Chapter 2: Care of the Endocrine System

Diabetes Overview DMMP and Action Plans

Glucose Testing

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Diabetes Overview

Diabetes is a chronic disease in which the body either does not make, or does not properly use insulin, a hormone needed to transport sugar, starches, and other food into the cells for energy. People with diabetes develop increased blood glucose (sugar) levels because they lack insulin, have insufficient insulin, or are resistant to insulin's effects. High levels of glucose build up in the blood and spill into the urine; as a result, the body loses its main source of fuel.

When insulin is no longer made, it must be obtained from another source—via injected. When the body does not use insulin properly, oral medications may be taken instead of, or in addition to, insulin shots. Neither insulin nor other medications, however, are cures for diabetes: they only help control the disease.

Taking care of diabetes is important. If not treated, diabetes can lead to serious health problems and impact the ability to learn. The disease can affect the blood vessels, eyes, kidneys, nerves, gums, and teeth. It is the leading cause of adult blindness, lower limb amputations, and kidney failure. People with diabetes also have a higher risk of heart disease and stroke. Some of these problems can occur in teens and young adults who develop diabetes during childhood. The good news is that research shows that these problems can be greatly reduced or delayed by keeping blood glucose levels under control.

Types of Diabetes

Type 1

Type 1 Diabetes Mellitus (T1DM), is an auto-immune disorder. In Type 1 Diabetes, the immune system attacks the beta cells (the insulin-producing cells of the pancreas) and destroys their ability to produce insulin. Without insulin, glucose in the blood cannot be transported out of the bloodstream and into the cells for use as energy, raising blood sugar levels. Because the pancreas can no longer produce insulin, people with Type 1 Diabetes need to take insulin daily to live. Type 1 can occur at any age, but it begins most often in children and young adults.

Type 1 Diabetes cannot be prevented.

Symptoms

- Increased thirst and urination
- Constant hunger
- Weight loss
- Blurred vision
- Fatigue

Risk Factors

- Genetics
- Environment

Type 2

Type 2 Diabetes Mellitus (T2DM), is a metabolic disorder. In Type 2 Diabetes, the body does not make enough and/or use insulin properly, (insulin resistance), resulting in high blood glucose levels. As blood sugar levels increase, the insulin-producing beta cells in the pancreas release more insulin, but eventually these cells become impaired and cannot make enough insulin to meet the body's demands.

Type 2 Diabetes used to be found mainly in overweight adults ages 40 or older. Now, as more children and adolescents in the United States become overweight and inactive, Type 2 Diabetes is occurring in younger people. Oral medication, insulin, or both may be needed to control blood glucose. The risk of getting Type 2 Diabetes can be decreased by avoiding obesity through healthy diet and plenty of exercise.

Symptoms

- Fatigue
- Increased thirst and urination
- Nausea
- Unexplained weight loss
- Blurred vision
- Frequent infections
- Slow healing of wounds or sores

Risk Factors

- Being overweight (greater than 85th percentile for height/weight)
- Having a family member who has T2DM
- Being African American, Hispanic/Latino American, American Indian, Asian American or Pacific Islander American
- Having a mother who developed gestational diabetes while pregnant
- Having high blood pressure, high cholesterol, high lipid levels
- Being inactive

Understanding Diabetes and Ketoacidosis

The pancreas makes enzymes and hormones. Enzymes help digest and breakdown food into smaller parts. When we eat, food is broken down into nutrients that can be absorbed by the cells in the body; amino acids (from proteins), fatty acids, cholesterol (from fats), and glucose (from carbohydrates). Glucose is a simple sugar used by the body for energy. Insulin is the hormone secreted by the beta cells of the pancreas and is required for glucose to enter cells. When someone has diabetes, the pancreas does not make enough insulin or the body becomes resistant to its insulin. When there is not enough effective insulin, glucose cannot enter the cells and blood glucose levels will increase.

When excess glucose builds up in the blood, the kidneys work to filter it out into the urine. In the process the body uses and loses a lot of water. This causes increased urination and thirst. Hunger is another symptom of diabetes caused by the body losing calories as a result of its inability to utilize the glucose from food that is consumed. This leads to weight loss and fatigue.

When the body cannot use glucose, it uses its own fat and muscle tissue for energy. Blood ketones are acids that are left in the blood when fat is used for energy. The body will try to get rid of excess ketones through the kidneys and lungs. Symptoms of nausea, vomiting, and eventually comma occur. The ketones will show up in the urine and will also cause the breath to smell fruity. Over time, increasing blood ketone levels can result in diabetic ketoacidosis (DKA), a medical emergency.

Management of Diabetes

The goal of effective diabetes management is to control blood glucose levels by keeping them within an individualized target range for each person. Optimal blood glucose levels helps to promote normal growth and development. Effective diabetes management is required to prevent the immediate dangers of blood glucose levels that are too high or too low. As noted earlier, research has shown that maintaining blood glucose levels within a target range can prevent or delay the long-term complications of diabetes, such as heart attack, stroke, blindness, kidney failure, nerve disease, and amputations of the foot or leg.

The key to optimal blood glucose control is to carefully balance food, exercise, and insulin or medication. As a general rule, food makes blood glucose go up, and exercise and insulin make blood glucose levels go down. Several other factors, such as growth and puberty, mental stress, illness, or injury can also affect blood glucose levels. With all of these factors coming into play, maintaining good blood glucose control is a constant juggling act—24 hours a day, 7 days a week.

Monitoring Blood Glucose

Students with diabetes check (test), their blood glucose levels throughout the day using a blood glucose meter (or sometimes now using a continuous glucose monitoring sensor). The meter gives a reading of the level of glucose in the blood at the time it is being checked. Monitoring involves pricking the skin with a lancet at the fingertip (best practice), forearm, or other test site to obtain a drop of blood and placing the drop on a special test strip that is inserted in a glucose meter. Students can take corrective action, such as eating, modifying their activity level, or administering insulin, if blood glucose levels are too low (hypoglycemia) or too high (hyperglycemia ***Low blood glucose levels, which can be life-threatening, present the greatest immediate danger to people with diabetes***.

Health care providers generally recommend that students check their blood glucose during the school day, usually before eating lunch or snacks, before physical activity, or whenever there are symptoms of hypoglycemia or hyperglycemia. In young children, symptoms may be subtle; blood glucose should be checked whenever symptoms are suspected. Many students can check their own blood glucose level; others will need supervision; and others will need to have the entire task performed by a school nurse or designated and trained, unlicensed assistive personnel (UAP). Students who can self-check can be allowed to do so whenever they need to, and at any school location. Being able to do so can help achieve better glucose control, independence in managing their diabetes, less stigma, and less time out of class. Frequency, supervision, and implementation of testing should be covered in the student's individualized health care plan.

Possible Causes of Hypoglycemia

- Too much insulin
- Too little food
- Extra physical activity
- Being ill, especially with vomiting
- Stress

Signs of Hypoglycemia—Low Blood Glucose	
Mild Symptoms	
• Hunger • Shakiness • Weakness • Paleness • Blurred vision • Increased heart rate/palpitations	• Sleepiness • Changed behavior • Sweating • Anxiety • Headache • Dilated pupils
Moderate to Severe Symptoms	
• Yawning • Irritability/frustration • Extreme tiredness/fatigue • Inability to swallow • Sudden crying	• Confusion • Restlessness • Dazed appearance • Having a seizure or convulsion • Unconsciousness/coma

Possible Causes of Hyperglycemia

- Too little insulin
- Expired insulin
- Decreased physical activity
- Illness, injury
- Stress or emotions
- Hormonal variations

Signs of Hyperglycemia—High Blood Glucose	
Mild Symptoms	
• Increased thirst • Increased urination • Dry mouth • Fatigue • Numbness or tingling • Agitation, fidgetiness, irritability	• Increased hunger • Nausea • Blurred vision • Weakness • Lack of concentration
Moderate Symptoms	
• Decreased appetite • Nausea • Abdominal pain	• Vomiting • Sunken eyes • Weight loss
Severe Symptoms	
• Continued vomiting • Sleepiness • Coma or unconsciousness	• Very weak • Deep breathing, fruity smell • Possible ketones

Nutrition Planning

Although students with diabetes have the same nutritional needs as other students, there are special considerations for the school setting. Structured meals and snacks contribute to optimal glucose control and assist in preventing hypoglycemia. Timing of snacks is based on peak insulin action times (when the insulin is most effective in lowering the blood glucose) and activity. Therefore snacks must be allowed according to pre-scheduled daily snacks and/or for treatment of hypoglycemia. Students with diabetes usually have an individualized meal plan based upon carbohydrate counting. All meal plans are nutritionally sound and encourage the daily calorie requirements needed for optimal growth and development.

Carbohydrate counting involves calculating the number of grams of carbohydrate. Carbohydrate information, can be obtained from nutrition labels, and is used to determine the amount of insulin the student needs to control blood glucose for any given meal or snack. Carbohydrate counting is the preferred method for determining food choices and portion sizes (see Carbohydrate Counting section).

It is important for school personnel working with students who have diabetes to realize that *any* food eaten that contains carbohydrate must be worked into the meal plan, even if it is labeled "sugar free."

Physical Activity

Exercise and physical activity are critical components of diabetes management. Everyone can benefit from regular exercise, but it is even more important for a student with diabetes. In addition to maintaining cardiovascular fitness and controlling weight, physical activity can

help to lower blood glucose levels. Students with diabetes should participate fully in physical education classes and team sports. To maintain blood glucose levels within their target ranges during extra physical activity, students may make adjustments in their insulin and food intake. To prevent hypoglycemia, they also may need to check their blood glucose levels more frequently while engaging in physical activity. Always follow the Diabetes Medical Management Plan and physician orders for any changes in care during physical activity.

A person with diabetes always needs to have a fast-acting sugar and a complex carbohydrate readily available for treatment of low blood sugar, along with plenty of water. Physical education instructors and sports coaches should be able to recognize and assist with the treatment of hypoglycemia.

Exercise increases the flow of blood in general, but especially to the muscles that are being used the most. Insulin is absorbed faster when there is increased blood flow to the exercising muscles. For example, if the insulin is injected in the arm before a run or swim, it may be absorbed more quickly. Muscles use stored energy while exercising and after exercise, the muscles need to replace this stored sugar. They do this by taking glucose out of the blood, which may continue for up to 12 hours after exercising.

Students using insulin pumps may disconnect from the pump for sports activities. If they keep the pump on, they may set a temporary, reduced rate of insulin while they are playing. The student's individualized health care plan should include specific instructions for physical activity.

Implications for Education

Students with diabetes should have adequate time for taking medication, checking blood glucose, and eating. School personnel can help eliminate barriers to these activities. Students also may need to have additional access to food or drink and to the restroom. Students with hyperglycemia or hypoglycemia often do not concentrate well, and blood glucose may need to be checked before and during academic testing. If a serious high or low blood glucose episode occurs, a student may need to be excused with an opportunity for retake.

Planning for Disasters and Emergencies

In the event of natural disasters or other emergency situations, students may need to stay at school. It is strongly recommended that the family provide a backup of all diabetes supplies needed, for the student, in case of an emergency or failure of equipment.
Backup Supplies:

- Blood glucose
- Testing strips
- Lancets
- Batteries for meter
- Insulin

- Syringes
- Insulin pump and supplies
- Other medications
- Glucagon emergency kit
- Antiseptic wipes
- Urine ketone strips/Blood ketone meter and strips
- Fast-acting source of glucose
- Carbohydrate-containing snacks
- Hypoglycemia food supplies (for 3 episodes): Quick acting sugar and carbohydrate, protein snacks
- Continuous glucose monitor supplies/equipment

Definitions
It is important to understand the meaning of key words used for diabetes management in schools:

OK Title 70, Chapter 15 – Health and Safety, Diabetes Management in Schools Act §1210.192 as used in the Diabetes Management in Schools Act:

1. "Diabetes medical management plan" means a document developed by the personal health care team of a student that sets out the health services that may be needed by the student at school and is signed by the personal health care team and the parent or guardian of the student;
2. "School" means a public elementary or secondary school. The term shall not include a charter school established pursuant to Section 3-132 of Title 70 of the Oklahoma Statutes;
3. "School nurse" means a certified school nurse as defined in Section 1-116 of Title 70 of the Oklahoma Statutes, a registered nurse contracting with the school to provide school health services or a public health nurse; and
4. "Volunteer diabetes care assistant" means a school employee who has volunteered to be a diabetes care assistant and who has successfully completed the training required by Section 6 of this act.

Student Rights

Taking immediate action is important for a student with diabetes; so that symptoms do not progress and the student does not miss additional class time. Blood glucose monitoring does not present a danger to others and can be performed anywhere. A plan, for the proper disposal of lancets, needles and other material used in the care of the student with diabetes, should be developed and consistent with Universal Precautions and local waste disposal laws.

OK Title 70, Chapter 15 – Health and Safety, Diabetes Management in Schools Act

§1210.196.7 – Student Management and Care of Diabetes states:

In accordance with the diabetes medical management plan of a student, a school shall permit the student to attend to the management and care of the diabetes of the student, which may include:

1. Performing blood glucose level checks
2. Administering insulin through the insulin delivery system used by the student;
3. Treating hypoglycemia and hyperglycemia;
4. Possessing on the person of the student at any time any supplies or equipment necessary to monitor and care for the diabetes of the student; and
5. Otherwise attending to the management and care of the diabetes of the student in the classroom, in any area of the school or school grounds, or at any school-related activity;
6. Each school shall provide a private area where the student may attend to the management and care of the student's diabetes.

Staff Responsibilities

Each school having a student with diabetes shall ensure the appropriate staff is adequately trained and available to provide care. The principal or designee of the principal will be assigned to provide assistance to a student with diabetes; known as the volunteer diabetes care assistants. A School nurse specifically trained in the instruction of volunteer diabetes care assistants or the Oklahoma State Department of Health designee shall provide training to the volunteer diabetes care assistants on an annual basis.

OK Title 70, Chapter 15 – Health and Safety, Diabetes Management in Schools Act
§1210.196.5 – Guidelines for Training of Volunteer Diabetes Care Assistants

The State Department of Health shall develop guidelines, with the assistance of the following entities, for the training of volunteer diabetes care assistants:

Oklahoma School Nurse Association;
The American Diabetes Association;
The Juvenile Diabetes Research Foundation International;
The Oklahoma Nurses Association;
The State Department of Education;
Oklahoma Board of Nursing;
Oklahoma Dietetic Association; and
Cooperative Council of School Administrators.

A school nurse or State Department of Health designee with training in diabetes shall coordinate the training of volunteer diabetes care assistants

The training shall include instruction in:

1. Recognizing the symptoms of hypoglycemia and hyperglycemia;
2. Understand the proper action to take if the blood glucose levels of a student with diabetes are outside the target ranges indicated by the diabetes medical management plan for the student;

3. Understanding the details of the diabetes medical management plan of each student assigned to a volunteer diabetes care assistant;
4. Performing finger sticks to check blood glucose levels, checking urine ketone levels and recording the results of those checks;
5. Properly administering insulin and glucagon and recording the results of the administration;
6. Recognizing complications that require seeking emergency assistance; and
7. Understanding the recommended schedules and food intake for meals and snacks for a student with diabetes, the effect of physical activity on blood glucose levels, and the proper actions to be taken if the schedule of a student is disrupted.

The volunteer diabetes care assistant shall annually demonstrate competency n the training

The school nurse, the principal, or a designee of the principal shall maintain a copy of the training guidelines and any records associated with the training.

School Nurse Duties

The school nurse is responsible to assist the student in management of their diabetes. In the absence of a school nurse, a volunteer may assist the student with diabetes. According to OK Statute, Title 70, Chapter 15 – Health and Safety, Diabetes Management in Schools Act, §1210.196.4 Duties of School Nurse include:

The school nurse at each school I which a student with diabetes is enrolled shall assist the student with the management of their diabetes care as provided for in the diabetes medical management plan for the student.

If a school does not have a school nurse assigned to the school, the principal shall make an effort to seek school employees who may or may not be health care professionals to serve as volunteer diabetes care assistants to assist the student with the management of their diabetes care as provided for in the diabetes medical management plan for the student.

Each school in which a student with diabetes is enrolled shall make an effort to ensure that a school nurse or a volunteer diabetes care assistant is available at the school to assist the diabetic student when needed.

A school employee shall not be subject to any penalty or disciplinary action for refusing to serve as a volunteer diabetes care assistant.

A school district shall not restrict the assignment of a student with diabetes to a particular school site based on the presence of a school nurse, contract school employee, or a volunteer diabetes care assistant.

Each school and volunteer diabetes care assistant shall at all times have access to a physician.

Diabetes Medical Management Plan (DMMP)

Every student with diabetes needs a Diabetes Medical Management Plan (DMMP) tailored to

their needs.

OK Statute, Title 70, Chapter 15 – Health and Safety, Diabetes Management in Schools Act §1210.196.3

A diabetes medical management plan shall be developed for each student with diabetes who will seek care for diabetes while at school or while participating in a school activity. The plan shall be developed by the personal health care teach of each student. The personal health care team shall consist of the principal or designee of the principal, the school nurse, if a school nurse is assigned to the school, the parent or guardian of the student, and to the extent practicable, the physician responsible for the diabetes treatment of the student.

The National Diabetes Education Program recommends developing a plan with at least three components:

- Diabetes Medical Management Plan (DMMP), which contains the prescribed diabetes health care regimen developed by the health care provider.
- Individualized health care plan developed by the school nurse.
- Quick Reference Emergency Action Plan describing how to recognize hypoglycemia and hyperglycemia and what to do as soon as signs of these conditions are observed.
- Some students may also need an education plan (individualized education plan [IEP] or a 504 plan) explaining what accommodations, education aids, and services are needed.

A sample DMMP can Quick Reference Emergency Plan follow this section. It may be copied and used to develop a plan for each student. A sample IHP can be found in Appendix A. For a student with diabetes, the following items should receive particular attention:

Diabetes Medical Management Plan

Working with parent/guardian(s) is an important part of a successful health care team. When a student enrolls in school with a history of diabetes, or if a current student is diagnosed with diabetes, the school nurse can contact the physician and request a DMMP from the physician be sent to the school. The DMMP should include the following:
Student name Date of
birth Date of
diagnosis

- Current health status
- *Emergency contact information*
- Physician name and contact information

- Name of insulin to be used at school
- Carbohydrate ration
- Sensitivity or correction factor Type of insulin delivery device
- Student willingness and ability to perform self-management tasks at school with or without supervision; including:
    - Can student check blood sugar
    - Can student calculate carbs
    - Can student calculate amount of insulin needed
    - Can student give own injections
    - Can student carry supplies with them Orders if student uses an insulin pump
- Orders if student uses a continuous glucose monitor (CGM)
- Blood glucose goals and target
- Times to check blood glucose at school
- Recommendations for snacks, lunch and recess
- Insulin dosing instruction
- Treatment for hypoglycemia (including use of glucagon)
- Treatment for hyperglycemia (including checking for ketones)
- Any restrictions or accommodation for exercise, activity and sports
- Supplies needed for care at school
- Physician, health care team, parent/guardian, etc. signature and date

Individualized Health care Plan (IHP)

An IHP is a written plan of care for each student with diabetes that includes specific details and additional information to provide care. This plan is attached to a written in addition to the DMMP. The IHP may include:

- Where and when blood glucose monitoring and treatment will take place
- Location of diabetes management supplies
- Identification of each volunteer diabetes trained assistant,
- Emergency contact information for family and health care provider
- Reinforce the need for free access to the restroom and water fountain
- Nutritional needs, including provisions for meals and snacks and obtaining nutritional (especially carbohydrate) information from dietary staff
- Desired goals and outcomes for health and education
- Information and plan for inclusion in extracurricular activities and full participation in all school-sponsored activities and field trips, with coverage by a volunteer diabetes care assistant.
- Alternative times for academic exams if student is experiencing hypoglycemia or hyperglycemia
- Flexible policies regarding absences for doctors' appointments and diabetes-related illness
- Disaster planning and location of backup supplies.
- Notice to maintain confidentiality and the student's right to privacy
- Other accommodations as identified

- Use of universal precautions

Emergency Care Plans for Hypoglycemia and Hyperglycemia

- Symptoms of hypoglycemia and hyperglycemia
- Actions to take when hypoglycemia or hyperglycemia occur
- Emergency contact information and phone numbers
- Basic information on the underlying health condition(s)

Diabetes Plans

Sample templates of the following documents are available in section three, (Tools for Effective Diabetes Management), of the NDEP guide, Helping the Student with Diabetes Succeed: A Guide for School Personnel, by the U.S. Department of Health and Human Resources, National Diabetes Education Program (NDEP) at https://www.niddk.nih.gov/health- information/health-communication-programs/ndep/health-care-professionals/school- guide/Pages/publicationdetail.aspx:

- Diabetes Medical Management Plan (DMMP)
- Individual Health Care Plan (IHP)
- Emergency Care Plans (ECP) for Hypoglycemia and Hyperglycemia

Sources:

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Diabetes Action Plans

1. Individual Health Care Plan (IHP)

2. Emergency Care Plan (ECP)

Sample templates of the following documents are available in section three of the NDEP guide, *Helping the Student with Diabetes Succeed: A Guide for School Personnel*, by the Department of Health and Human Resources, National Diabetes Education Program (NDEP) a*t https://www.niddk.nih.gov/health-information/communication-programs/ndep/health-professionals/helping-student-diabetes-succeed-guide-school-personnel*

- Diabetes Medical Management Plan (DMMP)
- Individual Health Care Plan (IHP)
- Emergency Care Plans (ECP) for Hypoglycemia and Hyperglycemia

Source: The National Diabetes Education Program. (2016). *Helping the Student with Diabetes Succeed: A Guide for School Personnel.* (Publication NDEP-61, 2nd ed.). Bethesda, MD: U. S. Department of Health and HumanServices.Availableonline:https://www.niddk.nih.gov/health-information/health-communication-programs/ndep/health-care- professionals/school-guide/Pages/publicationdetail.aspx

Procedure for Blood Glucose Testing

As of April 2018, there were 94 companies offering 360 glucose monitoring devices, each operating differently (http://www.medicalexpo.com/medical-manufacturer/blood-glucose-meter-607.html). Therefore, it is essential that families provide manufacturer instructions for the specific glucose monitoring device to the school. Below are *general* guidelines for blood glucose testing. However, individuals involved with glucose monitoring should be familiar with the manufacturer's instructions of the device they are using to ensure correct operation of the device for accurate readings, proper cleaning, calibration, battery replacement, and storage. At school, blood glucose is most often tested before meals, whenever a student feels blood glucose may be low (or high), and sometimes before physical activity.

1. Review directions for blood testing meter
2. Wash hands
3. Assemble equipment

- Alcohol prep pad
- Finger lancing device
- Blood glucose testing meter (for example, Accuchek, Bayer Contour, One Touch Ultra, Therasense Freestyle, Fora, True Metrix, etc.)
- Blood testing strips for specific electronic meter
- Tissue or cotton balls or spot bandage
- Gloves
- Student log

4. Wash hands and area to be tested with soap and water. If the caregiver is performing the procedure, put on gloves. Washing student's hands and test site is sufficient for prepping the site; however, alcohol may be used for further prepping. The site selected **must** be dry before pricking

   Alcohol may cause toughening of the skin or burning sensation. If moisture (water or alcohol) remains on the skin it may alter test results

5. Place glucose testing strip into electronic meter according to manufacturer's instructions
6. Prepare lancing device according to manufacturer's instructions. Some meters allow alternate testing sites (forearm). Blood glucose readings from alternate sites such as the forearm; tend to lag about 15 minutes behind readings obtained from a fingerstick. Therefore, fingersticks should be used to assess blood sugars whenever hypoglycemia is suspected
7. Select a site. If using a finger, use the top sides of fingertips. Hang the arm below the level of the heart for 30 seconds to increase blood flow. *The tips of the fingertips may be more sensitive*
8. Puncture the site with the lancing device. Gently squeeze the finger in a downward motion to obtain a large enough drop of blood to cover the test pad on the test strip

   Avoid squeezing the site excessively because excess squeezing can contaminate the sample with tissue fluid as well as causing hemolysis of sample and trauma to the site

9. Place blood on testing strip and complete instructions according to manufacturer

instructions. Compress lanced area with tissue or cotton ball until bleeding stops

10. Dispose of test strip and tissue or cotton ball in lined wastebasket. Dispose of lancing device in sharps container
11. Remove and dispose of gloves. Wash hands
12. Record results in student log/chart. Refer to student's DMMP or the Quick Reference Emergency Plan as needed

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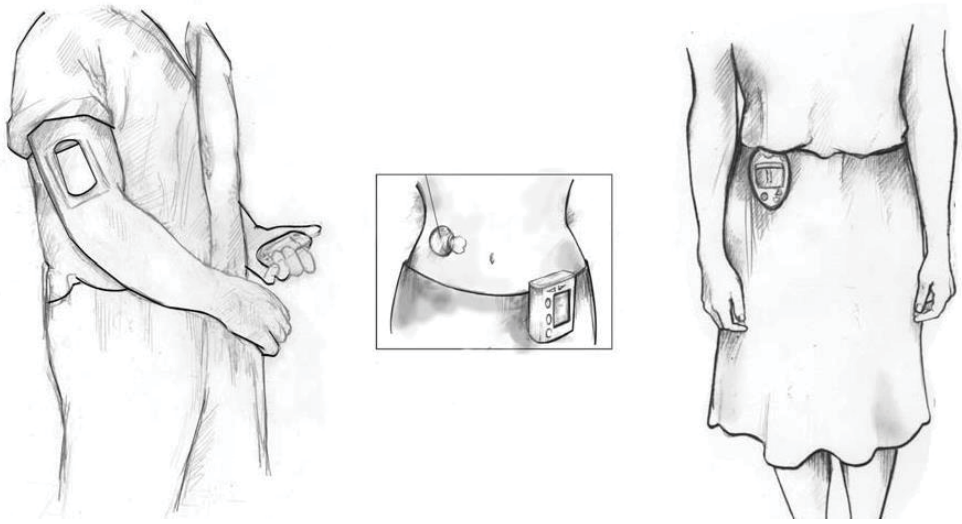
Continuous Glucose Monitoring

Overview

Continuous glucose monitors (CGM) monitor and record blood glucose levels twenty-four hours a day. It uses a tiny sensor inserted under the skin to check glucose levels in the interstitial tissues. The sensor can stay in place for several days to a week before needing to be replaced. A transmitter in the sensor sends information about the glucose levels wirelessly to a monitor. The monitor may be part of an insulin pump or may be a separate device that looks similar to a pager or cell phone and can be carried in a purse, backpack, or pocket. The CGM sets off an alert when glucose levels are trending too high or too low. Some models can send information directly to certain insulin pumps where insulin adjustments can be made.

CGM sensors typically take readings at 5-minute intervals. Special software downloads the glucose readings to a computer and analyzes patterns and trends. CGM systems may enable better glucose control through constant monitoring that allow corrections before glucose levels get too high or low. CGM systems monitor interstitial glucose levels so they tend to lag blood glucose levels slightly. If the CGM alarms, the student should use conventional blood glucose monitoring to check blood glucose levels to determine what specific adjustments should be made. Advances in continuous glucose monitoring continue with the hope that in the future, they will provide reliable feedback and a mechanism to provide insulin in a manner more like normal pancreatic function.

Examples of CGM systems:



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Hypoglycemia - Mild or Moderate Low Blood Glucose

Hypoglycemia is the greatest immediate danger to students with diabetes and can develop within minutes and requires immediate attention. Staff supervising a child with diabetes and suspected "low blood sugar" should not leave the child unattended at any time.

HYPOGLYCEMIA IS A MEDICAL EMERGENCY THAT REQUIRES IMMEDIATE ACTION WITH A SUGAR CONTAINING PRODUCT OR GLUCAGONN FOLLOWING THE DMMP AND/OR EMERGENCY CARE PLAN.

Recognize signs of low blood glucose. Ask student to describe how he/she feels. Refer to student's individualized health care plan, if possible.

Mild Symptoms		Moderate Symptoms
• Hunger	• Sweating	• Headache
• Shakiness	• Drowsiness	• Behavior change
• Weakness	• Personality change	• Poor coordination
• Paleness	• Inability to concentrate	• Blurred vision
• Anxiety	• Dizziness	• Slurred speech
• Irritability	• Headache	• Confusion

If student is unable to swallow, combative, uncooperative, unconscious, or having a seizure, proceed immediately to Procedure for Severe Low Glucose.

Factors Which Can Lead to Low Blood Glucose

- Too much insulin
- Skipping or delaying meals or snacks
- Not eating enough food to cover the amount of insulin taken
- Illness, particularly with gastrointestinal illness (vomiting or diarrhea)
- Intense or extra physical activity

Hypoglycemia is not always preventable, especially in the newly diagnosed student with diabetes.

To Prevent Hypoglycemia:

- Allow students to check blood sugar routinely per DMMP
- Allow students to test blood sugar anywhere
- Facilitate a regular schedule for eating meals, snacks, and exercise
- Reinforce with students the importance of rotating injection sites
- Always double check insulin dose before giving per DMMP
- Be prepared for emergency school situations (shelter in place, evacuations, lock-downs, etc.)
- Keep a fast-acting carbohydrate source with the student ***ALWAYS***
- Treat low blood glucose at the onset of symptoms
- Have an up-to-date diabetes management plan from student's healthcare

provider

- Ensure that food eaten matches insulin dosing. Watch picky eaters. Provide nutrition information to families about school meals, as well as snacks and classroom activities involving food
- Never leave a student unattended when low blood glucose is suspected.

2. Test blood glucose. (See Procedure for Blood Glucose Testing) If no blood glucose meter is available, treat immediately. **When in doubt, always treat.**
   If moderate symptoms, provide immediate adult supervision.

3. **<u>If blood glucose level is below the level indicated per the healthcare provider - usually 70-80 mg/dL</u>**
   - Have student eat or drink one of the following fast-acting carbohydrates (refer to student's DMMP, IHP, and ECP)
   - 4 oz. (1/2 cup) fruit juice
   - 4 Glucose tablets (chewed thoroughly before swallowing)
   - 6 ounces of regular (not diet) soda (about half a can)
   - 1 small tube of glucose gel or cake decorating gel (0.68 oz = 16 carbs)
   - 1Tablespoons of honey

   Treat "on the spot." **The student should never be left alone or sent anywhere alone when experiencing hypoglycemia**. Students should be permitted to carry a source of glucose with them at all times.
   If blood glucose is above 80 and student is not feeling well, repeat test to verify results.

   1. Observe for 15 minutes, then recheck blood glucose
   2. If blood glucose is over target and student is feeling better:
      a. Resume regular classroom activities
   3. If no improvement – treat again with fast-acting sugar
   4. Observe for another 15 minutes, then recheck blood glucose
   5. If not within target range – call parent/guardian
   6. If pupil becomes unable to participate in care, proceed immediately to Emergency Procedure for Severe Hypoglycemia

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Emergency Procedure for Severe Hypoglycemia – Severe Low Blood Glucose

Hypoglycemia/Insulin Reaction

Signs of severe low blood glucose:

- Unable to swallow
- Unconscious
- Combative
- Uncooperative
- Seizures

Signs are so severe that student cannot participate in care.

Factors Which Can Lead to Low Blood Glucose

Too much insulin
Missing or delaying meals or snacks
Too little food
Extra physical activity intense or unplanned physical activity
Being ill, particularly with gastrointestinal illness

To prevent hypoglycemia:

- Keep a fast-acting carbohydrate source with the student ***ALWAYS***.
- Treat low blood glucose at the **onset** of symptoms.
- Eat, take insulin, test blood glucose, and exercise at the prescribed times.
- Have an up-to-date diabetes management plan from student's health care provider.
- Ensure that food eaten matches insulin dosing. Watch picky eaters. Provide information to families about school meals (monthly menus with carbohydrate counting), as well as snacks and classroom activities involving food.

Monitor blood glucose variations on "gym days"

If student has signs of severe blood glucose:

- Have someone call emergency medical services (911 in most areas), school nurse, and family. ***Student should not be left unattended.***

Place student on side or in upright position if restless/uncooperative. *Maintain head position to one side to prevent aspiration*

- Do not attempt to give food or put anything in the student's mouth
  Student may aspirate or choke
- Give glucagon injection, per order in student's DMMP

- If student becomes alert after receiving glucagon, stay with student until emergency services arrive. Student may be given sips of fruit juice or regular soda once awake and able to drink.
- Document in student chart/log.

Sources:

American Diabetes Association. (2015, revised). *Diabetes care tasks at school: What key personnel need to know*. PowerPoint and training modules. Available online: http://www.diabetes.org/living-with-diabetes/parents-and-kids/diabetes-care-at-school/school-staff-trainings/diabetes-care-tasks.html

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Glucagon

Definition

Glucagon is a hormone that occurs naturally in the body. It is produced in the pancreas and raises blood glucose levels by causing the release of glycogen (a form of stored carbohydrate) from the liver and muscles to raise blood glucose levels.

Purpose

Glucagon injections are prescription medications used to treat serious hypoglycemia. If it is specified in the student's DMMP and/or individualized healthcare plan (IHP), glucagon should be used when the student is unconscious, having seizures, or cannot eat or drink safely. Severe hypoglycemia can cause brain damage or death.

Although it may cause nausea and vomiting when the student regains consciousness, glucagon is a life-saving treatment that cannot harm a student.

Storage

Each student with Type 1 Diabetes should have a glucagon kit available for use during school and all school sponsored activities. The student may possess any supplies or equipment needed to care for their diabetes at any time or place during school and school sponsored activities in accordance with the DMMP

OK Statute, Title 70, Chapter 15 – Health and Safety, Diabetes Management in Schools Act, §1210.196.7 Student Management and Care of Diabetes Oklahoma

In accordance with the diabetes medical management plan of a student, a school shall permit the student to attend to the management and care of the diabetes of the student, which may include:

1. Performing blood glucose level checks;
2. Administering insulin through the insulin deliver system used by the student;
3. Treating hypoglycemia or hyperglycemia;
4. Possessing on the person of the student at any time any supplies or equipment necessary to monitor and care for the diabetes of the student; and
5. Otherwise attending to the management and care of the diabetes of the student in the classroom, in an area of the school or school grounds, or at any school-related activity

Each school shall provide a private area where the student may attend to the management and care of the student's diabetes.

The glucagon kit should be stored at room temperature in a place designated by the student's IHP. The expiration date should be checked, and it should not be administered if expired, discolored, or does not dissolve well. It should not be mixed until it needs to be given. Combine the glucagon for injection immediately before use by following instructions that are included with the glucagon kit.

Sources:

American Diabetes Association. (2015, revised). *Diabetes care tasks at school: What key personnel need to know*. PowerPoint and training modules. Available online: http://www.diabetes.org/living-with-diabetes/parents-and-kids/diabetes-care-at-school/school-staff-trainings/diabetes-care-tasks.html

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Procedure for Giving Glucagon for Severe Hypoglycemia

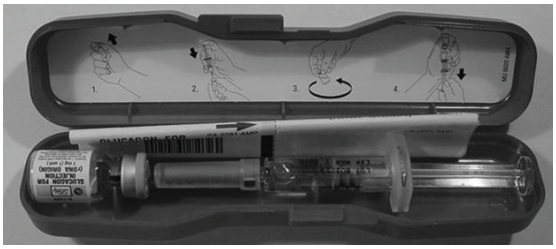
1. Verify signs of severe low blood glucose:
   - Unable to swallow
   - Unconscious
   - Combative
   - Uncooperative
   - Seizures

   Signs are so severe that student cannot participate in care.

2. **Have someone call emergency medical services, school nurse, and family.**
   - ***Student should not be left unattended.***
3. If seizure occurs, follow procedure in student's the Emergency Care Plan for Managing a Seizure

4. Place student on side or in upright position if restless/uncooperative.
   - *Maintain head position to one side to prevent aspiration*

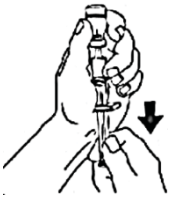
5. Obtain glucagon kit. Wash hands (if possible) and put on gloves.
6. Determine glucagon dose and route for administering the medication per the DMMP/ provider orders



7. Flip cap off glass vial (bottle) containing dry powder. Remove needle cover from syringe

8. Take the fluid-filled syringe in the glucagon emergency kit and inject the fluid into the vial containing the glucagon powder. Gently swirl, shake or roll to mix per manufacturer's instructions until all powder is dissolved and solution is clear. Inspect medication for color, clarity and presence of lumps. Solution should be clear and colorless before use

9. Hold vial upside down and withdraw the prescribed amount (usually all) of glucagon back into the syringe. The prescribed amount should be specified in the student's DMMP. Withdraw needle from vial.
   Generally, if the student's weight is greater than 45 pounds, the full vial (1 cc) of Glucagon may be injected. If the child weight is less than 45 pounds, inject ½ of the solution



10. When possible, the injection site should be exposed and cleaned. However, glucagon can be administered through clothing, if necessary. Suggested sites include the outer thigh, upper outer buttock, or arm
11. Inject needle straight into muscle of site and inject glucagon
12. Withdraw needle and press site with cotton ball or wipe. Massage injection site for 10 seconds; apply bandage if needed
13. Do not recap syringe. Put used syringe in sharps container
14. Stay with the student. It may take 15-20 minutes for student to regain consciousness. Turn student on side because glucagon may cause vomiting
15. Recheck blood sugar. Follow the student's specific instructions in IHP or DMMP for response to results. Some students may have a second injection of glucagon ordered if glucose remains low
16. The student may be given sips of fruit juice or regular soda once awake and able to drink. This may be followed with a snack containing proteins and carbohydrates such as peanut butter sandwich or cheese crackers to keep blood sugar levels elevated to normal levels and to prevent recurrence
17. Don't be surprised if student does not remember being unconscious, incoherent or has a headache. Blood sugar may also rise over 200 and nausea or vomiting may occur
18. When emergency services arrive, turn care of the student over to the emergency crew. Notify school nurse and family
19. Document in student log

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Procedure for High Blood Glucose

Hyperglycemia

1. Observe/Recognize signs of high blood glucose, although student may frequently be asymptomatic

Mild Symptoms

- Increased thirst
- Frequent urination
- Dry mouth
- Fatigue
- Numbness or tingling
- Agitation, fidgetiness, irritability
- Inability to concentrate
- Hunger
- Blurred vision
- Urine ketones (negative-small)

Moderate Symptoms

- Decreased appetite
- Nausea
- Abdominal pain/stomach cramps
- Vomiting
- Sunken eyes
- Weight loss
- Dry mouth
- Urine ketones (moderate-large)

Severe Symptoms

- Continued vomiting
- Sleepiness
- Confusion
- Coma or unconsciousness
- Very weak
- Deep breathing, fruity smell
- Ketones (moderate-large)

Factors Which Can Lead to High Blood Glucose (hyperglycemia):

- Too little insulin
- Expired insulin
- Too much food (for insulin taken)
- Decreased physical activity
- Any combination of the above
- Illness, injury
- Stress or emotions
- Hormonal fluctuations
- Menstrual periods
- Over treating hypoglycemia

1. To prevent hyperglycemia:

- Test blood glucose, take insulin, eat, and exercise at the prescribed times
- Have an up-to-date management plan from student's health care provider
- Ensure that food eaten matches insulin dosing. Monitor food intake. Report binge eating
- Provide information to families about school meals (monthly menus with carbohydrate counting), as well as snacks and classroom activities involving food. Consult family when snack, meal, or exercise times must be changed and prior to extra snacks
- Take appropriate action if a missed dose is suspected or if an insulin pump malfunctions
- Avoid "over treating" low blood sugar reactions
- Respect the students; realize their limits

2. Test blood glucose. (See Procedure for Blood Glucose Testing)
3. **Initiate care per health care provider's orders for high blood glucose**. This may include insulin administration, checking for ketones, and possibly activity restriction (exercising when ketones are present may elevate blood glucose levels even further). Insulin administration during hyperglycemia may be referred to as a "sliding scale insulin" or "correction factor" order. Refer to student's individualized health care plan.
4. Check urine and/or blood ketones as prescribed by the health care provider in the DMMP. (Reference the procedure for Testing Urine Ketones and/or Blood Ketones in chapter.)
5. Encourage student to drink water, generally 16-24 ounces over 2 hours or 8 ounces per hour. Allow free use of the bathroom.
   If student resumes classroom activities, he/she may need to use a water bottle in class to ensure adequate fluid intake.
6. If student is feeling okay, he or she may resume classroom activities. If student does not feel well (nausea, lethargy, headache), then the family should be called.
7. Recheck blood glucose according to student's individualized plan.
8. If the student develops severe stomach pains, vomiting and/or rapid breathing, call emergency medical services, school nurse, and family immediately.
9. Document care in student log.

Sources:

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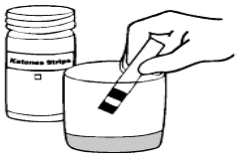
Procedure for Testing Urine Ketones

When the body can't use glucose, it uses its own fat and muscle tissue for energy. Ketones are acids that are left in the blood when fat is used for energy. As ketone production increases, ketone blood levels increase causing *diabetic ketoacidosis*, also referred to as "DKA," and may occur with hyperglycemia. Symptoms of hyperglycemia include nausea, vomiting, possible ketones and coma.

The body will try to get rid of ketones through the kidneys and lungs. The ketones will show up in the urine and may also cause the breath to smell fruity. Other symptoms include nausea, vomiting, abdominal pain, thirst, frequent urination, and drowsiness. If testing for urine ketones shows medium or large ketones to be present, extra insulin may be needed, if specified in the student's individualized health plan (IHP).

If ketones are not detected early, particularly during illness, they will build up in the body and DKA may result. DKA is the number one reason for hospitalizing children with diabetes. Early detection of ketones and treatment helps to prevent hospitalizations for DKA.

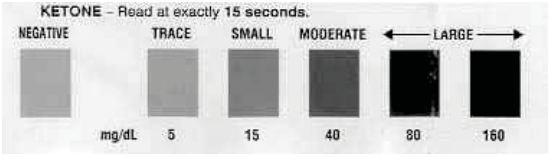
1. Wash hands. Review directions for urine ketone testing if not familiar with them.
2. Assemble equipment:
    - Bottle of ketone strips--check expiration date
    - Urine cup
    - Gloves



3. Put on gloves
4. Saturate the test strip with urine by one of the following methods
    - Student urinates in cup, and then test strip is dipped into urine
    - Student holds test strip in urine flow

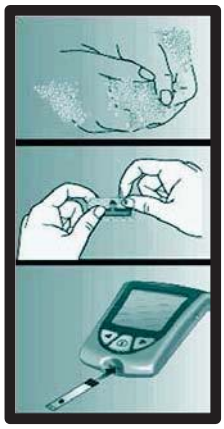
    If assisting the student, wear disposable gloves during this procedure
5. Dip the ketone test strip in the cup containing urine
6. Wait the **exact** amount of time for test strip to develop, per directions on test strip bottle (usually 15 seconds)

7. Compare color of strip to chart on bottle. Results will be read as negative, small, moderate, or large. Refer to student's individualized health plan for actions. **Generally, if results are moderate or large, student should not engage in physical activity and family should be called to take student home for observation and/or medical care**
8. Remove gloves and wash hands
9. If urine ketone results are trace or small, increase fluid intake
10. Record results in student log. Notify school nurse and family



Procedure for Testing Blood Ketones

1. Review directions for blood ketone testing if not familiar with them
2. Wash hands
3. Assemble equipment
    - Finger lancing device
    - Ketone testing meter
    - Ketone testing strip in foil packet for specific ketone testing meter
    - Tissue or cotton ball
    - Gloves
    - Student log



4. Wash hands and area to be tested with soap and water. Pat dry.
   If the caregiver is performing the procedure, put on gloves.
   Washing student's hands and test site is sufficient for prepping the site
5. Remove the ketone test strip from its foil packet, and insert the three black lines at the end of the test strip into the ketone testing meter strip port. Refer to manufacturer's instructions as needed.
6. Push the test strip in until it stops

7. Prepare the lancing device according to manufacturer's instructions
8. Puncture the top side of the fingertip with the lancing device
   Gently squeeze the finger in a downward motion to obtain a large enough drop of blood to cover the purple area on the top of the test strip until the monitor begins to test
9. Compress lanced area with tissue or cotton ball until bleeding stops
10. The blood ß-ketone result will show on the meter display window with the word KETONE

11. Dispose of test strip and tissue or cotton ball in lined wastebasket
    Dispose of lancing device in sharps container
12. Remove and dispose of gloves. Wash hands
13. Record results in student log. Refer to student's DMMP for actions

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Insulin

Definition

Insulin is a hormone constructed of proteins that is normally produced by the pancreas. It is needed to help glucose enter the cells of the body and be used for energy. Students with Type 1 Diabetes (and some students with Type 2 Diabetes) need daily injections of insulin. Several days without insulin can cause a life-threatening condition of ketoacidosis, coma, and eventually death. Insulin dosage is tailored to each student based on blood glucose monitoring. The goal of insulin therapy is to maintain near normal blood glucose levels while avoiding hypoglycemia. Insulin is administered by two or more subcutaneous injections each day or continuously by a portable insulin pump.

Storage

Insulin can be affected by extremes in temperature, which can denature the protein and decrease or eliminate its effect. It is recommended that unopened insulin be stored in a refrigerator where it maintains potency until the expiration date on its label.

Opened insulin or insulin stored in pens or cartridges can be left unrefrigerated at temperatures 59-86ºF. It should be kept away from direct sunlight and heat and not be left in the glovebox of a car. Once opened, the date should be written on the vial and is usually good for 30 days, although one brand of insulin now says it maintains potency for 60 days at room temperature. Follow manufacturer's instructions for storage and use by dates, which should be noted in the student's individualized health care plan (IHP).

Dosage and Administration

Insulin doses are measured in “units.” There are 1000 units of insulin in a 10 milliliter vial and 300 units in an insulin pen. One unit of insulin can alter a blood glucose level; therefore, ***it is imperative that the ordered dosage be EXACT!***

The number of insulin units to be given is ordered by the child’s licensed health care provider--physician or nurse practitioner. The amount or dose of insulin will be adjusted based on several factors including blood glucose levels, carbohydrates consumed, and physical activity.

Insulin injections are given with a small needle subcutaneously (area between the skin and the muscle). The only syringes used to inject insulin should be insulin syringes (orange tip). Tuberculin syringes and other 1 or 3- milliliter syringes should never be used because they are not calibrated for insulin. Sites should be rotated to avoid scar tissue or fatty cell growth under the skin.

Insulin Delivery Systems

Insulin delivery methods include syringes, insulin pens, and insulin pumps. In addition, syringes can be attached to several types of spring-loaded aids which make injection easier. See procedure sections for insulin syringes, insulin pens and insulin pumps for more information.

Other insulin delivery systems such as inhaled insulin and pancreas transplants are being studied and may be used in the future.

Types of Insulin

Insulin can be classified as rapid-acting, short-acting, intermediate-acting, or long-acting. The different types vary in onset of action (length of time the insulin takes to start working), peak action (when the insulin has its strongest effect), and duration of action (the length of time the insulin usually lasts). Rapid-acting and short-acting insulin can be used for meal coverage or carbohydrate coverage and correction doses (doses given in order to decrease elevated blood glucose). If an *extra* dose of rapid or short-acting insulin is given, the blood glucose should be checked approximately 30 minutes to 2 hours later, or as specified in student's IHP. Some insulin orders may call for the mixing of short-acting insulin with longer-acting insulin, but these combinations are usually not given during school hours. Some insulin formulations come already mixed with intermediate and short or rapid-acting insulins combined. Long-acting insulins glarine, detemir, and degludec should not be mixed with any other insulin in one syringe. See chart below for insulin action times:

Insulin Action Times

Type of Insulin	**Names**	**Onset of Action** (how long before it starts to work)	**Peak Action** (when the insulin has the strongest effect)	**Duration of Action** (how long the insulin usually lasts)
Rapid-Acting	Lispro (Humalog) Aspart (Novolog) Glulisine (Apidra)	5-15 minutes 5-15 minutes 5-15 minutes	30-90 minutes 1-2 hours 30-90 minutes	2-4 hours 2-4 hours 2-4 hours
Short-Acting	Regular (Humulin R, Novolin R)	30-60 minutes	2-3 hours	5-8 hours
Intermediate-Acting	NPH (Humulin N, Novolin N)	2-4 hours	6-10 hours	10-18 hours

Long-Acting (basal)	Glarine (Lantus, basaglar) Detemir (Levemir) Degludec (Tresiba)	2-4 hours 3-8 hours	peakless	24 hours 6-24 hours

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Carbohydrate Counting and Correction Factors:
Procedure for Determining Insulin Dosages

Overview

Carbohydrate (carb) counting is one common method of maintaining healthy blood glucose levels for students who have diabetes. Carbohydrates are the starches and sugars found in grains, pasta, dried beans, starchy vegetables, fruits, dairy products, and sweets. A student with diabetes who ingests carbohydrates needs insulin to utilize the glucose in the carbohydrate. By calculating the amount of carbohydrates to be eaten, the student or caregiver can determine how much insulin is needed to cover the carbohydrates in that meal.

Food labels list the amount of carbohydrates in a serving of the food. Care needs to be taken in noting the serving size and accounting for this in determining the amount of carbohydrates to be consumed. In school cafeterias, the dietary or food service manager has access to the nutritional content of foods and can provide a listing for students with diabetes and the adults trained to assist them with carb counting. If food is brought from home, the family should calculate the carbohydrate count. A number of books contain information on carbohydrate counting, as well as a number of "apps" for cell phones and tablets.

One method of meal planning using carb counting is to follow a consistent carb intake meal plan and ingest the same amount of carbohydrates each day along with taking intermediate-acting insulin in the morning and possibly taking a preset amount of rapid-acting insulin at lunch. These students do not adjust their mealtime insulin doses, but this method requires that they consume the same, predetermined amount of carbohydrates every day.

A method allowing more flexibility is to adjust the amount of insulin given to the amount of carbs to be consumed, which is the method more commonly used today. This method is often combined with adding a "correction factor" for the blood glucose level to determine a total dose of insulin at each mealtime to maintain blood glucose in the target range.

The *insulin-to-carbohydrate ratio* is the amount of insulin prescribed in a student's DMMP for a specific amount of carbohydrates. The health care provider will commonly express the amount as a ratio. One unit of insulin for every 15 grams of carbohydrates will be a 1:15 ratio; one unit of insulin for every 30 grams of carbohydrates will be a 1:30 ratio.
The *correction factor* is the amount of insulin given for a level of blood glucose above student's target glucose level (somewhat similar to diabetic management of the past called "sliding scale insulin"). The actual blood glucose is subtracted from the target blood glucose and divided by the correction factor will dictate how much insulin is needed to decrease the actual level to the target level. For example, if the correction factor is 1 unit of insulin for every 50 mg/dL over 150, and the student's blood glucose is 250, then 2 units of insulin is the correction dose. It is important to note that an additional correction dose should not be given within 3 hours after having been given insulin for a meal/snack, after treatment for hypoglycemia (low blood

glucose) or after a previous correction dose.

Many students with diabetes use both the insulin-to-carbohydrate ratio and a correction factor to determine the amount of insulin they need before each meal. The two amounts are combined for one dose of insulin before meals.

Sample Calculation for Computing Insulin Dose using both Insulin-to-Carb Ratio and Blood Glucose Correction Factor

Note: This is only an example--values from a student's DMMP must be used instead of the sample values.

1. Insulin to carb ratio--Student's DMMP states insulin-to-carb ration is 1:15
    a. Determine how much insulin is needed for carbs--on this day, the student's meal contains 45 grams of carbohydrate
    b. Divide the total number of grams of carbs in the meal by the insulin-to carb ratio

    *Calculation: 45 grams of carbs ÷ 15 grams/unit = 3 units of insulin

2. Blood glucose correction factor--Student's DMMP states correction factor is 1 unit of rapid-acting insulin for each 50 mg/dL that the blood glucose level is over the target of 150 mg/dL
    a. Determine pre-meal glucose and target glucose--on this day, the student's pre-meal glucose is 250; target glucose is 150
    b. Subtract target glucose from actual glucose--on this day 250-150=100
    c. Divide the difference by the correction factor

    *Calculation: 250 mg/dL (pre-meal glucose) - 150 mg/dL (target glucose) = 100 mg/dL

    100 mg/dL ÷ 50 mg/dL/unit = 2 units

3. Total dose
    a. Add the number of units from the insulin-to-carb ratio and correction factor

    *Calculation: 3 units + 2 units = 5 units

On this day, when the student's blood glucose is 250 and the student's meal contains 45 grams of carbohydrates, the student will receive 5 units of insulin.

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Procedure for Insulin Administration by Syringe

Injection of Regular or Humalog/Novolog/Apidra Insulin (and no mixing with other insulins)

Obtain a blood glucose reading before administering insulin per health care provider orders.

1. Wash hands.
2. Assemble equipment:
   - Vial of insulin
   - Syringe with needle (use only an insulin syringe)
   - Alcohol prep pad
   - Cotton balls or spot bandage (optional)
   - Gloves (if done by anyone other than student)
   - Sharps container

3. Determine insulin dose by health care provider orders
4. If insulin is cold, warm in the palm of hand to room temperature

   Injecting cold insulin can cause pain and may affect absorption
5. Put on gloves
6. If this is a new bottle of insulin, remove the flat, colored cap. Do not remove the rubber stopper or the metal band under the cap. Check expiration date of the vial of insulin. Write the date opened on the vial
7. Clean the rubber top of the insulin vial with alcohol and let dry for a few seconds
8. Remove the cap from the syringe. Fill the syringe with air equal to the number of units of insulin needed. Inject air into Regular or Humalog/Novolog/Apidra insulin bottle with syringe remaining in bottle, invert and pull plunger back beyond the number of units desired. Keeping the syringe in an upright position and the needle below the liquid in the vial, clear any air by pulling plunger back and tapping syringe to raise air bubbles to the top. Push plunger to desired amount of units, ensuring that no air bubbles remain and withdraw the syringe

   Air is always injected into the vial to prevent creating a vacuum inside the vial as insulin is removed. ***Air bubbles left in the syringe can alter the desired dose***

9. Slip needle back into cap without touching cap or needle (See Procedure for One-Handed Needle Recapping if syringe must be recapped.)
10. Review the insulin order. It is always a good idea to have a second person check the insulin dose after drawing it up, if possible
11. Select the site to be used and prep with alcohol and let dry. If area is dirty, first wash with soap and water and dry. Ask the student if they have a preferred site and listen to the student's guidance

    Any subcutaneous tissue can be used for injection sites. The best absorption is in the lower abdomen, followed by the upper, outer arms, tops of the thighs and lastly the upper areas of the buttocks. Exercise and heat (like the warmth from a heating pad or whirlpool) hastens absorption of an injected area

12. Pinch up skin and tissue with one hand. With the other hand, hold the syringe, with the eye of the needle pointing upward, like a pencil. Dart the needle into the "soft pocket" (area that lies directly in front or in back of the pinched up skin) at a 90 degree angle
13. Inject the insulin in one to five seconds. (Do not aspirate or pull back the plunger.) Release pinched up skin and remove needle while applying gentle pressure at the injection site for 10-15 seconds. This will help to prevent leakage from the site

    Take care to avoid injecting into the muscle, as it will hasten absorption. Do not massage the area as it irritates the tissue and hastens absorption

14. Dispose of syringe with needle intact into a sharps container being careful to point it away from the student while disposing of it

    Recapping a contaminated needle can result in a needlestick injury

15. Document in student log the dose and type of insulin given, time given, the site used, and any reactions or problems. If there are any problems or concerns, contact the school nurse and/or family

Sources:

American Diabetes Association. (2015, revised). *Diabetes care tasks at school: What key personnel need to know*. PowerPoint and training modules. Available online: http://www.diabetes.org/living-with-diabetes/parents-and-kids/diabetes-care-at-school/school-staff-trainings/diabetes-care-tasks.html

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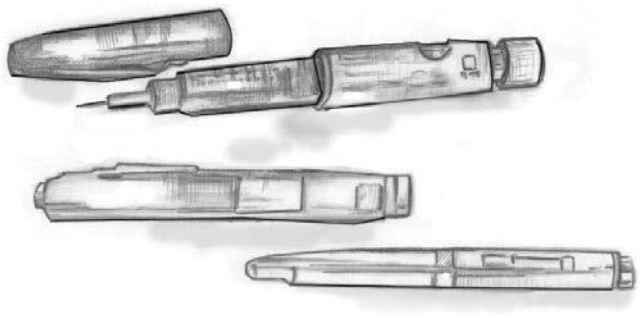
Procedure for Insulin Pen Delivery System

An insulin pen is an insulin delivery system that has the visual appearance of a writing pen; it consists of a cartridge holder (insulin must be purchased in prescribed cartridges), a piston rod (this is a screw mechanism that adjusts the desired dose), a dose indicator window (dose is indicated by visual numbers), a push button (this delivers the insulin), and a pen encasement.

The purpose of an insulin pen is to provide insulin injections with a convenient and accurate device. Insulin pens assist in preventing dose errors that may occur with reading the lines on a syringe and drawing from a vial. Insulin pens are easier to use and easier to carry around than a syringe and vial. Some pens can be purchased with the insulin cartridge already in place (these are considered "disposable pens") while other pens require "loading" of a specific insulin cartridge. The cartridge in an insulin pen is generally good for 30 days once the first dose has been used; however check the manufacturer's instructions to verify. Insulin pens do not allow manual mixing of insulins, although some pens come with a premixed blend of shorter-acting and intermediate-acting insulin.

1. Obtain a blood glucose reading prior to insulin administration per health care provider orders.
2. Determine insulin dose with health care provider's orders.
3. Wash hands and put on gloves.
4. Assemble equipment:
    - Insulin pen device
    - Pen needle
    - Alcohol prep pad
    - Cotton balls or spot bandage (optional)
    - Gloves (if done by anyone other than student)
    - Sharps container
5. Check insulin type/brand. This must match health care provider's orders exactly
6. Check the "opened date" on pen and the level of insulin remaining in the insulin cartridge

    Cartridges are made for multiple doses. Ensure that enough insulin remains in the cartridge for accurate dosing



7. Attach new needle. Remove outer plastic cap and plastic needle cover. Place outer cap on a flat surface with open end facing up

This will assist in needle disposal after insulin is given.

8. Dial in two units of insulin to perform an "air shot" to "prime the pump." Insulin should appear at needle tip. If it does not, repeat procedure

Change in temperatures can cause air intake. This procedure ensures that any accumulated air will be released, thereby ensuring accurate insulin dosage

9. Dial in prescribed dose. Double check the dose and get a second person to verify, if possible

10.Ask the student if they have a preferred site for injection and listen to the student's guidance

11.Cleanse skin with alcohol and allow to dry before injecting

12.Pinch up the skin at selected area and dart the needle into the soft pocket at a 90 degree angle

The soft pocket lies directly in front of or in back of the pinched up skin. Do not pinch skin if using a Nano pen needle

13 Press the button at the end of the pen to inject the insulin

14.Count slowly to ten seconds and then remove the needle.

Some pen manufacturers require a longer count.

15.Grasping the pen, place the needle into plastic needle cap that was left upright on a flat surface. Unscrew the needle tip and carefully discard into a sharps container.

Do not lift the cap up with fingers to cover needle tip. Leave cap on the counter and use the pen to place the needle into the cap to avoid possibility of fingerstick injury (see Procedure for One-Handed Needle Recapping). The needle must be changed after each injection, as leaving the pen needle attached leaves an OPEN passageway into the insulin and contamination may occur.

16.Document in student log the dose and type of insulin given, time given, the site used, and any reactions or problems. If there are any problems or concerns, contact the school nurse and/or family.

17.If an accidental needle stick occurs with a contaminated needle, wash the area thoroughly with soap and warm water, allowing bleeding to occur to cleanse the wound. Notify your supervisor immediately in accordance with the school division's Bloodborne Exposure Control Plan.

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Insulin Pump Therapy

Overview

Insulin Pump Therapy, or Continuous Subcutaneous Insulin Infusion (CSII), is a method of insulin delivery that uses a small mechanical pump to deliver doses of rapid or short acting insulin. The pump is about the size and weight of a small cell phone. It holds a reservoir of insulin inside the pump and is programmed to deliver the insulin through a thin plastic tube called an *infusion set*. The infusion set is inserted via a needle that is covered by a cannula (catheter) just below the skin. Once inserted, the needle is removed and the cannula stays in place for two to three days. The process of inserting an infusion set is very similar to giving an insulin shot, except that it only needs to be done every two or three days. When it is time to change the infusion set, a new infusion set is inserted into a different site. There is a disconnect mechanism that allows students to remove the pump (while leaving the cannula in place) if needed for bathing or sports.

An alternate insulin pump mechanism has two components: a waterproof "pod" type pump attached to the body and a separate handheld computer that programs delivery of insulin from the pod. This tubeless system allows the student to leave the pump on while bathing, swimming, or playing sports. **Routine site changes for any type of insulin pump therapy are performed at home by the student or family**.

Use of insulin pumps has been increasing, especially for students with type 1 diabetes. Insulin dosing is more precise (to 1/100th of a unit) and allows continuous insulin delivery/absorption to more naturally mimic normal blood insulin/glucose levels with additional bolus doses to match food intake and activity. The system allows more flexibility for mealtimes and has been shown to improve growth in children, decrease the incidence of hypoglycemia, and decrease the incidence of long-term diabetes complications.

The disadvantages of the system include increased expense, technical malfunctions, skin infections, and more calculations on the part of the student or caregiver. The system requires a student and family to commit to counting dietary carbohydrates, monitoring blood glucose, judging the impact of exercise on insulin requirements, and making the appropriate adjustments to insulin infusion rates. Many families are already doing that and find the pump can facilitate management. The other disadvantage is that the system does not use any long-acting insulin so if the pump malfunctions, blood glucose levels can rise quickly.

Improved systems are continually becoming available, some of which can automatically adjust insulin infusions to match blood glucose levels without requiring calculations.

Type of Insulin

Insulin Pump Therapy uses rapid-acting insulin such as Humalog, Novolog or Apidra (and less commonly, short-acting insulins). It combines a continuous basal infusion of insulin for 24 hours and a bolus dose for meal or snack times and times of high blood glucose.

Basal rate:	Amount of insulin required when no food is eaten; a pre-programmed feature measured in units per hour (U/H) and delivered in tiny doses every few minutes; can be altered based on the pumper's daily needs; can be temporarily changed for alteration in schedule activity, illness or food.
Bolus:	Amount given when the pump is programmed to give a dose of insulin for meals, snacks and /or for correction of elevated blood glucose.

Pump Operation and Maintenance

The specific pump manufacturer instructions must be followed. Manuals, booklets, and videos are available free of charge by calling the manufacturer's number listed on the back of the pump or consulting its website. Representatives of manufacturers are often willing to visit a school and help with training for a pump in use there.

If the supply of insulin is interrupted due to mechanical pump failure, dislodgment of the infusion set, accidental severing of the tubing, or obstructed tubing, the blood glucose level can rise quickly because there is no long-acting insulin in the system. A back up supply of syringes, rapid-acting insulin or insulin pens should be kept at school in case one of these incidents occurs to prevent or limit the subsequent hyperglycemia and possible ketoacidosis (which can occur in as little as 3 hours).

Pumps are designed to be durable enough to withstand abuse associated with everyday living. Safety is a primary concern so they have alarms to warn of low battery and obstruction to the tubing. The pump can be disconnected using a quick release set. This is usually done before water activities or contact sports. Most are splash proof, and some are even waterproof. Waterproof pumps allow the student to bathe or swim without having to disconnect.

A card with the student's name, pump model and serial number, and the pump manufacturer's help line phone number should be readily available in the health office for any problems that might occur. A wallet-sized programming card and an alarm card or manufacturer's instructions should also be available in the health office for reference.

Contact information for companies that make or sell insulin pumps in the United States:

Company	Phone	Website
Animas (One Touch)	877-937-7867	www.animascorp.com
Medtronic MiniMed (Paradigm, 530 with Enlite)	800-646-4633	www.minimed.com
OmniPod (Insulet)	800-591-3455	www.myomnipod.com
Roche (Accuchek)	800-668-4578	www.accu-chekinsulinpumps.com
Tandem (t: slim)	858-366-6900	www.tandemdiabetes.com

OneTouch® Ping™

t:slim® Insulin Pump

ACCU-CHEK Combo System

Image Source: Children with Diabetes. (2014). *Insulin pump therapy*. Available online: http://childrenwithdiabetes.com/pumps/.

Insulin Pump Skills

School nurses and designated, trained, unlicensed assistive personnel should be trained in operating the individual student's insulin delivery system.

Assessment of the following skills can be used in determining a student's ability to independently manage Insulin Pump Therapy:

- Appropriately counts carbohydrates
- Calculates appropriate correction dose based on health care provider orders
- Calculates total dose based on health care provider's orders for carbohydrate consumption and correction dose
- Programs appropriate bolus
- Adjusts temporary rate for exercise
- Disconnects and reconnects tubing
- Inserts new infusion set
- Fills reservoir and primes tubing
- Troubleshoots alarms appropriately
- Appropriately identifies high and low blood glucose levels
- Cares for skin site
- Recognizes pump malfunctions (dead batteries, no delivery, high pressure alarm)
- Replace batteries, as needed
- Uses standard precautions including proper disposal of sharps and contaminated wastes

Insulin Pump Supplies

The following extra supplies should be provided by the family and kept in a designated place at school.

- Infusion set
- Reservoir
- Insulin
- Skin prep items
- Alcohol wipes
- Syringe or pen injector (in case of infusion set or insulin pump malfunction)
- Pump batteries
- Inserter (if used)
- Manufacturers manual, alarm card, contact phone numbers

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American Diabetes Association. (2015, revised). *Diabetes care tasks at school: What key personnel need to know*. PowerPoint and training modules. Available online: http://www.diabetes.org/living-with-diabetes/parents-and-kids/diabetes-care-at-school/school-staff-trainings/diabetes-care-tasks.html

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Procedure for Hyperglycemia with Pump Therapy

1. Follow the instructions in the student's DMMP and IHP for hyperglycemia to include checking and treatment for blood glucose, urine and/or blood ketones as prescribed by the health care provider. Reference the "Procedure for High Blood Glucose" (previous section) as appropriate.

2. Check site for leakage, cannula dislodgement, redness and/or tenderness.

   Redness and/or tenderness at the site may indicate obstruction. The blood glucose can rise quickly since the delivery of short-acting insulin has been interrupted and there is no long-acting insulin in the body.

3. For an infusion site malfunction, insert new infusion set and/or replace reservoir or pod, or administer insulin by syringe or pen. (Refer to student's DMMP and IHP.)

4. For a suspected insulin pump malfunction, suspend or remove pump and administer insulin by syringe or pen. (Refer to student's DMMP and IHP.)

Procedure for Hypoglycemia with Pump Therapy

1. Follow "Procedure for Low Blood Glucose" (previous section) and instructions in student's IHP or DMMP for low blood glucose while receiving insulin pump therapy. Follow pump-specific directions if pump therapy must be suspended.

   Even students who usually function independently may require assistance during hypoglycemia due to mental status changes. *School personnel working with students with diabetes need to be able to recognize signs of low blood glucose and when to obtain assistance. The pump can be programmed to "suspend" function during exercise so hypoglycemia can be avoided or extra carbohydrates can be consumed for every 30 minutes of exercise.*

2. If problems continue, notify the school nurse.

   School nurse will notify family and/or health care provider according to student's IHP or DMMP.

Contact information for companies that make or sell insulin pumps in the United States:

Company	Phone	Website
Animas	877-937-7867	www.animascorp.com
Medtronic MiniMed	800-646-4633	www.minimed.com
OmniPod (Insulet)	800-591-3455	www.myomnipod.com
Roche	800-668-4578	www.accu-chekinsulinpumps.com
Tandem	858-366-6900	www.tandemdiabetes.com

Training for School Employees

The National Diabetes Education Program (2016) has recommended the following levels of training for school staff to provide effective diabetes management. Training for unlicensed staff should be completed by a diabetes-trained health care professional such as the school nurse or a certified diabetes educator.

Level 1. All school personnel should receive training that provides a basic understanding of diabetes, how to recognize and respond to the signs and symptoms of low blood glucose (hypoglycemia) and high blood glucose (hyperglycemia), and whom to contact immediately in case of emergency.

Level 2. Classroom teachers and all school personnel who have responsibility for students with diabetes throughout the school day should receive Level 1 training plus additional training to carry out their individual roles and responsibilities and to know what to do in case of a diabetic emergency in the absence of a school nurse.

Level 3. One or more school staff members should receive in-depth training about diabetes and routine and emergency care for each student with diabetes from a registered nurse, licensed physician, or certified diabetes educator such as the school nurse or a certified diabetes nurse educator. This training will help ensure that a school staff member is always available to help younger or less-experienced students or those with additional physical or mental impairments perform diabetes care tasks (e.g., administering insulin or checking their blood glucose) in the absence of a school nurse.

Title 70, Chapter 15 Section 1210.196.4 ensures that each school in which a student with diabetes is enrolled shall make an effort to ensure that a school nurse or a volunteer diabetes care assistant is available at the school to assist the diabetic student when needed.

Sources

Adapted from *Helping the Student with Diabetes Succeed: A Guide for School Personnel*. National Diabetes Education Program, U.S. Department of Health and Human Resources. (2016). NIH Publication No. 10-5217 Available online https://www.niddk.nih.gov/health-information/health-communication-programs/ndep/health-care-professionals/school-guide/Pages/publicationdetail.aspx

Actions for the School Nurse

School nurses are the key school staff members to coordinate care for students with diabetes at school. Evidence-based practice in diabetes care and diabetes technology constantly evolves as new evidence and therapies/devices are developed. The school nurse (SN) leads

the team at school and, according to the National Diabetes Education Program, should take the following actions:

- Understand the SN role in ensuring compliance with federal and state laws that may apply to students with diabetes.
- Understand state laws regarding delegation of nursing tasks.
- Obtain and review the student's current DMMP.
- Using the medical orders in the DMMP and information obtained from a thorough nursing assessment; develop an IHP which promotes independence and self-care consistent with the student's abilities.
- Prepare the student's Emergency Care Plans for hypoglycemia and hyperglycemia based on the orders in the DMMP.
- Facilitate the initial school health team meeting to discuss implementing the student's DMMP and IHP.
- Serve as the school health expert on the school teams that create and implement the student's 504 plan, the IEP, or other educational plan.
- Plan and implement diabetes management training for the trained diabetes personnel and all staff who have responsibility for the student with diabetes.
- Obtain materials and medical supplies necessary for performing diabetes care tasks from the family.
- Perform routine and emergency diabetes care tasks.
- Maintain accurate documentation of all diabetes care provided at school.
- Provide ongoing education and training as the school year progresses for staff.
- Assess competence and provide ongoing supervision of trained diabetes personnel.
- Conduct ongoing, periodic assessments of the student with diabetes and update the IHP.
- Help ensure that the student has a supportive learning environment and is treated the same as students without diabetes.
- Distribute the NDEP primer to all school personnel who have responsibility for students with diabetes.
- Provide education and act as a resource on managing diabetes at school to the student, family and school staff.
- Act as an advocate for students to help them meet their diabetes health care needs.
- Assist the classroom teachers with developing plans for substitute teachers.
- Assist the physical education teacher with managing the student's physical activity at school.
- Collaborate with coworkers and outside agencies to obtain nutrition information for families.

- Communicate with the student's family--and with their permission--communicate with the student's diabetes health care team about progress and concerns.
- Treat the student with diabetes the same as other students, except to respond to their medical needs.
- Respect the student's confidentiality and right to privacy.

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Resources for Teachers, Child Care Providers, Parents, and Health Professionals

American Diabetes Association. (2015, revised). *Diabetes Care Tasks at School: What Key Personnel Need to Know*. PowerPoint and training modules. Available online: http://www.diabetes.org/living-with-diabetes/parents-and-kids/diabetes-care-at-school/school-staff-trainings/diabetes-care-tasks.html

American Diabetes Association. *Written Care Plans*. Website has links to samples of Diabetes Medical Management Plans (DMMP), 504 Plans, and Individual Education Plans for students with diabetes. Plans in both English and Spanish available as well as recommendations to consider. Available online: http://www.diabetes.org/living-with-diabetes/parents-and-kids/diabetes-care-at-school/written-care-plans/

American Diabetes Association. *State Laws, Regulations, and Policies for School Diabetes Care for Oklahoma*. Can also use website to look up information about other states. Available online: http://www.diabetes.org/living-with-diabetes/parents-and-kids/diabetes-care-at-school/legal-protections/school-laws-and-policies/state-laws-and-policies-display.html? State=OK

Children with Diabetes. Non-profit website dedicated to providing online support for families with children with diabetes. Includes resources for pump clothing (pump packs, pump pouches) and other accessories. Available online: www.childrenwithdiabetes.org

Children with Diabetes. *Diabetes at School.* Resources for students, classmates of students with diabetes, teachers of students with diabetes, and other school-related resources. Available online: http://www.childrenwithdiabetes.com/d_0q_000.htm

Everyday Magic. (2015). Resources developed by Disney and Lilly Diabetes to help children and families manage diabetes, especially newly-diagnosed diabetics. Includes videos, books, digital books, and other digital resources. Available: http://www.t1everydaymagic.com/

Sandra Hollenberg. *My Own Book About Pumping*. Book for children with easy-to-understand information about insulin pumps (good introduction for adults too!). Can be downloaded at: http://grandmasandy.org/books/ABOUT_PUMPING.pdf

JDRF (Juvenile Diabetes Research Foundation). T1D in School website. Has a *School Advisory Toolkit for Families* and a variety of other resources. Available online: http://jdrf.org/life-with-t1d/starting-school/

National Association of Chronic Disease Directors. *Diabetes School Health Resources*. Extensive listing of resources for students with diabetes. Available online http://www.chronicdisease.org/?page=DiabetesSchoolResour

National Association of School Nurses. *Managing Diabetes at School: Tool for the School Nurse*. Manual adapted from NASN H.A.N.D.S. (Helping Administer to the Needs of the Student with Diabetes in School) program. Available for a fee at www.nasn.org

National Diabetes Education Program, U.S. Department of Health and Human Resources. (2016). Helping the Student with Diabetes Succeed: A Guide for School Personnel. NIH Publication No. 10-5217. Available at https://www.niddk.nih.gov/health-information/health-communication-programs/ndep/health-care-professionals/school-guide/Pages/publicationdetail.aspx or calling 1-800-860-8747 or 1-888-693-6337.

National Diabetes Education Program. *Diabetes HealthSense*. Variety of resources for living well including diet and exercise resources and stress management in video and website form. Available online: http://ndep.nih.gov/resources/diabetes-healthsense/index.aspx.

National Diabetes Education Program. *Publications*. Extensive listing of online and print publications to help with all topics relating to diabetes. Can use filter to find resources for specific age groups or topics. Resources available for students, families, health care professionals, and community organizations. Available online: http://ndep.nih.gov/index.aspx

Oklahoma Chapter of the American Diabetes Association. Variety of online resources for parents, children, and schools. http://www.diabetes.org/in-my-community/local-offices/oklahoma-city-oklahoma/

Note: The National Diabetes Education Program, U.S. Department of Health and Human Resources guide, *Helping the Student with Diabetes Succeed: A Guide for School Personnel*, was updated and released in 2016. It is available online at https://www.niddk.nih.gov/health-information/health-communication-programs/ndep/health-care-professionals/school-guide/Pages/publicationdetail.aspx.