Complete Summary

GUIDELINE TITLE

Care of children and adolescents with type 1 diabetes: a statement of the American Diabetes Association.

BIBLIOGRAPHIC SOURCE(S)

Silverstein J, Klingensmith G, Copeland K, Plotnick L, Kaufman F, Laffel L, Deeb L, Grey M, Anderson B, Holzmeister LA, Clark N. Care of children and adolescents with type 1 diabetes: a statement of the American Diabetes Association. Diabetes Care 2005 Jan;28(1):186-212. [237 references] PubMed

GUIDELINE STATUS

This is the current release of the guideline.

COMPLETE SUMMARY CONTENT

SCOPE
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SCOPE

DISEASE/CONDITION(S)

- Type 1 diabetes mellitus
- Acute and chronic complications of diabetes
    - Growth impairment and poor or excessive weight gain
    - Diabetes ketoacidosis (DKA)
    - Hypoglycemia
    - Nephropathy
    - Hypertension
    - Dyslipidemia
    - Retinopathy
    - Foot problems

- Associated autoimmune conditions
    - Thyroid disease
    - Celiac disease
- Adjustment and psychiatric disorders
    - Eating disorders

GUIDELINE CATEGORY

Diagnosis
Evaluation
Management
Screening

CLINICAL SPECIALTY

Endocrinology
Family Practice
Internal Medicine
Nursing
Nutrition
Pediatrics

INTENDED USERS

Advanced Practice Nurses
Allied Health Personnel
Dietitians
Nurses
Patients
Physician Assistants
Physicians

GUIDELINE OBJECTIVE(S)

To provide a single resource on current standards of care pertaining specifically to children and adolescents with type 1 diabetes

TARGET POPULATION

Children and adolescents with type 1 diabetes

INTERVENTIONS AND PRACTICES CONSIDERED

Diagnosis/Evaluation/Screening

1. Medical history
    - Signs and symptoms
    - Family history of diabetes
2. Physical examination
3. Laboratory evaluation

    - Serum glucose, electrolytes, serum or urine ketones, arterial or venous pH
    - Glycated hemoglobin (A1C) testing
    - Lipid profile
    - Test for microalbuminuria
    - Thyroid-stimulating hormone (TSH) levels
    - Celiac antibodies
4. Screening for depression
5. Referrals to specialists as needed
6. Differentiating type 1 from type 2 diabetes

Management

1. Continuing diabetes education for a child and family
2. Appropriate self-management by age
3. Glycemic control
4. Insulin therapy
5. Medical nutrition therapy
6. Exercise
7. Psychosocial assessment and care
8. Management of diabetes complications
    - Height and weight monitoring
    - Management of diabetes ketoacidosis (DKA)
    - Prevention of hypoglycemia
    - Management of microalbuminuria (angiotensin-converting enzyme [ACE] inhibitors, patient education)
    - Management of hypertension (salt restriction, ACE inhibitors)
    - Management of dyslipidemia (medical nutrition therapy, lifestyle changes, lipid-lowering agents)
    - Management of retinopathy (regular examinations by eye care professional)
    - Foot care (annual examinations beginning at puberty)
9. Management of associated autoimmune conditions
    - Thyroid disease (monitoring thyroid function, thyroid hormone replacement therapy, treatment of hyperthyroidism)
    - Celiac disease (tissue transglutaminase [tTG] antibody and endomysial autoantibody [EMA] testing, referral to a gastroenterologist, gluten-free diet, consultation with a registered dietitian
10. Adjustment and psychiatric disorders (referral to a psychiatrist for treatment)
11. Counseling adolescents about risk behaviors
12. Immunization

MAJOR OUTCOMES CONSIDERED

- Effect of coping skills training and peer support on metabolic control and quality of life in diabetic adolescents
- Blood glucose levels
- Mortality and morbidity associated with diabetes

METHODOLOGY

METHODS USED TO COLLECT/SELECT EVIDENCE

Searches of Electronic Databases

DESCRIPTION OF METHODS USED TO COLLECT/SELECT THE EVIDENCE

Not stated

NUMBER OF SOURCE DOCUMENTS

Not stated

METHODS USED TO ASSESS THE QUALITY AND STRENGTH OF THE EVIDENCE

Not stated

RATING SCHEME FOR THE STRENGTH OF THE EVIDENCE

Not applicable

METHODS USED TO ANALYZE THE EVIDENCE

Review
Review of Published Meta-Analyses

DESCRIPTION OF THE METHODS USED TO ANALYZE THE EVIDENCE

Not stated

METHODS USED TO FORMULATE THE RECOMMENDATIONS

Expert Consensus

DESCRIPTION OF METHODS USED TO FORMULATE THE RECOMMENDATIONS

The information provided is based on evidence from published studies whenever possible and, when not, supported by expert opinion or consensus.

RATING SCHEME FOR THE STRENGTH OF THE RECOMMENDATIONS

Not applicable

COST ANALYSIS

Studies in children with type 1 diabetes have demonstrated that patient and family education, delivery of intensive diabetes case management, and close telephone contact with the diabetes team are associated with reduced hospitalizations, emergency room visits, and overall costs to the payer and patient.

METHOD OF GUIDELINE VALIDATION

Internal Peer Review

DESCRIPTION OF METHOD OF GUIDELINE VALIDATION

American Diabetes Association Statements are reviewed externally and also by the Professional Practice Committee for overall content.

RECOMMENDATIONS

MAJOR RECOMMENDATIONS

Diagnosis

- Diagnosis is similar to that in adults and should be pursued expeditiously.
- Hyperglycemia alone in the setting of an acute illness and isolated glucosuria may be due to other causes.
- Differentiating type 1 from type 2 diabetes is based on patient characteristics, history, and lab tests, if appropriate.

Table. Criteria for the Diagnosis of Diabetes
1. Symptoms of diabetes and a casual plasma glucose ≥ 200 milligrams per deciliter (mg/dL) (11.1 millimoles per liter [mmol/L]). Casual is defined as any time of day without regard to time since last meal. The classic symptoms of diabetes include polyuria, polydipsia, and unexplained weight loss. OR 2. Fasting plasma glucose ≥ 126 mg/dL (7.0 mmol/L). Fasting is defined as no caloric intake for at least 8 hours. OR 3. 2-hour plasma glucose ≥ 200 mg/dL (11.1 mmol/L) during an oral glucose tolerance test. The test should be performed as described the World Health Organization, using a glucose load of 75 grams anhydrous glucose dissolved in water or 1.75 grams per kilogram (g/kg) body weight if weight is <40 pounds (18 kg). Note: In the absence of unequivocal hyperglycemia, these criteria should be confirmed by repeat testing on a different day. The oral glucose tolerance test is not recommended for routine clinical use, but may be required in the evaluation of patients when diabetes is still suspected despite a normal fasting plasma glucose.

Initial Care

- Ideally, every child newly diagnosed with type 1 diabetes should be evaluated by a diabetes team (consisting of a pediatric endocrinologist, a nurse educator, a dietitian, and a mental health professional) qualified to provide up to date pediatric-specific education and support.

Diabetes Education

- Ideally, the education should be provided by a team of certified professionals, including physician, nurse, dietitian, and mental health professional, that is dedicated to communicating basic diabetes management skills within a context that addresses family dynamics and issues facing the whole family.
- Education is best provided with sensitivity to the age and developmental stage of the child, both with regard to the educational approach and content of the material delivered.
- The patient and family should receive ongoing education regarding the prevention of and screening for the micro- and macrovascular complications of diabetes.

Identification

Children with diabetes should wear identification (ID) indicating that they have diabetes.

Diabetes Care

The components of the initial diabetes visit, including medical history, physical examination, laboratory evaluation, referrals, and screening, are listed in Table 3 in the original guideline document. Items listed pertain to the initial presentation of a child for medical care, possibly in diabetic ketoacidosis (DKA). Continuing care visits will include many of the same components.

Glycemic Control

Table. Plasma Blood Glucose and A1C Goals for Type 1 Diabetes by Age Group

	Plasma glucose goal range (mg/dL)			
Values by age	**Before meals**	**Bedtime/Overnight**	**A1C**	**Rationale**
Toddlers and preschoolers (<6 years)	100-180	110-200	<8.5 (but >7.5)%	• High risk and vulnerability to hypoglycemia
School age (6-12 years)	90-180	100-180	<8%	• Risks of hypoglycemia and relatively low risk

	Plasma glucose goal range (mg/dL)			
Values by age	**Before meals**	**Bedtime/Overnight**	**A1C**	**Rationale**
				of complications prior to puberty
Adolescents and young adults (13-19 years)	90-130	90-150	<7.5%*	• Risk of hypoglycemia • Developmental and psychological issues

Key concepts in setting glycemic goals:

- Goals should be individualized and lower goals may be reasonable based on benefit-risk assessment
- Blood glucose goals should be higher than those listed above in children with frequent hypoglycemia or hypoglycemia unawareness
- Postprandial blood glucose values should be measured when there is a disparity between preprandial blood glucose values and A1C levels

* A lower goal (<7.0%) is reasonable if it can be achieved without excessive hypoglycemia.

Insulin Management of Diabetes

- Insulin requirements are usually based on body weight, age, and pubertal status.
- A basal-bolus insulin regimen using either a multiple daily insulin injection (MDI) regimen or an insulin pump should be considered.

Blood Glucose Monitoring

- Use glucose levels to make insulin dose adjustments acutely for rapid- or short-acting insulins and after observing patterns over several days to adjust doses of long-acting insulins.
- Use insulin-to-carbohydrate ratios and correction doses for high and low blood glucose levels.
- Test at least four times a day.
- Periodically test postprandial, before and after-exercise, and nocturnal glucose levels.

Medical Nutrition Therapy

- Consultation with a dietitian to develop/discuss the medical nutrition plan is encouraged.
- Evaluate height, weight, body mass index (BMI), and nutrition plan annually.

- Calories should be adequate for growth and restricted if child becomes overweight.

Exercise

- Children and adolescents with type 1 diabetes should adhere to the Centers for Disease Control and Prevention (CDC) and American Academy of Sports Medicine recommendations for a minimum of 30 to 60 minutes of moderate physical activity daily.
- Blood glucose monitoring before exercise is recommended with a suggested intake of 15 grams of carbohydrate (amount may need to be less in younger children -- 10 grams, for example) for a blood glucose level below target range before exercise; for vigorous physical activity expected to be >30 minutes, an additional 15 grams of carbohydrate may be necessary.
- For prolonged vigorous exercise, hourly blood glucose monitoring during the exercise, as well as blood glucose monitoring after completion of exercise, is recommended to guide carbohydrate intake and prospective insulin dose adjustment for recurring exercise events.
- At the onset of a new sports season, frequent blood glucose monitoring during the 12-hour postexercise period should be undertaken to guide insulin dose adjustments.
- In the child or adolescent (particularly if overweight/obese), physical exercise should be encouraged and sedentary activity discouraged.

Psychosocial Issues Affecting the Diabetes Care Plan

- Patient and family characteristics predicting difficulty with diabetes management should be sought and addressed.

Acute Complications

Growth Assessment

- All children and adolescents should have height and weight plotted on the CDC growth curves at each clinic visit.
- Thyroid function (serum thyroid-stimulating hormone [TSH] levels) should be monitored at diagnosis and every 1 to 2 years thereafter or obtained at any time growth rate is abnormal.
- Evaluation for celiac disease should be considered if there is unsatisfactory weight gain that cannot be explained by poor metabolic control.

Diabetic Ketoacidosis (DKA)

Monitoring

- Hourly heart rate, respiratory rate, blood pressure, and neurologic status
- Hourly accurate fluid input and output
- Electrocardiogram monitoring for assessment of T-waves for evidence of hyperkalemia/hypokalemia
- Hourly capillary glucose

- Laboratory tests: electrolytes, blood glucose, and blood gases should be repeated every 2 to 4 hours.

Fluids and Electrolytes

- Intravenous fluids should be given to replace fluid deficits over 48 hours.
- Hypotonic fluids (<0.45N NaCl) should never be given as initial therapy.
- Potassium levels should be monitored closely and replaced as soon as urine output is established.

Insulin Replacement

- Initial insulin therapy should be given intravenously in a dose of 0.1 unit x kg^{-1} x h^{-1}.

A flow sheet should be maintained documenting clinical observations, intravenous and oral fluids, insulin dosing, and laboratory results.

Hypoglycemia

- Frequency of hypoglycemia should be determined at every visit.
- Presence of hypoglycemia unawareness should be assessed at every visit.
- If hypoglycemia unawareness is present or if symptomatic hypoglycemia is frequent, blood glucose targets should be reassessed.
- Severe hypoglycemia in children <5 years of age may be associated with cognitive deficits; thus, blood glucose goals are higher for this age-group.
- Recognition of hypoglycemia symptomatology is developmental and age-dependent; the limitations of infants and toddlers to detect such symptoms may influence treatment goals and monitoring frequency.
- Treatment of hypoglycemia requires the administration of rapidly absorbed glucose, glucagon, and intravenous glucose with treatment based on the severity of the hypoglycemia

Immunization

Children with diabetes and children who have family members with type 1 diabetes should receive all immunizations in accordance with the recommendations of the American Academy of Pediatrics.

Chronic Complications

Nephropathy

Screening

- Annual screening for microalbuminuria should be initiated once the child is 10 years of age and has had diabetes for 5 years; more frequent testing is indicated if values are increasing.
- Screening is done with a random spot urine sample analyzed for microalbumin-to-creatinine ratio; a timed overnight or a 24-hour analysis can be done in follow-up, if indicated.

- Because exercise, smoking, and menstruation can affect the results and albumin excretion can vary from day to day, an abnormal value should be repeated; the diagnosis of persistent abnormal microalbumin excretion requires documentation of two of three consecutive abnormal values obtained on different days.

Treatment

- Confirmed, persistently elevated microalbumin levels should be treated with an angiotensin-converting enzyme (ACE) inhibitor titrated to normalization of microalbumin excretion (if possible).
- Patients should be educated about the importance of attention to glycemic control and avoidance or cessation of smoking in preventing and/or reversing diabetic nephropathy.
- If hypertension exists, rigorous attention to normalization of blood pressure is important for reversal or delay of progression of nephropathy.
- Rigorous treatment of elevated low-density lipoprotein (LDL) cholesterol may offer some benefit.
- If medical treatment is unsatisfactory, referral to a nephrologist should be considered.

Hypertension

- Blood pressure determination, using an appropriately sized cuff and with the patient relaxed and seated, should be part of every diabetes physical examination.
- If an elevated blood pressure is detected and confirmed, non-diabetes-associated causes of hypertension should be excluded.
- Treatment of high-normal blood pressure (systolic or diastolic blood pressure consistently above the 90th percentile for age, sex, and height) should include dietary intervention and exercise, aimed at weight control and increased physical activity, if appropriate. Dietary intervention consists of eliminating added salt to cooked foods and a reduction in foods high in sodium content. If target blood pressure is not reached within 3 to 6 months of lifestyle intervention, pharmacologic treatment should be initiated.
- Pharmacologic treatment of hypertension (systolic or diastolic blood pressure consistently above the 95th percentile for age, sex, and height or consistently >130/80 millimeters of mercury [mmHg], if 95% exceeds that value) should be initiated as soon as the diagnosis is confirmed.
- ACE inhibitors should be considered for the initial treatment of hypertension, with dose titrated to achieve a blood pressure (both systolic and diastolic) consistently <130/80 mmHg or below the 90th percentile for age, sex, and height, whichever is lower. A once-daily formulation is recommended to promote adherence.
- If target blood pressure is not reached with an ACE inhibitor alone, additional antihypertensive medications should be considered
- ACE inhibitors are contraindicated during pregnancy.

Dyslipidemia

Screening

- Prepubertal children: a fasting lipid profile should be performed on all children >2 years of age at the time of diagnosis (after glucose control has been established) if there is a family history of hypercholesterolemia (total cholesterol >240 mg/dL) or a history of a cardiovascular event before age 55 years, or if the family history is unknown. Borderline or abnormal values should be repeated for confirmation. If values fall within the accepted risk levels (LDL <100 mg/dL), a lipid profile should be repeated every 5 years. If family history is not of concern, the first lipid screening should be performed at puberty (>12 years).
- Pubertal children (>12 years old): a fasting lipid profile should be performed at the time of diagnosis (after glucose control has been established). If values fall within the accepted risk levels (LDL<100 mg/dL), the measurement should be repeated every 5 years.

Treatment

- Treatment should be based on fasting lipid levels (mainly LDL) obtained after glucose control is established.
- Initial therapy should consist of optimization of glucose control and medical nutrition therapy aimed at a decrease in the amount of total and saturated fat in the diet, as well as encouragement of lifestyle changes to control weight, increase exercise, and if applicable, discontinue tobacco use.
- The addition of pharmacologic lipid-lowering agents is strongly recommended for LDL >160 mg/dL and is also recommended in patients who have LDL cholesterol values 130-159 mg/dL after failure of medical nutrition therapy and lifestyle changes based on the patient's cardiovascular disease (CVD) risk profile. Further studies are needed to determine recommendations for children with LDL values <130 mg/dL.
- The goal of pharmacologic therapy is an LDL value <100 mg/dL.
- Youth at risk for pregnancy should be counseled about lipid-lowering agents, and drug therapy should be stopped immediately if pregnancy is suspected.

Retinopathy

Screening

- Ophthalmological screening evaluations should be reviewed and regular examinations scheduled with an eye care professional skilled in the care of children and adolescents with diabetes.
- The first ophthalmologic examination should be obtained once the child is $\geq$10 years of age and has had diabetes for 3 to 5 years.
- After the initial examination, annual routine follow-up is generally recommended. Less frequent examinations may be acceptable on the advice of an eye care professional.
- The young woman who is planning a pregnancy should have an ophthalmologic examination before conception, during the first trimester, and at physician discretion contingent on the results of the first trimester exam.

Foot Care

- Annual foot exams should begin at puberty.

Associated Autoimmune Conditions

Thyroid Disease

- Thyroid function should be monitored after metabolic control has been established for several weeks. This should be done with a TSH measurement. If TSH is abnormal, free T4 and, if indicated, total T3 can be measured. Thyroid function tests should be obtained at any time clinical thyroid dysfunction is suspected and in any patient who has thyromegaly.
- Patients with previously normal TSH levels may be rechecked every 1 to 2 years or obtained at any time the growth rate is abnormal.
- The presence of thyroid autoantibodies (antithyroid peroxidase [TPO] and antithyroglobulin [TG]) identifies patients at increased risk for thyroid autoimmunity.
- Patients with elevated TSH levels should be treated with thyroid hormone replacement therapy.
- Comprehensive evaluation and treatment of hyperthyroidism should be initiated in patients with suppressed TSH and elevated T4/T3 levels.

Celiac Disease

- Patients with type 1 diabetes should be screened for celiac disease, using tissue transglutaminase (tTG) antibodies or endomysial autoantibody (EMA), with documentation of normal serum immunoglobulin A (IgA) levels. Testing should occur soon after the diagnosis of diabetes and subsequently if growth failure, failure to gain weight, weight loss, or gastroenterologic symptoms occur.
- Positive antibody levels should be confirmed.
- Individuals with confirmed elevated tTG or EMA antibodies should be referred to a gastroenterologist for consultation and will usually require a small-bowel biopsy.
- Individuals with type 1 diabetes and confirmed celiac disease should follow a gluten-free diet.
- Consultation with a registered dietitian experienced in managing both diabetes and celiac disease in children should be obtained.
- Consideration should be given to periodic rescreening of patients with negative antibody levels.

Adjustment and Psychiatric Disorders

- Youth with difficulties achieving treatment goals or with recurrent DKA should be screened for psychiatric disorders.
- Routine screening of psychosocial functioning, especially depression and family coping, should be performed.
- Youth with positive screening should be referred promptly for treatment.

Eating Disorders

- Failure to achieve treatment goals, particularly but not exclusively in an underweight patient, should prompt screening for eating disorders by a mental health professional.

Adolescence

- Routine annual screening for depression of all youth ≥10 years of age with type 1 diabetes
- The adolescent should gradually assume greater responsibility for diabetes management tasks.
- Parents should be encouraged to maintain a partnership with youth for diabetes decisions important for optimal diabetes control.
- Transition to adult care providers should be planned and negotiated among the patient, the family, the pediatric diabetes team, and the adult care providers.

Adherence to Self-Management

- Behavioral interventions that enhance the ability of youth and families to self-manage diabetes should be incorporated into routine care.

Risk Behaviors

- Providers should counsel adolescents to test blood glucose before driving, to carry a source of glucose in the car while driving, and to stop immediately should symptoms of hypoglycemia occur; this counseling should be documented in the record.
- Preconception counseling should be provided to all girls contemplating sexual activity.
- Information about risk of fetal malformations and of diabetes in offspring should be provided to all sexually active adolescents.

CLINICAL ALGORITHM(S)

None provided

EVIDENCE SUPPORTING THE RECOMMENDATIONS

TYPE OF EVIDENCE SUPPORTING THE RECOMMENDATIONS

The information is based on evidence from published studies whenever possible and, when not, supported by expert opinion or consensus.

BENEFITS/HARMS OF IMPLEMENTING THE GUIDELINE RECOMMENDATIONS

POTENTIAL BENEFITS

Appropriate diagnosis and management of type 1 diabetes in children and adolescents

POTENTIAL HARMS

Not stated

CONTRAINDICATIONS

CONTRAINDICATIONS

Angiotensin-converting enzyme (ACE) inhibitors are contraindicated during pregnancy.

QUALIFYING STATEMENTS

QUALIFYING STATEMENTS

This statement is not meant to be an exhaustive compendium on all aspects of the management of pediatric diabetes. However, relevant references are provided and current works in progress are indicated as such in the original guideline document.

IMPLEMENTATION OF THE GUIDELINE

DESCRIPTION OF IMPLEMENTATION STRATEGY

An implementation strategy was not provided.

INSTITUTE OF MEDICINE (IOM) NATIONAL HEALTHCARE QUALITY REPORT CATEGORIES

IOM CARE NEED

Living with Illness

IOM DOMAIN

Effectiveness
Patient-centeredness

IDENTIFYING INFORMATION AND AVAILABILITY

BIBLIOGRAPHIC SOURCE(S)

Silverstein J, Klingensmith G, Copeland K, Plotnick L, Kaufman F, Laffel L, Deeb L, Grey M, Anderson B, Holzmeister LA, Clark N. Care of children and adolescents with type 1 diabetes: a statement of the American Diabetes Association. Diabetes Care 2005 Jan;28(1):186-212. [237 references] PubMed

ADAPTATION

Not applicable: The guideline was not adapted from another source.

DATE RELEASED

2005 Jan

GUIDELINE DEVELOPER(S)

American Diabetes Association - Professional Association

SOURCE(S) OF FUNDING

American Diabetes Association (ADA)

GUIDELINE COMMITTEE

Not stated

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FINANCIAL DISCLOSURES/CONFLICTS OF INTEREST

Not stated

GUIDELINE STATUS

This is the current release of the guideline.

GUIDELINE AVAILABILITY

Electronic copies: Available from the American Diabetes Association (ADA) Web site.

Print copies: Available from the American Diabetes Association, 1701 North Beauregard Street, Alexandria, VA 22311.

AVAILABILITY OF COMPANION DOCUMENTS

None available

PATIENT RESOURCES

None available

NGC STATUS

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