
- Key Resources
  - Sheri Colberg, *Diabetic Athlete's Handbook*, 2009
  - Diabetes Exercise and Sports Association (www.diabetes-exercise.org)

Colberg SR. *Diabetic Athlete's Handbook.* 2009.
Diabetes Exercise and Sports Association. Available at: www.diabetes-exercise.org.

Take-Home Points. Both aerobic exercise and resistance exercise benefit persons with type 2 diabetes (as long as they have no contraindications). The effects of exercise on BG levels are influenced by many factors, including the intensity and duration of exercise, the time of day at which exercise is performed, the timing of exercise in relation to meals, environmental conditions, and individual physiological responses. General guidelines have been developed for modifying insulin regimens and meal plans in anticipation of exercise. However, to ensure that they derive maximal benefits from exercise and minimize the risk for developing hypoglycemia, patients should use SMBG results as the basis for any modifications.

Key Resources. The *Diabetic Athlete's Handbook*, which was written by Sheri Colberg, PhD, and published in 2009, is a comprehensive guide to aerobic and resistance exercise for persons with diabetes. In addition to providing general information about the physiology of exercise and avoiding sports-related injuries, the book includes guidance on typical modifications to insulin regimens and meal plans for individuals involved in many different kinds of physical activities and sports. Another key resource is DESA, an international organization whose mission is to enhance the quality of life of people with diabetes through exercise and fitness. It has an extensive Web site, publishes a quarterly magazine (*The Challenge*), and sponsors regional, national, and international conferences for consumers and health care providers.

Travel

Now, let’s talk about travel.

Travel

- Factors that can affect BG levels
  - Missed meals
  - Dietary changes
  - Increased exercise
  - Time zone changes
  - Stress
  - Travel-related illness or injury
- Major considerations for travelers
  - Documenting their medication and supplies
  - Replacing lost or damaged supplies
  - Adhering to TSA policies (if traveling by air)
  - Adjusting insulin administration for time zone changes

TSA = Transportation Security Administration

Kruger DF. *The Diabetes Travel Guide.* 2nd ed. 2006.
Childs BP et al. *Complete Nurses Guide to Diabetes Care*. 2nd ed. 2009.

Many factors, including missed meals, dietary changes, increased exercise, time zone changes, stress, and travel-related illness or injury, can affect BG levels during travel.

Major considerations for travelers include documenting their medication and supplies, being able to replace lost or damaged supplies, adhering to Transportation Security Administration (TSA) policies (if traveling by air), and adjusting insulin administration for time zone changes.

Having complete and up-to-date documentation is invaluable if it is necessary to replace medication or other diabetes supplies and is especially important for frequent travelers and international travelers. One useful document is a letter from the health care provider stating that the traveler has diabetes and summarizing the medication regimen. Another letter from the health care provider might summarize the type(s) of insulin used, the prescribed concentration and dose(s) of insulin, the size of the syringe, and information about any other glucose-lowering medications. Travelers should also carry a copy of their prescription for each medication (using generic names) and device.

Transporting and Obtaining Supplies

- Travelers should always have access to insulin, other diabetes supplies, and extra food and drink
- Insulin should be kept in a carrying case with an insulin cool pack if the insulin will be exposed to temperature extremes or if the trip will last more than 28 days
- Travelers need a system for bringing home used syringes or insulin pen needles
- Because insulin names may be different in other countries, labels must be read carefully
- To ensure an uninterrupted supply of insulin, travelers should take extra insulin vials or pens with them
  - Many prescription plan vendors have a travel policy that permits members to obtain an extended supply of insulin (beyond the usual 90-day supply) in preparation for a long trip
  - Travelers should contact their vendor well in advance of their departure date to determine whether they qualify for this benefit

Kruger DF. *The Diabetes Travel Guide.* 2nd ed. 2006.
Childs BP et al. *Complete Nurses Guide to Diabetes Care*. 2nd ed. 2009.

Travelers should always have access to insulin, other diabetes supplies, and extra food and drink. They should keep insulin in a carrying case with an insulin cool pack if the insulin will be exposed to temperature extremes or if the trip will last more than 28 days. It is also important to have a system for bringing used syringes or insulin pen needles home for disposal.

Because insulin names may be different in other countries (eg, a 70/30 mixture may be called 30/70), it is important to read labels carefully. Travelers using a newer insulin product may wish to contact the manufacturer prior to scheduled travel to determine whether the product is available in the destination country and what it is called in that country.

The best way to ensure an uninterrupted supply of insulin is for travelers to take extra insulin vials or pens with them. Many insurance companies that offer prescription drug coverage have a travel policy whereby members can obtain an extended supply of insulin, rather than the usual 90-day supply, before a long trip. Travelers should contact their prescription plan vendor well in advance of their departure date to determine whether their company has such a policy and if they qualify for this benefit.

Transportation Security Administration Regulations

- Diabetes-related supplies allowed through the airport checkpoint after screening
  - Insulin and insulin-loaded dispensing products (insulin in any form or dispenser must be clearly identified)
  - Unlimited number of unused syringes when accompanied by insulin or other injectable medication
  - Lancets, BG meters, test strips, alcohol swabs, meter-testing solutions
  - Insulin pumps and supplies (must be accompanied by insulin)
  - Glucagon emergency kit
  - Urine ketone test strips
  - Unlimited number of used syringes when transported in sharps disposal container or similar hard-surface container
  - Sharps disposal container or similar hard-surface container

TSA. Hidden disabilities. Available at: http://www.tsa.gov/travelers/airtravel/specialneeds/editorial_1374.shtm. Accessed January 12, 2010.

Before beginning a trip that involves air travel, travelers with diabetes, like all other travelers, should review current TSA policies, since they are subject to change. At the security checkpoint, airline passengers should tell the Security Officer that they have diabetes and are carrying their supplies with them. The diabetes-related supplies and equipment listed on this slide are allowed through the checkpoint once they have been screened.

Travelers have the option of requesting a visual inspection of their insulin and diabetes-related supplies rather than having them x-rayed. However, a visual inspection must be requested before the screening process begins. Passengers who wish to take advantage of this option should have their medication and associated supplies separated from their other property in a pouch or bag when they approach the Security Officer at the walkthrough metal detector. To prevent contamination or damage to medication and associated supplies, travelers are asked to display, handle, and repack their own medication and associated supplies during the visual inspection process. Any medication or supplies that cannot be cleared visually must be submitted for x-ray screening.

Travelers who are concerned about going through the walkthrough metal detector with their insulin pump should notify the Security Officer that they are wearing an insulin pump and would like a full-body patdown and a visual inspection of their pump instead. The Security Officer should be advised that the insulin pump cannot be removed because it is connected with a catheter under the skin.

Eastbound Travel With Time Changes of ≥3 Hours

Injection Frequency	Insulin Dose Adjustment
1	On travel day, take insulin as usual or decrease dose by 10%–20%
	On first full day at destination, wake on local time schedule and take usual insulin dose
	Continue to take insulin at same time each day using local time
≥2	On travel day, decrease last daily dose of intermediate- or long-acting insulin by 20%
	On first full day at destination, wake on usual time schedule and take usual insulin dose
	Continue to take insulin based on local time

Kruger DF. *The Diabetes Travel Guide.* 2nd ed. 2006.

Patients whose travel involves time zone changes should discuss their regimen with their health care provider. If the time change is 1 to 2 hours, insulin can usually be injected based on the new time. On the travel day, insulin should be taken based on the home time. The local time should be used beginning on the morning of the first day at the destination.

This slide shows suggested insulin dose adjustments for eastbound travel with time changes of 3 hours or more. In this case, the travel day is shortened.

The goals of these adjustments are to avoid the overlapping of long-acting insulin injections (eg, giving 2 doses of long-acting insulin 18 hours rather than 24 hours apart) and to begin using the destination time as soon as possible.

Westbound Travel With Time Changes of ≥3 Hours

Injection Frequency	Insulin Dose Adjustment
1	On travel day, take insulin as usual
	Since day will be extended, injection of same insulin may be needed before dinner
	Timing of second injection should be based on home time and be 1/3 of AM dose
	Alternatively, take usual AM injection based on home time and, if extra meal is eaten, take injection of rapid-acting insulin to cover CHO content of meal
≥2	On travel day, take breakfast insulin as usual
	If lunchtime insulin is used, take usual dose based on home time schedule
	Take usual dinnertime rapid-acting insulin at dinner meal
	If last daily injection of intermediate- or long-acting insulin is usually at dinnertime, delay it by 3 hours and decrease dose by 20%
	If last daily injection of intermediate- or long-acting insulin is usually at 9–10 PM, take injection at time it would be taken using home time and increase dose by 10%
	Upon arrival at destination, wake on destination time and take usual insulin dose(s) based on destination time schedule

Kruger DF. *The Diabetes Travel Guide.* 2nd ed. 2006.

This slide shows suggested insulin dose adjustments for westbound travel with time changes of 3 hours or more. In this case, the travel day is extended.

The goal of these adjustments is to begin using the destination time as soon as possible. For patients using a basal-bolus regimen, it is relatively easy to bridge any disruption in the use of long-acting insulin by administering a correction dose of rapid-acting insulin. In this way, long-acting insulin can be given at an hour that makes sense in the new time zone.

Traveling With an Insulin Pump

- Travelers should take
  - Extra pump supplies
  - Pump manufacturer's telephone number
  - Rapid-acting insulin and long-acting insulin (with delivery devices)
  - Record of their basal and bolus rates
- Adjusting the pump for time zone changes
  - Set clock to destination time zone during trip
  - Measure BG several times during trip
  - Bolus to cover snacks, meals, and elevated BG levels
  - Reset multiple basal rates based on BG readings and destination time zone after arriving at destination

Kruger DF. *The Diabetes Travel Guide.* 2nd ed. 2006.

Travelers who use insulin pumps can avoid problems by packing extra pump supplies, carrying the telephone number of the pump manufacturer, and taking rapid-acting insulin and long-acting insulin, along with delivery devices for those insulins. If they do not have a plan for injecting insulin as an alternative to insulin pump therapy, they should speak with their health care provider before traveling and carry written instructions with them. They should take a record of their basal and bolus rates so they can reprogram their existing pump if their data are deleted or program a new pump if the old one malfunctions.

The process of adjusting the insulin pump for time zone changes is straightforward. The insulin pump clock should be set to the destination time zone during the trip. Travelers should measure their BG levels several times during the trip and administer boluses to cover snacks, meals, and elevated BG readings. When they reach their destination, travelers should reset their multiple basal rates based on their BG readings and the destination time zone.

Case Study: Westbound Travel

Patient	Michael, 60 years old, 8-year history of type 2 diabetes, ISF = 24 Lives in North Carolina, going to visit son in Oregon Trip involves time change of 3 hours
Usual basal-bolus regimen	Rapid-acting insulin analog, prebreakfast: 10 units Rapid-acting insulin analog, prelunch: 10 units Rapid-acting insulin analog, predinner: 14 units Long-acting insulin analog, bedtime (10 PM): 38 units
Modified basal-bolus regimen for trip	Rapid-acting insulin analog, breakfast: 10 units (no change) Rapid-acting insulin analog, lunch: 10 units (same dose, based on home time) Rapid-acting insulin analog, dinner: 14 units (same dose, taken at dinner meal at destination) Long-acting insulin analog: taken at 7 PM destination time (10 PM home time), with dose increased by ~10%, to 42 units **Next Day** Rapid-acting insulin analog, prebreakfast: 10 units (no change, taken at destination time)
Correction bolus during travel	BG is 45 mg/dL above target; ISF is 24 45 ÷ 24 = 1.9, rounded up to 2 Correction bolus of 2 units

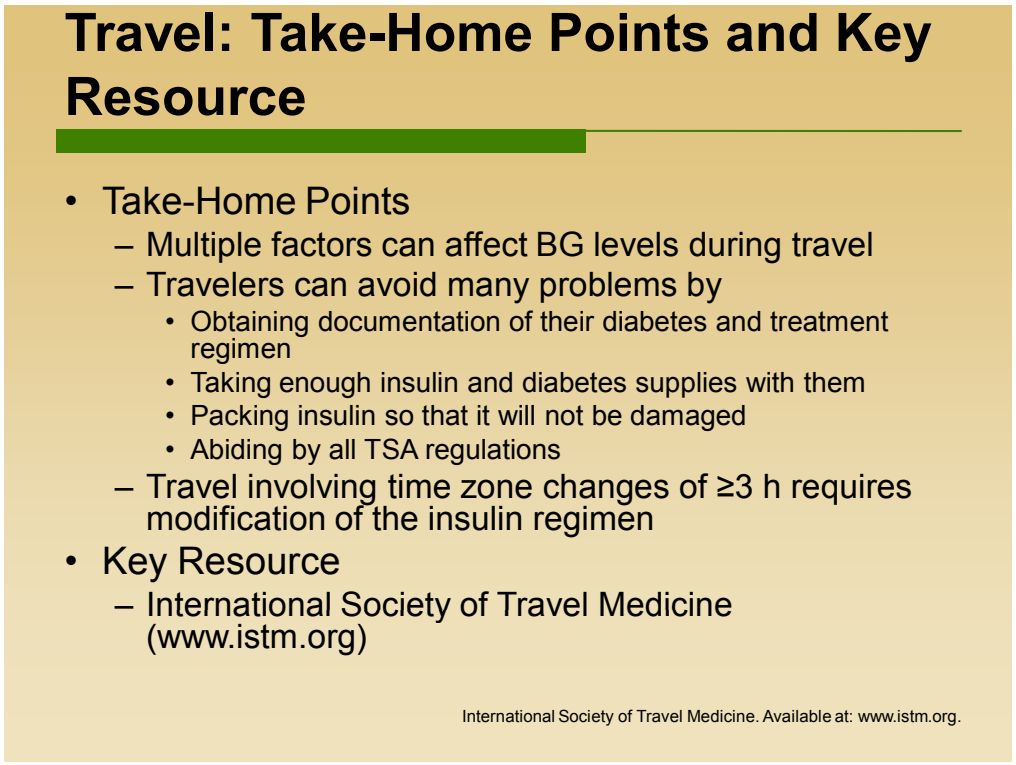
ISF = insulin sensitivity factor.

Kruger DF. *The Diabetes Travel Guide.* 2nd ed. 2006.

This case study gives an example of the way in which a basal-bolus insulin regimen can be modified for westbound travel involving a 3-hour time change. Michael is 60 years old and has an 8-year history of type 2 diabetes. His insulin sensitivity factor (ISF) is 24. He lives in Wilmington, North Carolina, and is going to Portland, Oregon, to visit his son. Michael's usual doses of rapid-acting insulin analog are 10 units before breakfast and lunch and 14 units before dinner. His customary dose of long-acting insulin analog is 38 units, which he takes at 10 PM, his bedtime.

On his travel day, Michael takes his usual 10 units of rapid-acting insulin with his breakfast, which he eats before driving to the airport. At noon home time, when he usually eats lunch, Michael is flying above the Mississippi River and it is 11 AM local time. Michael administers his customary lunchtime dose of rapid-acting insulin analog and eats a lunch purchased at the Wilmington airport. At 4 PM home time, Michael checks his BG and sees that it is 175 mg/dL, or 45 mg/dL above target. Michael attributes this high reading to his hours of unaccustomed inactivity on the plane. Since he has an ISF of 24, he administers a correction bolus of 2 units of rapid-acting insulin analog (45 ÷ 24 = 1.9, rounded up to 2).

After arriving in Portland and enjoying a happy reunion at the airport, Michael and his family have dinner at a nearby restaurant. Before sitting down to dinner at 5 PM local time (8 PM home time), Michael takes his usual dinnertime dose of 14 units of rapid-acting insulin analog. Later, at 7 PM local time (10 PM home time), he takes his daily dose of long-acting insulin analog. He increases the dose by about 10%, from 38 units to 42 units. The next day, Michael awakens at 7 AM local time and takes his usual dose of 10 units of rapid-acting insulin analog before sitting down with his family to breakfast.



Take-Home Points. Multiple factors, including missed meals, dietary changes, increased exercise, time zone changes, stress, and travel-related illness or injury, can affect BG levels during travel. Travelers can avoid many problems by obtaining documentation of their diabetes and their treatment regimen for diabetes, taking adequate amounts of insulin and diabetes supplies with them, packing insulin so that it will not be damaged by extreme environmental conditions, and abiding by all TSA regulations. Travel involving time zone changes of 3 hours or more requires modification of the insulin regimen. Guidelines for these modifications have been published, but travelers should discuss individualized modifications with their health care provider before leaving on their trip.

Key Resource. The International Society of Travel Medicine (ISTM) is an organization of health care providers from more than 70 countries. Its objective is to promote healthy travel worldwide. In addition to maintaining an extensive Web site, the organization publishes the bimonthly *Journal of Travel Medicine* and a variety of other publications for health care providers and travelers. The ISTM also sponsors worldwide and regional conferences and courses.

Situations Related to Meal Planning

In this section, we will discuss situations related to meal planning.

Situations Related to Meal Planning

- Many people who use insulin find it difficult to maintain glycemic control when their meal schedule is irregular
- Consistency in the timing and CHO content of meals is important with fixed-dose insulin therapy
- Both basal-bolus therapy and insulin pump therapy are helpful for persons with irregular schedules
  - Bolus insulin doses can be calculated on the basis of food intake
  - Meals and snacks can be customized for individual schedules and preferences

Bantle JP et al. *Diabetes Care.* 2007;30(Suppl 1):S48–S65.
Tomky DM, Kulkarrni K. *The Art and Science of Diabetes Self-Management Education.* 2006.

Irregular meal schedules are becoming increasingly common in the United States due to work, school, and family commitments. Many people who use insulin find it difficult to maintain glycemic control when faced with irregular meal schedules.

Although fixed-dose insulin regimens are often effective for people who eat on a predictable schedule and consume a consistent amount of carbohydrates at mealtimes, these regimens are frequently inadequate for persons with unpredictable lifestyles. Many persons with type 2 diabetes and irregular schedules benefit from basal-bolus therapy, and others benefit from insulin pump therapy. With both types of therapy, patients can calculate bolus insulin doses based on food intake, and meals and snacks can be customized to the individual's schedule and preferences in meal sizes and food types.

Monitoring Carbohydrate Intake

- Monitoring CHOs is a key strategy for achieving glycemic control
- Carbohydrate counting is a meal-planning approach by which patients perform premeal SMBG and adjust their prandial insulin dose based on the anticipated carbohydrate content of a meal
- Calculation of the patient's insulin-to-carbohydrate ratio (ICR) is a prerequisite to carbohydrate counting
  - ICR is based on individual's sensitivity to insulin
  - For a person with an ICR of 1:8, 1 unit of insulin is needed to match 8 g of carbohydrate
  - Typical ICRs are 1:10 to 1:15 for nonobese adults and 1:5 for obese adults
  - ICRs may vary throughout the day

Bantle JP et al. *Diabetes Care.* 2007;30(Suppl 1):S48–S65.
Tomky DM, Kulkarrni K. *The Art and Science of Diabetes Self-Management Education.* 2006.
Kulkarni KD. *Clin Diabetes.* 2005;23:120–122.

According to the ADA, monitoring of carbohydrates, either by carbohydrate counting or experienced-based estimation, is a key strategy for achieving glycemic control. Carbohydrate counting is a powerful meal-planning tool. With carbohydrate counting, patients perform SMBG before meals and adjust their prandial insulin dose based on the anticipated carbohydrate content of the meal.

A prerequisite for carbohydrate counting is the calculation of the patient's insulin-to-carbohydrate ratio (ICR). The ICR is based on the principle that 1 unit of rapid-acting insulin is needed to match a specified amount of carbohydrate, and the ratio is determined by the individual's sensitivity to insulin. (This calculation is discussed on the next slide.) For example, for a patient with an ICR of 1:12, 1 unit of insulin is needed to match 12 grams of carbohydrate. An adult who is not obese might have an ICR ranging from 1:10 to 1:15. In contrast, an adult who is obese might have an ICR of 1:5. Initially, a diabetes educator or dietitian might calculate the ICR, but it should be recalculated regularly by the patient to reflect changes in insulin sensitivity. ICRs can vary throughout the day. For example, an individual's ICR may be 1:12 at breakfast, 1:10 at lunch, and 1:8 at dinner.

Calculating a Correction Bolus

- Individuals with variable mealtimes and content can also improve their glycemic control by administering a correction bolus when their premeal BG level is too high
- The size of the correction bolus is calculated using the patient's ISF
- ISF is the value in mg/dL by which 1 unit of insulin lowers BG
  - A patient using a rapid-acting insulin analog needs a smaller dose of insulin to reduce the BG level than a patient using regular human insulin
  - According to widely used formulas, a patient using a rapid-acting insulin analog calculates the ISF by dividing 1700 by the total daily insulin dose and a patient using a regular human insulin divides 1500 by the total daily insulin dose (thus arriving at a larger insulin dose)
- To determine the size of the correction bolus, the patient calculates the difference between the actual premeal BG value and the target BG value
- This difference, divided by the ISF, is the correction bolus dose to be administered

Tomky DM, Kulkarrni K. *The Art and Science of Diabetes Self-Management Education.* 2006.

In addition to using carbohydrate counting, persons with diabetes can further improve their glycemic control by administering correction bolus doses of rapid-acting insulin when their BG levels exceed target values. The size of the correction bolus dose can be calculated once an individual's ISF has been determined.

The ISF is the value in mg/dL by which 1 unit of insulin lowers BG. The type of insulin that a patient uses for correction doses helps to determine the way in which a correction dose is calculated. For example, if patients need to reduce their BG level by 50 mg/dL, a patient using a rapid-acting insulin analog would need to administer a smaller dose of insulin than a patient using regular human insulin.

According to widely accepted formulas, a patient using a rapid-acting insulin analog calculates the ISF by dividing 1700 by the total daily insulin dose and a patient using a regular human insulin calculates the ISF by dividing 1500 by the total daily insulin dose (thus arriving at a larger insulin dose). Other experts calculate the ISF in slightly different ways. The ISF should be determined by the patient's health care team.

To determine the size of a correction bolus to be administered before a meal, the patient calculates the difference between the actual premeal BG value and the target value. This difference, divided by the ISF, is the correction bolus dose that should be administered.

Challenges of Restaurant Eating

- US residents spend about half of every food dollar on restaurant food, eat about one third of their calories away from home, and eat 6 restaurant meals per week
- Restaurant eating poses many challenges
  - Patrons often view restaurant eating as a special occasion, when usual constraints do not apply
  - Nutrition information is often unavailable
  - Oversized portions, all-you-can-eat buffets, and two-for-one specials encourage overeating
  - Foods are often high in sodium and fat (including hidden fats)
  - Meat is frequently the primary attraction, and vegetables are often overcooked

Warshaw HS. *American Diabetes Association Guide to Healthy Restaurant Eating*. 4th ed. 2009.

Today, US residents spend about half of every food dollar on restaurant food, eat about one third of their calories away from home, and eat 6 restaurant meals per week. This is understandable, given the hectic pace of modern life. However, restaurant eating poses many challenges to the general public and especially to people with diabetes.

Despite the fact that eating in restaurants has become so common, many patrons continue to view restaurant eating as a special occasion, when usual dietary constraints do not apply. Another challenge involves nutrition information about the foods served in restaurants. Although nutrition information has become widely available for food served at national chain restaurants (especially those restaurants in which the customer walks up to the counter or drives up to a window to place an order), sparse information is available for most “sit down and eat” national chains. Furthermore, there is almost no available nutrition information for independent chains, single-unit restaurants, and most ethnic establishments.

Drastically oversized portions, all-you-can-eat buffets, and two-for-one specials and other promotions encourage overeating. Foods are often high in sodium and fat (including hidden fats). Some type of meat, served in an excessively large portion, is usually the primary attraction, and vegetables are often overcooked.

Healthy Restaurant Eating

Educate patients to:

- Obtain nutrition information from the restaurant itself, the Internet, or a reference book
- Choose foods with their nutritional goals in mind and include foods from each food group
- Ask questions about foods on the menu
- Make special requests about how food is prepared and served
- Avoid fried and high-fat foods
- Take advantage of nutritious appetizers, soups, and salads, and do not feel obliged to order an entrée
- Stop eating when nutritional and caloric needs have been met
- Observe and record individual responses to specific foods and food combinations by checking BG levels before and after eating

Warshaw HS. *American Diabetes Association Guide to Healthy Restaurant Eating*. 4th ed. 2009.

There are many strategies for making restaurant eating a healthier experience for people with type 2 diabetes. Health care providers should educate patients to do the following:

- Obtain nutrition information from the restaurant itself, the Internet, or a reference book
- Choose foods with their nutritional goals in mind and include foods from each food group
- Ask questions about foods on the menu and how they are prepared
- Make special requests about how food is prepared and served. For example, a customer might ask that a chef's salad be prepared with all turkey rather than turkey and ham, or that salad dressing be served on the side
- Avoid fried foods and high-fat foods such as cheese, avocado, and sausage
- Take advantage of nutritious appetizers, soups, and salads, and do not feel obliged to order an entrée
- Stop eating when nutritional and caloric needs have been met, rather than feeling obliged to eat everything on the plate
- Observe and record individual responses to specific foods and food combinations by checking BG levels before and after eating

Case Study: Irregular Schedule and Restaurant Eating

Patient	Robin, 48 years old, 8-year history of type 2 diabetes Works in metropolitan Washington, DC, as sales representative During workweek, meal schedule is variable, reflecting client needs Eats all lunches and several dinners each week in restaurants
History	When she began her job 3 years earlier, was on fixed-dose regimen of twice-daily premixed insulin analog In retrospect, realizes that she made many poor food choices when eating in restaurants A1C increased from 6.9% when she began job to 8.2% after 6 months Realized that she needed to take drastic action and consulted her physician and diabetes educator

This case study gives an example of the way in which a person with a basal-bolus insulin regimen can optimize glycemic control despite an irregular meal schedule and frequent restaurant eating.

Robin is 48 years old and has an 8-year history of type 2 diabetes. She works in the metropolitan Washington, DC, area as a sales representative for a specialty software manufacturer. During the workweek, Robin's meal schedule is highly variable, reflecting the needs of her clients. She eats all of her lunches and several of her dinners in restaurants.

Three years earlier, when she began her job, Robin was on a fixed-dose regimen of twice-daily premixed insulin analog. In retrospect, she sees that she made many poor food choices when she started eating in restaurants. When her A1C increased from 6.9% to 8.2% over a 6-month period, Robin realized that she needed to take drastic action and consulted her physician and diabetes educator.

Case Study: Irregular Schedule and Restaurant Eating (2)

Standard basal-bolus regimen	Long-acting insulin analog, bedtime: 34 units Rapid-acting insulin analog, prebreakfast: 8 units Rapid-acting insulin analog, prelunch: 5 units Rapid-acting insulin analog, predinner: 11 units
Adjustment of bolus doses, correction boluses	CHO counting, using ICR of 1:12 Correction bolus doses, based on ADA BG targets and ISF of 29
"Restaurant survival strategy"	When eating alone, go to familiar restaurants where nutrition information is available and eat combinations of nutritious foods known to give good SMBG results When eating with client in unfamiliar restaurants, read menu carefully, ask questions, request healthier alternatives, and be vigilant about portion control
Most recent A1C	6.4%

In consultation with her physician, Robin decided that it was time for her to transition to a basal-bolus insulin regimen, so she can adjust her insulin doses on an ongoing basis. Over several weeks, her standard regimen was adjusted to 34 units of a long-acting insulin analog administered at bedtime. Her standard regimen also includes a rapid-acting insulin analog, administered at doses of 8 units before breakfast, 5 units before lunch, and 11 units before dinner. SMBG showed that Robin's basic regimen allows her to meet ADA BG targets on weekends, when she eats at home, but is not sufficiently flexible to meet all of the demands of her weekly schedule. Robin worked closely with a registered dietitian and gradually developed solid carbohydrate-counting skills. She learned to match the amount of rapid-acting insulin taken before lunch and dinner to the anticipated carbohydrate content of her meal, using her ICR of 1:12. Robin also learned to administer a correction bolus dose of rapid-acting insulin, based on ADA BG targets and her ISF of 29.

Robin and the registered dietitian also discussed approaches to healthy restaurant eating and Robin read several books and articles on the subject. Gradually, Robin developed what she calls her "restaurant survival strategy." When she eats out by herself, she goes to restaurants associated with 2 national chains that publish nutrition information and offer a number of healthy food choices. When she eats with a client at an unfamiliar restaurant, she reads the menu carefully and asks that her food be served without heavy sauces or other sources of extra calories and fats. She also requests healthy alternatives to standard side dishes, such as steamed zucchini rather than onion rings. She is vigilant about portion control.

Robin's basal-bolus regimen and restaurant survival strategy have been successful, as demonstrated by her most recent A1C of 6.4%.

Case Study: Irregular Schedule and Restaurant Eating (3)

Food choices at "comfort food" restaurant	Rejects high-fat entrées, such as macaroni and cheese Orders roast chicken, requesting that cream sauce be omitted Requests a side order of green beans rather than french fries Calculates that meal (using portion control) will total 60 g of CHO
Lunchtime bolus, based on CHO counting	ICR is 1:12 60 g CHO ÷ 12 = 5 units of rapid-acting insulin analog
Correction bolus, based on premeal BG	ISF is 29 ADA premeal BG target is 70–130 mg/dL Robin's prelunch BG level is 170 mg/dL 170 mg/dL – 130 mg/dL = 40 mg/dL 40 mg/dL ÷ 29 = 1.4, rounded down to 1 unit of rapid-acting insulin analog
Total premeal bolus dose	5 + 1 = 6 units of rapid-acting insulin analog
2-hour postprandial BG	164 mg/dL

One rainy Thursday, Robin and a client go to lunch at a new restaurant that specializes in "comfort food." When Robin studies the menu, she is dismayed to see that many of the entrées, such as macaroni and cheese and tortellini with Alfredo sauce, would be poor choices because of their high fat content. She orders the special of the day, roast chicken breast with herbed cream sauce and french fries, but asks that the chicken be served without the sauce and that green beans be substituted for the french fries. She will also have a small tossed salad with vinaigrette dressing and a small whole wheat roll.

Robin estimates that, by practicing strict portion control, her meal will include 60 g of carbohydrates. Based on her ICR of 1:12, she would take 5 units of rapid-acting insulin. However, when she checks her BG, she finds that it is 170 mg/dL, or 40 mg/dL above target. She attributes this high reading to her inability to walk that morning due to heavy rain. Since her ISF is 29, she divides 40 mg/dL by 29, which equals 1.4. She rounds this down to 1 and, including the 5 units of insulin needed to cover mealtime carbohydrates, administers a prelunch bolus dose of 6 units of rapid-acting insulin.

Two hours after beginning her meal, Robin checks her BG and finds that it is 164 mg/dL. Thus, it is within the ADA range for postprandial BG (<180 mg/dL).

Situations Related to Meal Planning: Take-Home Points and Key Resources

- Take-Home Points
  - Many people, including those with type 2 diabetes, have irregular meal schedules and often eat in restaurants
  - Both basal-bolus and insulin pump therapy can provide increased flexibility in the timing and content of meals
  - By using CHO counting to calculate prandial boluses and administering correction boluses, patients on a basal-bolus regimen can optimize BG control
  - With knowledge and self-discipline, customers can make restaurant eating a healthful experience
- Key Resources
  - Donna Tomky and Karmeen Kulkarni, "Intensifying insulin therapy: multiple daily injections to pump therapy," in *The Art and Science of Diabetes Self-Management Education*, 2006
  - Hope Warshaw, *ADA Guide to Healthy Restaurant Eating*, 2009

Tomky DM, Kulkarrni K. *The Art and Science of Diabetes Self-Management Education.* 2006.
Warshaw HS. *American Diabetes Association Guide to Healthy Restaurant Eating.* 4th ed. 2009.

Take-Home Points. Many people, including those with type 2 diabetes, have irregular meal schedules and often eat in restaurants. Both basal-bolus and insulin pump therapy can provide increased flexibility in the timing and content of meals. By using carbohydrate counting to calculate prandial boluses and administering correction boluses, patients on a basal-bolus regimen can optimize BG control. Restaurant eating poses many challenges to glycemic control and weight control. However, with knowledge and self-discipline, customers can make restaurant eating a healthful experience.

Key Resources. A book chapter, "Intensifying insulin therapy: multiple daily injections to pump therapy," which was written by Donna Tomky, MSN, CDE, and Karmeen Kulkarni, RD, CDE, provides a comprehensive overview of basal-bolus and insulin pump therapy. This practically oriented publication contains succinct discussions about carbohydrate counting and calculating the ICR and ISF. The *American Diabetes Association Guide to Healthy Restaurant Eating*, which was written by Hope Warshaw, RD, CDE, and published in a fourth edition in 2009, describes the health risks of restaurant eating and includes many valuable suggestions for healthy restaurant eating. The book contains detailed nutrition information about the offerings at 61 national and regional restaurant chains.

Cultural Values and Religious Practices

Let’s shift our attention to cultural values and religious practices.

Cultural Values and Religious Practices

- There is increasing awareness of the powerful impact that cultural values and religious practices can have on self-management in people with type 2 diabetes
- Failure of health care providers to address these factors may have negative consequences
  - Reluctance to make necessary lifestyle modifications
  - Failure to adhere to prescribed drug regimens
  - Unwillingness to transition to insulin therapy
- Many health care providers need to improve their cultural competence and modify their education and treatment strategies so they are consistent with the values and practices of their patients

Caballero AE. *Insulin.* 2007;2:80–91. Campos C. *Insulin.* 2006;1:70–76.
Lorenzi GM. *The Art and Science of Diabetes Self-Management Education.* 2006.

Recently there has been an increased awareness of the powerful impact that cultural values and religious practices can have on self-management in people with type 2 diabetes. Unless health care providers are aware of these factors and address them, they may have many negative consequences for the patient's well-being, including reluctance to make necessary lifestyle modifications, failure to adhere to prescribed drug regimens, and unwillingness to transition to insulin therapy. Many health care providers need to improve their cultural competence and modify their education and treatment strategies so that they are consistent with the values and practices of their patients.

In this section, we will discuss several examples of cultural values and religious practices that affect the management of patients with type 2 diabetes. Each example includes suggestions for ways in which health care providers can assist patients to achieve their glycemic goals and optimize their overall health and well-being despite of potential barriers.

Cultural Values: Psychological Resistance to Insulin in Hispanic Persons

Cultural Values That Can Serve as Barriers

Value	Description	Consequences If Ignored by Provider
Familismo	Collective loyalty to extended family that supersedes individual needs	Patient–provider conflicts, poor continuity of care, patient dissatisfaction, nonadherence to therapy
Personalismo	"Formal friendliness," patient's desire to develop warm, personal relationship with health care provider	Patient reluctance to share details of health status, nonadherence to therapy, reluctance to begin insulin therapy, patient dissatisfaction
Simpatia	Politeness and pleasantness in the face of stress	Communication problems, reluctance to share details of health status, nonadherence
Respeto	Expectation that patient will be respected by health care provider	Communication problems, reluctance to share details of health status
Fatalismo	Belief that patient cannot alter his/her fate	Avoidance of effective diabetes treatment

Caballero AE. *Ethn Dis*. 2006;16:559–568.

Psychological resistance to insulin, the reluctance to begin insulin therapy when it would be beneficial, has been shown to be very strong in the Hispanic community. Psychological resistance to insulin may be especially pronounced when health care providers fail to recognize and respect the key cultural values shown on this slide. (Note that these values vary among different Hispanic and Latino cultures and among individuals, based on their level of acculturation in the United States. Second- and third-generation Hispanic Americans and Latino Americans may respond differently than their parents and grandparents.)

Because of *familismo*, patients often wish to consult with their extended family before making treatment decisions. Failure of the provider to recognize this value can result in unnecessary conflicts with the patient, poor continuity of care, and other problems. As a result of *personalismo*, patients expect handshakes and other types of physical contact from their provider. If these are absent, patients may believe that their provider does not care about them, hesitate to share details about their health, and manifest their dissatisfaction in other ways.

Because of *sympatia*, patients expect that their provider will be polite and pleasant, and they are often uncomfortable with the neutral demeanor of many American health care providers. The perceived absence of *sympatia* may cause communication problems, patient reticence about their health status, and nonadherence to the treatment plan. Owing to the value of *respeto*, patients may become distant and resentful if they perceive that they are not respected by their provider.

Fatalismo, the belief that individuals cannot alter their fate, may cause patients to resist effective treatments, such as insulin therapy.

Cultural Values: Psychological Resistance to Insulin in Hispanic Persons (2)

Ways in Which Health Care Providers Can Acknowledge Patients' Values

Value	Appropriate Response by Health Care Provider
Familismo	Encourage family participation in patient visits; give patient ample time to discuss transition to insulin with extended family
Personalismo	Reduce physical distance from patient, initiate socially appropriate physical contact, and convey a friendly attitude
Simpatia	Emphasize courtesy, a positive attitude, and social amenities
Respeto	Use appropriate titles and formal greetings, involve patients in the decision to initiate insulin therapy, and give patients time to express their concerns about starting insulin
Fatalismo	Emphasize the efficacy and safety of insulin as a treatment for type 2 diabetes

Caballero AE. *Ethn Dis*. 2006;16:559–568.

Health care providers can demonstrate their respect for the cultural values of Hispanic patients, and thus facilitate their transition to insulin therapy, in many ways.

Providers can recognize the importance of *familismo* by encouraging family attendance at and participation in patient visits and by giving the patient ample time to discuss starting insulin therapy with extended family members. They can demonstrate their respect for *personalismo* by reducing their physical distance from the patient, initiating socially appropriate physical contact, and conveying a friendly attitude.

Providers can show their appreciation for *simpatia* by emphasizing courtesy, a positive attitude, and social amenities. They can demonstrate *respeto* by using appropriate titles and formal greetings, involving patients in the decision to initiate insulin therapy, and giving patients time to express their concerns about insulin.

Health care providers can respond to *fatalismo* by emphasizing the efficacy and safety of insulin as a treatment for type 2 diabetes.

Cultural Values: Management Challenges in Chinese Americans

Challenges to Diabetes Management

Challenge	Examples
Family harmony	Increased irritability threatens family harmony Social rather than physiological aspects of glucose regulation are most important
Dietary issues	Limiting rice consumption challenges concept that rice is essential for physical and emotional well-being Dietary restrictions • Disregard concerns about balancing foods • Complicate ritual meals and celebrations • Cause patient to stand out and require special attention
Roles and responsibilities	Family members often disagree about • Who should create, observe, and enforce food restrictions • How much each member should know about diabetes regimen • Which treatment philosophy should prevail (traditional Chinese medicine vs Western medicine)

Chesla CA et al. *Diabetes Care.* 2009;32:1812–1816.

Results of a study of Chinese American immigrants provide another example of the way in which cultural values affect the management of type 2 diabetes. Chesla and colleagues conducted an interview-based study of married couples that had immigrated to the United States from China that included one spouse who had type 2 diabetes without diabetic complications.

As shown on the slide, interviews identified 3 major areas of concern: family harmony, dietary issues, and roles and responsibilities. Because of the value placed on social ease, avoidance of overt expression and strong negative emotions, and accommodating other family members' needs, increased irritability as a symptom of diabetes is considered a challenge to family harmony. The social rather than the physiological aspects of glucose regulation are paramount in this context.

Concerning dietary restrictions, providers' recommendations that patients limit rice consumption and eat less highly processed types of rice challenge the basic concept that large servings of white rice are essential to physical and emotional well-being. Patients may not comply with dietary restrictions because these restrictions seem to disregard traditional concerns about balancing foods, complicate ritual meals and celebrations, and cause patients to stand out and require special attention.

Regarding roles and responsibilities, family members often disagree about who should create, observe, and enforce food restrictions; how much each family member should know about the patient's diabetes regimen; and which treatment philosophy should prevail—traditional Chinese medicine or Western medicine.

Cultural Values: Management Challenges in Chinese Americans (2)

Ways in Which Health Care Providers Can Address Management Challenges

Challenge	Examples
Family harmony	Explain that emotional lability is a common symptom of glucose dysregulation and that it may also follow diagnosis of a chronic disease Screen patient for depression if lability is severe
Dietary issues	Explain why too much rice has detrimental effects on BG Encourage patients and their families to transition gradually to an "ideal" diet and to explore alternatives to white rice Shift focus from a "restricted diet" to a "balanced diet" Refer patients to dietitians familiar with Chinese dietary preferences
Roles and responsibilities	Encourage discussion and problem solving about family roles Address concerns about family well-being and "face" during patient-centered education

Chesla CA et al. *Diabetes Care.* 2009;32:1812–1816.

When treating Chinese American immigrants with type 2 diabetes, health care providers can address challenges related to cultural values in several ways.

With regard to family harmony, providers should advise patients and their families that emotional lability is a common symptom of glucose dysregulation. It is also common following the diagnosis of a chronic disease such as diabetes. Patients who experience severe emotional lability should be screened for depression.

Concerning dietary issues, providers can minimize distress by recommending a gradual transition to an ideal diet and by encouraging patients and family members to explore alternatives to white rice and rice noodles. Teaching patients about how rice affects BG may help to dispel cultural myths. Providers can also shift the focus from "restrictions" to "balance." Prescribing a diet that balances new with customary foods or rice with vegetables and proteins is more culturally appropriate than recommending a diet that limits the consumption of some foods. Providers should also refer patients to dietitians who are familiar with Chinese dietary preferences. Although all patients should receive education about dietary issues, adjusting the patient's doses of insulin and/or other medications may ultimately prove more effective than urging patients to explore alternatives to white rice.

Regarding roles and responsibilities, health care providers can encourage discussion and problem solving by acknowledging the multiple and competing concerns that families are dealing with. They can also address concerns related to family well-being and "saving face" during patient-centered education.

Religious Practices: Fasting on Yom Kippur

- Most insulin-treated patients who have no major comorbidities and are not pregnant can safely fast
- Pregnant women with gestational or preexisting diabetes should not fast
- The main therapeutic objective is to avoid hypoglycemia
- If BG increases over the course of the day, it will not create a short- or long-term problem (except for pregnant women)
- Avoiding hypotension is important, especially in elderly patients, and blood pressure medication must be adjusted carefully

Grajower MM. *Endocr Pract.* 2008;14:305–311.

Fasting is an example of a religious practice that affects the management of persons with type 2 diabetes. Many adherents to Judaism, Islam, and other faith traditions practice religious fasting. Although many Jewish persons observe several fast days throughout the year, individuals are most likely to fast on Yom Kippur. Yom Kippur, the holiest day of the Jewish year, involves a 25-hour fast, from sunset until 1 hour after sunset the following day. Girls under the age of 12 years, boys under the age of 13 years, pregnant women, and persons with diabetes and other medical conditions are exempt from fasting, but many Jewish persons with type 2 diabetes elect to fast on Yom Kippur. Martin Grajower, an Orthodox Jew and endocrinologist whose goal is to synthesize Jewish law with good medical practice, has developed guidelines for the management of diabetes on Yom Kippur.

Most insulin-treated patients who have no major comorbidities and are not pregnant can safely fast. However, pregnant women with gestational or preexisting diabetes should not fast, since hyperglycemia and hypoglycemia can be harmful to the fetus.

The main therapeutic objective on Yom Kippur is to avoid hypoglycemia. If BG increases over the course of the day, it will not create a short- or long-term problem (except, as already mentioned, for pregnant women).

Anyone who refrains from eating and drinking for 25 hours will become dehydrated, and many otherwise healthy people experience a decrease in their blood pressure as a result. It is important to avoid clinically significant hypotension, especially in elderly patients. Therefore, blood pressure medication must be managed carefully.

Religious Practices: Fasting on Yom Kippur (2)

Guidelines for Adjusting Glucose-Lowering Medications on Yom Kippur

Timing	Insulin + Other Agents	Insulin Only
Night before	Take usual dose of short-acting insulin before dinner, and one half to one third the usual evening dose of intermediate-acting or basal insulin (based on A1C). Do not take SU; take all other medications before last meal	Take usual dose of short-acting insulin before dinner, and one half to one third the usual evening dose of intermediate-acting or basal insulin (based on A1C)
Day of fast	Do not take any medications, including insulin	Take no insulin unless BG is >250 mg/dL; then take short-acting insulin analog, and aim to lower BG only to 110–140 mg/dL
After fast	Resume all usual predinner and bedtime medications. Reduce dose of short-acting insulin if patient will eat smaller dinner than usual	Resume all usual predinner and bedtime doses; adjust dose of short-acting insulin if patient will eat smaller dinner than usual

DPP-4 = dipeptidyl peptidase-4; SU = sulfonylurea.

Grajower MM. *Endocr Pract.* 2008;14:305–311.

For patients who elect to fast on Yom Kippur, medication regimens need to be modified, beginning on the evening before the fast. This table shows guidelines for adjusting glucose-lowering medications in patients who are treated with insulin plus other agents and in those who are treated with insulin only.

Patients who use other glucose-lowering agents in addition to insulin should take their normal dose of any agent except a sulfonylurea before the last meal. Because of the potential for hypoglycemia, a sulfonylurea should not be taken on the evening before the fast. Depending on the A1C, the patient's dose of basal insulin should be reduced by one third to one half at this time. A patient who will break the fast on the evening of Yom Kippur with a smaller meal than usual should reduce the dose of prandial insulin taken at this meal.

Patients who use premixed insulin should reduce the dose taken before the prefast meal by one half to one third, based on their A1C. A patient on a premixed regimen who has a BG level greater than 250 mg/dL on the fast day should treat it by administering a rapid-acting insulin analog. (Treatment of BG excursions is discussed on the next slide.)

Patients with an insulin pump should not administer an insulin bolus once the fast has begun (unless the BG level exceeds 250 mg/dL). They should reduce the basal rate by about 10% beginning in the early morning, or earlier if they normally have a bedtime snack. They should increase the frequency of SMBG, especially the first time they fast with an insulin pump.

Religious Practices: Fasting on Yom Kippur (3)

SMBG and Glucose Excursions

- Insulin-treated patients should test their BG level when they get up on the morning of the fast and then every 4–6 h
  - They should test more frequently if BG levels are <70 mg/dL or if they have symptoms of hypoglycemia
- Hypoglycemia
  - Patients who have a BG level of <60 mg/dL or are symptomatic should take a commercially available glucose tablet and retest BG in 30–60 min*
  - Patients with hypoglycemia for a 1–2 h period should discontinue the fast and eat food
- Hyperglycemia
  - For BG levels >250 mg/dL, patients should administer a rapid-acting insulin analog, aiming for a BG value in the range of 110–140 mg/dL

*As an alternative, many experts advise treating BG levels <70 mg/dL with 15 g of carbohydrate and then retesting BG in 15 minutes.

Grajower MM. *Endocr Pract.* 2008;14:305–311.

Insulin-treated patients should test their BG level when they get up on the morning of Yom Kippur and then every 4 to 6 hours. They should test more frequently if BG levels are less than 70 mg/dL or if they are symptomatic.

Patients who have a BG level of less than 60 mg/dL or are experiencing symptoms of hypoglycemia should take a commercially available glucose tablet (rather than food or drink) and retest their BG in 30 to 60 minutes. Patients whose hypoglycemia has persisted for 1 to 2 hours should discontinue the fast and eat food. Thresholds for determining how often BG should be tested and how long a patient should wait before breaking the fast depend on the age and general health of the individual patient.

Patients with a BG level greater than 250 mg/dL should administer insulin, aiming for a BG value in the range of 110 to 140 mg/dL. A rapid-acting insulin analog rather than regular human insulin should be used to treat hyperglycemia.

Religious Practices: Fasting on Yom Kippur (4)

Patient–Health Care Provider Interactions

- The health care provider should
  - Ask Jewish patients if they would like to discuss regimen changes for Yom Kippur and/or other fast days
  - Give the patient written recommendations for the fast day regimen
  - Check with the patient at the next office visit to determine whether the fast went smoothly and use notes from this conversation as the basis for future recommendations
  - Encourage the patient to consult with a rabbi, especially if the patient expresses the determination to fast when it could be harmful

Grajower MM. *Endocr Pract.* 2008;14:305–311.

Health care providers should be proactive and, before Yom Kippur and other fast days, ask their Jewish patients with diabetes if they would like to discuss changes to their medication for the coming fast day. This discussion would prevent the patient from relying solely on personal judgment, possibly taking too much medication, and developing hypoglycemia.

The health care provider should give the patient written recommendations for the fast day regimen. These should cover: changes in medication before, during, and after the fast; frequency of SMBG; and planning for terminating the fast if the BG declines below a certain value or the patient becomes symptomatic.

The health care provider should check with the patient at the next office visit to determine whether the fast went smoothly. Notes from this conversation can serve as the basis for future recommendations.

A patient who is determined to fast despite medical evidence that fasting might be harmful should be encouraged to discuss the situation with a rabbi.

Religious Practices: Guidelines for Fasting During Ramadan

- Have a comprehensive medical assessment 1–2 months before Ramadan
- Perform SMBG several times a day
- Follow a healthy and balanced diet, avoid common practice of ingesting large amounts of food rich in fat and CHOs, eat the predawn meal as late as possible
- Avoid excessive physical activity, especially in the hours before the sunset meal
- Follow the prescribed insulin regimen (which often consists of a long-acting and a rapid-acting insulin analog before the evening meal and a rapid-acting insulin analog before the predawn meal)

Al-Arouj M et al. *Diabetes Care.* 2005;28:2305–2311.

During the lunar-based month of Ramadan, which occurs at a different point in the Julian calendar from year to year, most of the world's Muslims observe an absolute fast, consuming no food or water between dawn and sunset. Worldwide, an estimated 40 to 50 million people with diabetes practice the Ramadan fast, although they are not required to do so.

Consensus guidelines for the management of diabetes during Ramadan were published in 2005. Key recommendations are:

- Have a comprehensive medical assessment 1 to 2 months before Ramadan to make sure it is safe to fast
- Perform SMBG several times a day and end the fast immediately if BG levels are less than 60 mg/dL, less than 70 mg/dL in the first hours after the start of the fast, or more than 300 mg/dL
- Follow a healthy and balanced diet, avoid common practice of ingesting large amounts of food rich in fat and carbohydrates, eat the predawn meal as late as possible
- Avoid excessive physical activity, especially in the hours before the sunset meal
- Follow the prescribed insulin regimen. This often consists of a long-acting and a rapid-acting insulin analog before the evening meal and a rapid-acting insulin analog before the predawn meal

Case Study: Religious Practices

Patient	Morrie, 56 years old, 5-year history of type 2 diabetes A1C = 6.8%; ICR = 1:10; ISF = 32
Usual regimen	Long-acting insulin analog, bedtime: 32 units Rapid-acting insulin analog, prebreakfast: 6 units Rapid-acting insulin analog, prelunch: 7 units Rapid-acting insulin analog, predinner: 8 units Metformin: 1000 mg twice daily; glipizide: 10 mg twice daily
Changes to regimen	Night before (predinner): 10 units rapid-acting insulin analog (usual dose), 11 units long-acting insulin analog (32 units × 0.33 = 10.56, rounded to 11 units), metformin 1000 mg (usual dose), no glipizide Day of fast: no medication except to treat hyperglycemia (see below) After fast (predinner): 9 units of rapid-acting insulin analog, based on meal with ~90 g of CHO (90 g ÷ 10 = 9), metformin 1000 mg (usual dose), glipizide 10 mg (usual dose) After fast (bedtime): 32 units (usual dose)
Treatment of hyperglycemia	SMBG at 1 PM on day of fast showed BG of 280 mg/dL. Gave 4-unit dose of rapid-acting insulin analog to reduce BG to 140 mg/dL (280 – 140 = 140 ÷ 32 = 4.3, rounded down to 4)

Grajower MM. *Endocr Pract.* 2008;14:305–311.

This case study gives an example of the way in which a person with a basal-bolus insulin regimen can adjust the regimen for religious fasting. Morrie is 56 years old and has a 5-year history of type 2 diabetes. His A1C is 6.8%, his ICR is 1:10, and his ISF is 32. He has recently transitioned to insulin therapy and consults his health care provider about a plan for safely fasting on Yom Kippur.

Morrie's usual regimen is 32 units of a long-acting insulin analog, as well as a rapid-acting insulin analog given at doses of 6 units prebreakfast, 7 units prelunch, and 8 units predinner. He also takes metformin 1000 mg twice daily and glipizide 10 mg twice daily. Based on written instructions from his health care provider, Morrie makes several alterations to this regimen. Before the prefast meal, he takes his usual doses of rapid-acting insulin analog and metformin but takes no glipizide. He reduces his usual dose of long-acting insulin analog to 11 units, or about one third of his usual dose. He intends to take no medication on Yom Kippur itself. However, when Morrie performs SMBG at 1 PM on that day, his BG is 280 mg/dL. Based on the desire to reduce his BG to 140 mg/dL and his ISF of 32, Morrie takes 4 units of rapid-acting insulin analog. Morrie estimates that his postfast meal will be larger than his usual dinners, including about 90 g of carbohydrate. Using his ICR of 1:10, he calculates that he should take 9 units of rapid-acting insulin analog before dinner. That evening Morrie also takes his usual dose of metformin 1000 mg and resumes his glipizide dose of 10 mg and his long-acting insulin analog dose of 32 units.

Cultural Values and Religious Practices: Take-Home Points and Key Resources

- Take-Home Points
  - There is increasing awareness of the powerful impact that cultural values and religious practices can have on self-management in persons with type 2 diabetes
  - Failure of health care providers to address these factors may have negative consequences for patients
  - Examples
    - Many Hispanic people place great value on the extended family and on interpersonal relations characterized by courtesy and cordiality
    - Many Jewish people who are treated with insulin wish to fast on Yom Kippur and other fast days
    - Worldwide, an estimated 40 to 50 million Muslims with diabetes, including those who are treated with insulin, elect to fast from dawn to sunset throughout the month of Ramadan
- Key Resources
  - Steven Levene and Richard Donnelly, *Management of Type 2 Diabetes Mellitus*, 2009
  - Aziz Sheikh and Sunita Wallia, "Ramadan fasting and diabetes," *BMJ*, 2007

Levene S, Donnelly R. *Management of Type 2 Diabetes Mellitus: A Practical Guide.* 2008.
Sheikh A, Wallia S. *BMJ.* 2007;335:613–614.

Take-Home Points. There is increasing awareness of the powerful impact that cultural values and religious practices can have on self-management in persons with diabetes. Failure of health care providers to address these factors may have negative consequences for patients. For example, many Hispanic people, especially those who have recently arrived in the United States, place great value on the extended family and on interpersonal relations characterized by courtesy and cordiality. Many Jewish people who are treated with insulin wish to fast on Yom Kippur and other fast days. Worldwide, an estimated 40 to 50 million Muslims with diabetes, including those who are treated with insulin, elect to fast from dawn to sunset throughout the month of Ramadan.

Key Resources. *Management of Type 2 Diabetes Mellitus: A Practical Guide*, written by Steven Levene, MD, BChir, and Richard Donnelly, MD, provides a brief but comprehensive and insightful section on cultural values and religious practices. This book is particularly valuable because it discusses cultural concerns of ethnic groups that are seldom covered, including recent immigrants from Africa, South Asia, and the Caribbean. It discusses religious practices of Hindus and Sikhs, as well as those of Jews and Muslims.

In addition to the consensus guidelines on the management of diabetes during Ramadan that has already been mentioned, numerous articles on this topic have been published during the past decade. Especially noteworthy is a brief but comprehensive article by Aziz Sheikh and Sunita Wallia, entitled "Ramadan fasting and diabetes," that was published in the *British Medical Journal* in 2007.

Preparing for Medical Procedures or Surgery

Let’s move to preparing for medical procedures or surgery.

Preparing for Medical Procedures

- Bowel preparation is a prerequisite for many types of abdominal surgery or medical procedures
  - Colonoscopy
  - Endoscopy
  - Gallbladder ultrasound
  - Sigmoidoscopy
- For persons with type 2 diabetes, major considerations when preparing for abdominal surgery or a medical procedure involving bowel preparation are
  - Meeting nutritional needs
  - Maintaining glycemic control
  - Avoiding substances that will compromise visibility, affect test results, or alter intestinal motility

Joslin Diabetes Center. Prep for surgery–liquid diet. JDC #0063-1007-001-0000. 2007.

Today, bowel preparation is a prerequisite for many types of abdominal surgery and other medical procedures, including colonoscopy, endoscopy, gallbladder ultrasound, and sigmoidoscopy.

For persons with diabetes, major considerations when preparing for abdominal surgery or a medical procedure involving bowel preparation are meeting nutritional needs, maintaining glycemic control, and avoiding substances that will compromise visibility, affect test results, or alter intestinal motility.

Preparing for Medical Procedures: General Dietary Recommendations

- Drink and eat regular (not sugar-free) clear liquids to help meet caloric and CHO needs
- Drink 8 oz of liquid without calories every hour that you are not having liquid with calories
- Avoid food or beverages that compromise visibility (eg, milk, ice cream, sherbet)
- Avoid food and beverages containing red or purple dye, since they can affect test results
- Limit caffeine intake, if requested by your health care provider, since caffeine can stimulate intestinal motility
- Consult with your dietitian to determine how many clear liquid choices are necessary to obtain sufficient calories and CHO

Joslin Diabetes Center. Prep for surgery–liquid diet. JDC #0063-1007-001-0000. 2007.

This slide shows general dietary recommendations developed at the Joslin Diabetes Center for patients who are undergoing bowel preparation.

- Drink and eat regular (not sugar-free) clear liquids to help meet caloric and carbohydrate needs
- Drink 8 ounces of liquid without calories every hour that you are not having liquid with calories
- Avoid food or beverages that compromise visibility (eg, milk, ice cream, sherbet)
- Avoid food and beverages containing red or purple dye, since they can affect test results. However, cranberry juice is acceptable, since it is naturally red in color
- Limit caffeine intake, if requested by your health care provider, since caffeine can stimulate intestinal motility
- Consult with your dietitian to determine how many clear liquid choices are necessary to obtain sufficient calories and carbohydrate

Preparing for Medical Procedures: Sample Clear Liquid Meal Plan

Meal	CHO (g)	Food/Drink
Breakfast	60	6 oz cranberry juice 1 cup regular Jello® Decaffeinated tea or coffee (no milk/cream)
Morning snack	30	6 oz white grape juice
Lunch	60	2 popsicles 12 oz regular ginger ale 1 cup clear chicken broth
Afternoon snack	30	6 oz cranberry juice
Dinner	60	4 oz apple juice 6 oz fruit-flavored ice 4 oz Slice® 1 cup clear beef broth
Evening snack	30	1/2 cup regular Jello® 8 oz Gatorade®

Joslin Diabetes Center. Prep for surgery–liquid diet. JDC #0063-1007-001-0000. 2007.

This slide shows an example of a clear liquid meal plan developed at the Joslin Diabetes Center for patients who are undergoing bowel preparation for a medical procedure or surgery.

This meal plan, which patients would typically follow on the day before the procedure, illustrates the range of options available within a clear liquid diet. Patients should be reminded to avoid items like red and purple popsicles, since the dye in these products can interfere with the interpretation of test results.

While they are following the clear liquid meal plan, it is important for patients to consume the same amount of carbohydrates that they typically have at each meal. They should take their usual amounts and types of insulin on the day before the procedure.

Preparing for Medical Procedures: Day of the Procedure

Type of Adjustment	Recommended Adjustment
Meal plan	Do not eat or drink anything after midnight Treat hypoglycemia with glucose gel Resume normal meal plan after procedure (unless instructed otherwise)
Insulin regimen*	Rapid- or short-acting insulin: do not take Intermediate-acting insulin: take half of usual morning dose Long-acting insulin (AM dosing): take usual dose Premixed insulin analog: Omit dose until after procedure, then take 50% of normal dose Insulin pump: maintain basal rate without bolus before and during procedure

*Resume usual insulin routine once you are following usual meal plan.

Joslin Diabetes Center. Prep for surgery–liquid diet. JDC #0063-1007-001-0000. 2007.

This slide shows Joslin Diabetes Center recommendations for changes to the meal plan and insulin regimen on the day of a medical procedure.

Patients should not eat or drink anything after midnight. If they experience hypoglycemia, they should treat it with glucose gel that does not contain red dye. They should go back to following their normal meal plan after the procedure, unless instructed otherwise.

The necessary modifications to the insulin regimen on the day of the procedure depend on the type of insulin used. Patients should not take rapid- or short-acting insulin before the procedure, since they are not eating. Those on an intermediate-acting insulin regimen should take half of their usual morning dose. Patients who take long-acting insulin in the morning should take their usual dose. Those who take a premixed insulin analog should omit the dose until after the procedure and then take 50% of their normal dose. Patients with an insulin pump should maintain the basal rate without bolus before and during the procedure.

Patients should resume their normal insulin routine once they are following their normal meal plan after the procedure.

Case Study: Preparing for Colonoscopy

Patient	Eva, 55 years old, 11-year history of type 2 diabetes Having first colonoscopy
Usual regimen	Meal plan: consumes 50 g of CHO at breakfast and lunch, 60 g at dinner Premixed insulin analog (morning): 18 units Premixed insulin analog (evening): 20 units
Regimen, day before procedure	Meal plan: consumes clear liquid diet, with usual amount of CHO at each meal Insulin regimen: no change
Regimen, day of procedure	Meal plan: nothing to eat or drink after midnight; treated 4 AM episode of symptomatic hypoglycemia with glucose gel Insulin regimen: no insulin before procedure; takes 50% of normal AM dose (9 units) after procedure
Return to usual regimen	Resumes normal meal plan at lunch, takes usual 20 units of premixed insulin analog in the evening

Joslin Diabetes Center. Prep for surgery–liquid diet. JDC #0063-1007-001-0000. 2007.

This case study gives an example of the way in which a person on a twice-daily premixed insulin regimen alters the meal plan and insulin regimen in preparation for a medical procedure.

Eva is 55 years old and has an 11-year history of type 2 diabetes. She is about to have her first colonoscopy. When she follows her usual regimen, Eva consumes 50 g of carbohydrates at breakfast and lunch and 60 g at dinner. She takes 18 units of premixed insulin analog in the morning and 20 units in the evening.

On the day before her colonoscopy, Eva consumes a clear liquid diet but is careful to have her usual amount of carbohydrates at each meal. She follows her normal insulin regimen on that day.

Eva has nothing to eat or drink after midnight. When she gets up to use the bathroom at 4 AM, she feels lightheaded, checks her BG, and finds that her BG level is 58 mg/dL. She successfully treats this episode of hypoglycemia with glucose gel.

Later that morning, Eva leaves for the hospital without eating or drinking anything and without taking her usual morning insulin. After her colonoscopy, she takes 9 units of her premixed insulin analog, which equals 50% of her usual dose. She resumes her regular meal plan at lunch, and takes her usual 20-unit dose of premixed insulin analog in the evening.

Preparing for Medical Procedures: Take-Home Points and Key Resources

- Take-Home Points
  - Major considerations when preparing for a medical procedure or abdominal surgery are meeting nutritional needs, maintaining glycemic control, and avoiding substances that compromise visibility, affect test results, or alter intestinal motility
  - Patients following a clear liquid meal plan should have their usual amount of insulin at each meal
  - Modifications to insulin regimens on the day of a medical procedure depend on the type(s) of insulin that the patient uses and the usual timing of insulin administration
- Key Resources
  - Joslin Diabetes Center, *Guideline for Inpatient Management of Surgical and ICU Patients*, 2007
  - American Association of Clinical Endocrinologists et al, "Medical guidelines for clinical practice for the perioperative nutritional, metabolic, and nonsurgical support of the bariatric surgery patient," 2008

Joslin Diabetes Center. *Guideline for Inpatient Management of Surgical and ICU Patients.* 2007.
Mechanick JI et al. *Endocr Pract.* 2008;14(Suppl 1):1–83.

Take-Home Points. Major considerations when preparing for abdominal surgery or many types of medical procedures are meeting nutritional needs, maintaining glycemic control, and avoiding substances that compromise visibility, affect test results, or alter intestinal motility. Patients following a clear liquid meal plan in preparation for the procedure should have their usual amount of insulin at each meal. Modifications to insulin regimens on the day of a medical procedure depend on the type(s) of insulin that the patient uses and the usual timing of insulin administration.

Key Resources. In this section we have focused on patient-oriented guidelines developed by the Joslin Diabetes Center. Another Joslin Diabetes Center publication, *Guideline for Inpatient Management of Surgical and ICU Patients*, was published in 2007 and is intended for health care providers. It focuses on the pre-, peri-, and postoperative care of patients with diabetes. Another comprehensive publication for health care providers is "Medical guidelines for clinical practice for the perioperative nutritional, metabolic, and nonsurgical support of the bariatric surgery patient." These guidelines, published in 2008, were developed by the American Association of Clinical Endocrinologists, The Obesity Society, and the American Society for Metabolic and Bariatric Surgery.

Emergencies

Let’s shift our focus to emergency preparedness.

Emergencies: Preparedness

- Keep 2 weeks worth of medications and supplies at home, in an easily transported, waterproof emergency kit
- Keep a small waterproof bag stocked with basic supplies at work
- Keep at least a 3-day supply of nonperishable food at home
- Obtain copies of important documentation and keep it in a resealable waterproof bag in the emergency kit
- Check and update emergency supplies every 2–3 months
- Wear a diabetes identification bracelet or similar identification at all times

ADA. *The Disaster Preparedness Guide for People With Diabetes.* 2006.
ADA. *Tips for emergency preparedness.* Available at: www.diabetes.org.

Problems experienced by persons with chronic diseases in the aftermath of Hurricane Katrina emphasized the importance of disaster preparedness for people with diabetes. This slide shows ADA recommendations for preparing for an emergency.

Two weeks worth of medications and supplies should be kept at home, in an easily transported, waterproof emergency kit. Testing supplies are as important as medication, since people under stress may react differently to their medications. Test strips are often the most overlooked necessity in an emergency situation.

Copies of important documentation should be kept in a resealable waterproof bag in the emergency kit. These documents should include a copy of the patient's insurance card, an extra prescription for each medication, a list of all medications taken and their dosages, and the names and phone numbers of doctors and pharmacists. The document bag should also include a copy of the diabetes care plan, photocopies of key pages from owner's manuals for BG meters and test kits, a log book for recording BG data, and a pen.

It is important to take stock of emergency supplies every 2 to 3 months. Expiration dates on medication, supplies, and food should be checked, and documentation should be examined for out-of-date information. An efficient way to make sure that supplies are safe to use is to prepare and regularly review a spreadsheet that lists all emergency items and their expiration dates.

Emergencies: Dealing With Emergency Situations

- Identify yourself to relief workers as having diabetes
- Avoid hyperglycemia, which leads to dehydration
- Regain access to and begin drinking clean water and/or non–CHO-containing drinks as soon as possible
- Avoid hypoglycemia, and treat it promptly if it occurs
- Seek immediate treatment for open wounds to avoid infections
- Do not use insulin or other medications that may have been contaminated or damaged unless absolutely necessary
- Reuse your own syringes if necessary, but do not use another person's syringes or lend someone one of your syringes
- Perform quality checks to ensure that your BG meter is functioning properly

ADA. *Medical advice for people with diabetes in emergency situations.* Available at: www.diabetes.org.
ADA. *The Disaster Preparedness Guide for People With Diabetes.* 2006.

This slide shows ADA recommendations for people with diabetes who find themselves in an emergency situation. Patients who are temporarily without access to insulin or other glucose-lowering medications should reduce their carbohydrate consumption, if possible.

Because individuals in emergency situations may be at an increased risk for hypoglycemia due to higher than normal activity levels, stress, and dietary changes, it is advisable to allow the BG level to be somewhat higher than usual.

If access to insulin or other glucose-lowering medications has been interrupted, medications should be restarted cautiously when they become available. A person's need for a particular medication and dosage may have changed if significant weight loss has occurred or a person has gone without adequate food intake for a significant period of time.

Persons who run out of syringes can reuse their own syringes until they can obtain a new supply. Used syringes should not be cleaned with alcohol or another disinfecting or cleaning solution. The syringe should be completely empty after each use. Another person's syringes should never be used.

Emergencies: Switching Between Insulins (1)

Insulin Normally Used	Recommendations for Switching
Short-acting	Use a different brand of short-acting insulin Switch to a rapid-acting insulin (on a unit-by-unit basis)
Rapid-acting	Use a different brand of rapid-acting insulin analog Switch to a short-acting insulin (on a unit-by-unit basis)
Intermediate-acting	Use a different brand of intermediate-acting insulin Use a long-acting insulin (on a unit-by-unit basis)
Long-acting	Use a different brand of long-acting insulin analog Use an intermediate-acting insulin (on a unit-by-unit basis), BUT give half of the dose in the morning and half in the evening

US Food and Drug Administration. Information regarding insulin storage and switching between products in an emergency. Available at: www.fda.gov.

Under normal circumstances, insulin switching should only be done in consultation with a physician. However, temporary substitutions may be necessary in an emergency. This table shows US Food and Drug Administration (FDA) recommendations concerning emergency substitutions for patients who normally use short-acting, rapid-acting, intermediate-acting, or long-acting insulins.

Patients who switch insulins should try to adhere closely to their usual BG monitoring schedule or perform SMBG more frequently, if possible, to ensure that the emergency substitution is keeping their BG on target.

Switching between short-acting and rapid-acting insulins is straightforward and can be done on a unit-by-unit basis. Switching between intermediate-acting and long-acting insulins can also be done on a unit-by-unit basis. However, if an intermediate-acting insulin is substituted for a long-acting insulin, it must be given twice daily, once in the morning and once in the evening.

Emergencies: Switching Between Insulins (2)

Insulin Normally Used	Recommendations for Switching
Premixed (70/30 or 75/25 mix)	Use a different brand of premixed insulin (70/30 or 75/25 mix) Substitute an intermediate- or long-acting insulin for the basal component of the mix. Give 75% of the usual premixed dose, divided into morning and evening doses If short- or rapid-acting insulins are available, they may be used before major meals along with the intermediate- or long-acting insulin (dosed as above). The dose of short- or rapid-acting insulin should equal ~25% of the total dose of premixed insulin usually taken before that meal
Insulin pump	Inject an intermediate- or long-acting insulin for the 24-hour total basal dose of infused insulin on a unit-by-unit basis. Split the total dose of intermediate-acting insulin between morning and evening doses If regular- or rapid-acting insulin is also available, patients should administer mealtime insulin according to their previous system for calculating their bolus insulin doses

US Food and Drug Administration. Information regarding insulin storage and switching between products in an emergency. Available at: www.fda.gov.

This table shows FDA recommendations concerning emergency substitutions for patients who normally use premixed insulins (70/30 or 75/25 mix) or insulin pump therapy.

If a patient uses a premixed insulin (70/30 or 75/25 mix) and another premixed product is not available, the patient could take 75% of the usual premixed insulin dose as an intermediate- or long-acting insulin. Half of the dose of intermediate- or long-acting insulin should be taken in the morning, and half in the evening. If short- or rapid-acting insulins are also available, they may be used before major meals along with the intermediate- or long-acting insulin (dosed as above). The dose of short- or rapid-acting insulin should equal approximately 25% of the total dose of premixed insulin usually taken before that meal.

Patients using insulin pumps who must switch to injected insulin may substitute an intermediate- or long-acting insulin for the 24-hour total basal dose of infused insulin on a unit-by-unit basis, always making sure that the total dose of intermediate-acting insulin is split between morning and evening doses. If regular- or rapid-acting insulin is also available, patients should administer mealtime insulin according to their previous system for calculating their bolus insulin doses.

Case Study: Emergency Evacuation

Patient	Ron, 72 years old, 18-year history of type 2 diabetes Evacuated from home with 1 hour's notice when path of hurricane changed suddenly
Usual regimen	Long-acting insulin analog, bedtime: 40 units Rapid-acting insulin analog, prebreakfast: 10 units Rapid-acting insulin analog, prelunch: 12 units Rapid-acting insulin analog, predinner: 14 units
Changes to regimen	Intermediate-acting insulin, morning: 20 units Intermediate-acting insulin, evening: 20 units Short-acting insulin, prebreakfast: 10 units Short-acting insulin, prelunch: 12 units Short-acting insulin, predinner: 14 units

US Food and Drug Administration. Information regarding insulin storage and switching between products in an emergency. Available at: www.fda.gov.

This case study gives an example of the way in which a person in an emergency situation temporarily switches an insulin regimen. Ron is 72 years old, has an 18-year history of type 2 diabetes, and uses a basal-bolus insulin regimen. He was evacuated from his home in rural North Carolina with 1 hour's notice when the path of a hurricane suddenly changed. His usual daily insulin regimen is 40 units of a long-acting insulin analog at bedtime and 36 units of a rapid-acting insulin analog, divided as 10 units before breakfast, 12 units before lunch, and 14 units before dinner.

When he hears about the mandatory evacuation, Ron's main concern is packing several cartons of family memorabilia. After arriving at a small Red Cross shelter in the next county, Ron realizes that he has forgotten his insulin and other diabetes supplies. Carrie, a nurse, reassures him that the shelter has essential diabetes care supplies, but that he will need to change the types of insulin he uses on a temporary basis because the shelter does not have insulin analogs in stock. His emergency regimen consists of 40 units of an intermediate-acting insulin, which he administers as a 20-unit dose in the morning and a 20-unit dose in the evening. He substitutes a short-acting insulin for his rapid-acting insulin analog at mealtimes, but the sizes of his premeal doses remain the same. Note that since he is now using regular for his mealtime insulin, it should be taken 30 minutes prior to his meal.

Carrie checks with Ron from time to time to make sure that he is following his meal plan and monitoring his BG regularly. Ron's BG remains at target on his temporary regimen. He continues it for 2 days, until supplies of long-acting and rapid-acting insulin become available.

Emergencies: Take-Home Points and Key Resources

- Take-Home Points
  - Disaster preparedness includes keeping 2 weeks worth of medications, supplies, and documentation in a readily transportable container
  - The disaster kit should be checked periodically to make sure that expiration dates have not passed and information is still current
  - People in emergency situations should avoid hyperglycemia, dehydration, hypoglycemia, and infection, and follow FDA guidelines about switching insulins
- Key Resources
  - ADA, *The Disaster Preparedness Guide for People with Diabetes*, 2006
  - Web sites of the FDA, CDC, and ADA

ADA. *The Disaster Preparedness Guide for People With Diabetes.* 2006. FDA website. http://www.fda.gov. CDC website. http://www.cdc.gov. ADA website. http://www.diabetes.org.

Take-Home Points. Disaster preparedness for people with diabetes includes keeping 2 weeks worth of medications and supplies in a readily transportable container, maintaining access to key documentation, and keeping at least a 3-day supply of nonperishable food on hand. The content of the emergency kit should be periodically checked to make sure that expiration dates have not passed and information is still current. In an emergency situation, it is especially important for individuals with diabetes to avoid hyperglycemia, dehydration, hypoglycemia, and infection, and to follow FDA guidelines about switching insulins, should that be necessary. Persons with diabetes should follow Centers for Disease Control and Prevention (CDC) recommendations for preventing and treating seasonal and H1N1 influenza.

Key Resources. *The Disaster Preparedness Guide for People With Diabetes*, which was developed by the ADA and published in 2006, is a patient-oriented booklet that provides clearly presented recommendations for disaster preparedness and dealing with actual emergencies. Other sources of authoritative information about emergency situations and diabetes are the Web sites of the FDA, CDC, and ADA. Emergency-related information at these Web sites is updated continuously, so it is important to check them frequently.

Summary

- Special situations that necessitate individualized insulin regimens for persons with type 2 diabetes include
  - Exercise
  - Travel
  - Situations related to meal planning (eg, irregular mealtimes)
  - Cultural values or religious practices (eg, religious fasting)
  - Preparing for medical procedures or surgery
  - Emergencies (eg, natural disasters)
- Regular and accurate SMBG is an essential tool for improving diabetes self-management
- For persons who use insulin, special situations are best managed with basal-bolus or insulin pump therapy
- Health care providers who care for patients with type 2 diabetes should be familiar with key resources dealing with special situations

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Regular and accurate SMBG is an essential tool for improving diabetes self-management.

For persons who use insulin, special situations are best managed with basal-bolus or insulin pump therapy.

Health care providers who care for patients with type 2 diabetes should be familiar with key resources dealing with special situations.