

Managing diabetes in childhood and adolescence

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ABSTRACT

OBJECTIVE To describe management of children's and adolescents' diabetes outlining standards of care compatible with current clinical practice.

QUALITY OF EVIDENCE MEDLINE was searched using specified MeSH headings. Bibliographies of selected articles were used to find additional pertinent articles. Preference was given to randomized controlled trials, clinical practice guidelines, consensus statements, and task force recommendations. We also cite reviews of current practice regarding pediatric diabetes.

MAIN MESSAGE Managing children with diabetes presents a difficult challenge to parents and their advisors. Achieving good diabetic control is impossible unless parents are properly instructed in practical management of the disease. Children with diabetes should be managed quite differently from adults in several respects. Avoiding hypoglycemia is most important, particularly for preschool children. Higher target blood glucose levels than would be accepted for adults are both justifiable and necessary for preschool children. Controlling children's diabetes depends as much on personal factors and family adjustment as it does on insulin, food plans, and exercise.

CONCLUSION Diabetes mellitus is difficult to manage at any age. Managing children's diabetes successfully requires continuous education and encouragement of parents and children. Pediatric diabetes care teams and family physicians play a vital role in encouraging children to control their disease while participating fully in normal childhood activities.

RÉSUMÉ

OBJECTIF Décrire la prise en charge du diabète chez les enfants et les adolescents en insistant sur les normes de soins compatibles à la pratique clinique actuelle.

QUALITÉ DES DONNÉES Une recension a été effectuée dans MEDLINE à l'aide de rubriques MeSH spécifiques. Les bibliographies de certains articles ont également servi à trouver d'autres articles pertinents. La préférence a été accordée aux essais aléatoires contrôlés, aux guides de pratique clinique, aux déclarations consensuelles et aux recommandations de groupes de travail. Nous citons aussi des études de la pratique actuelle en ce qui concerne le diabète pédiatrique.

PRINCIPAL MESSAGE La prise en charge du diabète chez l'enfant représente un défi considérable pour les parents et leurs conseillers. Il est impossible d'exercer un bon contrôle du diabète à moins que les parents ne soient bien éduqués dans la prise en charge pratique de la maladie. Les enfants diabétiques devraient être traités assez différemment des adultes à plusieurs égards. Il importe le plus d'éviter l'hypoglycémie, en particulier chez les enfants d'âge préscolaire. Des objectifs plus élevés de taux de glycémie que ceux qui seraient acceptables chez l'adulte sont à la fois justifiables et nécessaires pour les enfants d'âge préscolaire. Le contrôle du diabète chez l'enfant dépend autant de facteurs personnels et de l'ajustement de la famille que de l'insuline, des régimes alimentaires et de l'exercice.

CONCLUSION La prise en charge du diabète sucré est difficile à tout âge. La prise en charge fructueuse du diabète chez les enfants exige une éducation constante et un encouragement des parents et des enfants. Les équipes spécialisées en diabète pédiatrique et les médecins de famille jouent un rôle essentiel dans l'encouragement des enfants à contrôler leur maladie tout en participant entièrement aux activités normales de l'enfance.

This article has been peer reviewed.

Cet article a fait l'objet d'une évaluation externe.

Can Fam Physician 2002;48:499-509.

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Diabetes mellitus is a metabolic disorder characterized by hyperglycemia due to defective insulin secretion, insulin action, or both. It is associated in the long term with serious dysfunction of various structures, especially the kidneys, eyes, nerves, heart, and blood vessels (Table 1¹).

Table 1. Classification of pediatric diabetes mellitus

TYPE 1 (β-cell destruction leading to absolute insulin deficiency)

TYPE 2 (insulin resistance with variable secretory defect)

OTHER SPECIFIC TYPES

Genetic defects of β-cell function: for example, maturity-onset diabetes of the young (MODY)

Diseases of the endocrine pancreas

- Cystic fibrosis
- Pancreatitis
- Hemochromatosis

Infections

- Congenital rubella
- Cytomegalovirus

Drugs

- Glucocorticoids
- Thyroid hormones
- Diazoxide
- Immunosuppressive agents

Endocrinopathies

- Cushing syndrome
- Pheochromocytoma

Other genetic syndromes

- Down syndrome
- Turner syndrome
- Prader-Willi syndrome
- Klinefelter syndrome

Adapted from Meltzer et al.¹

Modern classification of diabetes encompasses many hyperglycemic conditions.¹ In childhood and adolescence, type 1 diabetes accounts for most cases.² Over the past 20 years, clear evidence has shown that the incidence of type 1 diabetes mellitus has increased steadily among children and adolescents.³

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More recently, several articles have also documented an increase in the incidence of type 2 diabetes among adolescents.² Differences between type 1 and type 2 diabetes aid in differentiating them (Table 2).⁴

Table 2. Differences between type 1 and type 2 diabetes

ASPECT	TYPE 1	TYPE 2
Predominant age group	Children and adolescents	Adults
Prevalence	10% of all people with diabetes	90% of all people with diabetes
Etiology	Absolute insulin deficiency	Insulin resistance with or without variable insulin deficiency
Markers of islet autoimmunity	Present	Absent
Family history	Often none	Often present
Phenotype	Usually thin	Often overweight
Diabetic ketoacidosis	Present	Uncommon
Treatment	Insulin and controlled diet	Controlled diet, oral hypoglycemic agents, insulin

Successful management of diabetes ultimately depends on each patient's readiness to learn about the disease and willingness to adopt the disciplined lifestyle necessary for good diabetic control. With growing children, this presents a particularly difficult challenge to parents and health professionals. Young children vary in their readiness to receive knowledge and in their willingness to be influenced. In later childhood and adolescence, their desire for independence manifests in ways that are often at odds with the discipline demanded by diabetes.

Managing children and adolescents with diabetes is complex and time-consuming, and requires the combined efforts of several disciplines.⁵ The goals of diabetes management are best attained with the help of a diabetes treatment team and the child's family physician.⁶

As with adults, the main aim of managing children with diabetes is achieving optimal blood glucose control. The degree to which this is achievable, however, is different for children than for adults. The principles governing administration of insulin and the strategies adopted in teaching good diabetes management to children differ in important respects from those for adults. Some of these differences are:

- a need to educate parents so they can supervise their children's diabetes treatment until the children mature;
- the increased insulin sensitivity and greater risk of hypoglycemia in young children, necessitating use of smaller insulin doses and adoption of relatively liberal target ranges for blood glucose⁷;
- the unpredictable habits of preschool children, especially in terms of activity and calorie intake, that can result in varying insulin requirements from day to day; and
- the importance of recognizing older children's increasing maturity and encouraging them to manage the condition themselves and, at the same time, discouraging parents from being overprotective.^{8,9}

In our practice, we refer to the children in our care as children with diabetes, rather than the commonly accepted term "diabetics." We believe this term lays undue emphasis on the disease rather than the person. Young people with diabetes are children, first and foremost. Diabetes must fit into the daily fabric of their lives, but not become a controlling factor in their experience and enjoyment of life.

Quality of evidence

MEDLINE was searched using the MeSH terms "type 1 diabetes," "children and adolescents," "insulin therapy," and "team management." Bibliographies of articles selected were used to find additional pertinent articles. Where possible, we chose articles with a strong bias toward evidence-based practice. These included an American Diabetes Association consensus statement,¹⁰ Canadian clinical practice guidelines,¹ task force recommendations,¹¹ and randomized controlled trials.¹²

We also included some excellent reviews and recommendations regarding current pediatric diabetes practice,^{5,7,13-18} and some relevant prospective^{19,20} and retrospective¹⁴ studies. Articles dealing specifically with controversial areas, including diabetic ketoacidosis, were also included.^{4,21-24} Articles dealing with the incidence of type 1 and type 2 diabetes in childhood and adolescence are cited,^{2,3} as are some nonprospective psychological studies^{8,25,26} and articles based on personal experience in practice.^{6,9,27,28}

Managing newly diagnosed children and adolescents

Diabetes mellitus can present at any age from infancy onward, but peaks in incidence occur in both the 5- to 9-year-old and 10- to 14-year-old groups.¹⁴ Polydipsia and polyuria, accompanied by weight loss, are classic

presenting features of the disease.⁷ These symptoms might be overlooked in infants or toddlers until they become lethargic and dehydrated and develop the electrolyte, acid-base, and osmolar abnormalities characteristic of diabetic ketoacidosis (DKA).⁷

Children who present with symptoms of diabetes for the first time are often seen initially by their family physicians for evaluation. At this stage, they should be referred to a pediatric diabetes centre for confirmation of the diagnosis and institution of treatment. A teaching program should be set up to provide children's families with the skills necessary for managing children safely at home and reintegrating them into the routines of daily living.

In the past 5 to 10 years, an increasing number of centres have treated and taught newly diagnosed children on an outpatient basis.¹⁴ Children with the following conditions and circumstances, however, should be managed in hospital:

- diabetic ketoacidosis,
- younger than 5 years,
- parents with difficulty understanding the teaching program,
- psychomotor delay,
- families with serious psychosocial problems, and
- families who live outside the region.

Many parents are shocked when they are informed that their children have diabetes. Some grieve the loss of the child to a disease they fear will lead to severe complications and a shortened life.²⁷ While the difficulties presented by diabetes should not be denied, emphasis should be placed on the advances in treatment that have led to the possibility of substantial reductions in the rate and severity of complications and improvement in the overall prognosis.¹²

Initiating insulin

Children who present with hyperglycemia without DKA or dehydration should be started promptly on subcutaneous insulin (**Table 3**) and a diabetes meal plan. It is important to stress the following to children and parents at an early stage.

- Diabetes is a permanent condition.
- Insulin controls diabetes but does not cure it.
- Insulin will not control diabetes without modifications in diet and an exercise program.

Home blood glucose monitoring is essential for optimal control of diabetes.¹⁰ This should be carried out three to four times daily in the first few weeks after diagnosis in order to detect the fall in blood glucose levels that heralds the onset of a remission. This phase, the so-called honeymoon period, is marked by

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a temporary and partial recovery of islet cell function that results in increased endogenous insulin secretion. Risk of hypoglycemia is high at this time unless subcutaneous insulin is promptly reduced in response to falling blood glucose levels.

Table 3. Guidelines for insulin dose and target blood glucose ranges

Start treatment with intermediate-acting insulin only before breakfast and supper

To achieve better control at midday and bedtime, add short-acting insulin

Initial insulin dose should be 0.3 to 0.5 U/kg daily

Increase to 0.5 to 0.7 U/kg daily for preadolescent children and to 1.0 to 1.3 U/kg daily for adolescents

Aim for blood glucose levels of 6 to 12 mmol/L for preschool children, 4 to 10 mmol/L for older children, and 4 to 8 mmol/L for adolescents⁷

Initiation of insulin therapy in children is governed by the fact that, unlike adolescents and adults, they tend to be very sensitive to short-acting insulin. It is safest, therefore, to begin treatment with intermediate-acting insulin only, given once or twice daily. Short-acting regular or rapid-acting lispro insulin²¹ can be added in small doses if adequate control of blood glucose cannot be achieved with intermediate-acting insulin alone.¹⁵ In contrast to younger children, adolescents tend to be somewhat resistant to insulin.¹⁷ Because of this, they usually require larger doses of a mixture of short- and intermediate-acting insulin (Table 3). Use of premixed insulin is not recommended for children and adolescents because independent adjustment of short- and intermediate-acting insulin is often required to achieve control.²¹

Ongoing management and adjustment of insulin

Insulin adjustments are indicated when children with established diabetes become hyperglycemic or hypoglycemic (Table 3). In general, adjustment of children's insulin is more likely to be successful if parents and children understand the necessity of adhering to the prescribed food plan and continuing with usual patterns of activity while insulin adjustment is taking place.

Admission to hospital is not necessary for this adjustment, although hyperglycemia and ketosis with vomiting and suspected DKA or a severe hypoglycemic episode might necessitate such a step. Insulin might need adjustment:

- at the beginning and end of the honeymoon phase,

- at onset and termination of summer vacations,
- with intercurrent infections,
- periodically during growth and development, and
- during adolescence.

If children with diabetes develop a pattern of high blood sugar levels over several days, then the appropriate insulin should be increased by no more than 1 to 2 units as an initial step, assuming that their age, weight, and stage of development are taken into consideration before deciding the magnitude of the dose increase. Adjustments should be made to one insulin only at each visit; effects of each adjustment should be observed for several days before a further change is made. This one-step approach will enable physicians to recognize which insulin needs adjustment next to restore glycemic control. Such an approach also reduces the possibility of overadjustment, which might result in development of hypoglycemia. For children who present with hypoglycemia, the appropriate insulin should be reduced quickly by 1 or 2 units and the situation observed before further reductions are suggested.

Preschool children are very sensitive to even small increases in insulin, particularly short-acting insulin. As a result, they might unexpectedly become hypoglycemic. This dictates particular caution during insulin adjustment. For these children, additions of not more than 1 unit of intermediate-acting or short-acting insulin, whichever is appropriate, should be made each time during correction of hyperglycemia.

Routine follow up

Following diagnosis of diabetes, children and their parents are seen by the diabetes team every 3 to 4 months and assessed for the following:

- general health, including height, weight, and blood pressure;
- glycemic control from a record book, glucose monitor, or computer printout;
- comparison of glycemic control with glycosylated hemoglobin (Hgb A_{1c});
- accuracy of the glucose monitor compared with laboratory blood glucose testing equipment;
- meal plan requirements and adherence;
- knowledge of diabetes, insulin, and diet;
- attitudes to and management of diabetes;
- psychosocial problems; and
- school progress.

Children should also be screened for conditions associated with diabetes and for long-term complications. Thyroid function (serum thyroid-stimulating hormone levels) should be assessed *annually*. From

5 years after diagnosis, children should be screened annually for retinopathy (retinal examination with dilated pupils) and nephropathy (random urine microalbumin-to-creatinine ratio or 24-hour urine microalbumin excretion). Children should also be screened *intermittently* for lipid abnormalities (fasting serum lipid profile 6 months after diagnosis and again during adolescence or when diabetic control is poor¹⁶).

Emergency situations

Hypoglycemia. Hypoglycemia is the most frequent acute complication of diabetes in children. It is present when blood glucose drops below 3.5 mmol/L or when a child develops symptoms (Table 4). Causes include:

- excessive insulin therapy,
- missed or delayed meals or snacks,
- unusual amount of exercise without extra calories,
- use of alcohol, and
- changes in schedules.

Young people with diabetes frequently experience mild hypoglycemia. This occurs despite the fact that management of diabetes in young children is partly governed by the need to sacrifice strict control of blood glucose, if necessary, in order to reduce the risk of hypoglycemia as much as possible.⁷ Parents of preschool children with diabetes tend to worry more about the possibility of severe hypoglycemia than about poor control of blood sugar because young children are unable to report early hypoglycemia. Some parents tend to overcompensate by monitoring blood glucose too frequently.

Management of hypoglycemia is set out in Table 4. The value of glucagon in reversing severe hypoglycemia should be noted.¹⁷ All families are taught how to use this substance in an emergency. When injected, glucagon raises blood glucose levels by releasing glucose from glycogen stores in the

liver and muscles. If use of glucagon fails to raise blood glucose levels in a child or adolescent or if it is unavailable, the child should be taken to hospital where intravenous glucose can be administered immediately.

A severe episode of hypoglycemia is a serious event.¹⁷ It should always be followed up so that a cause can be determined and measures taken to prevent recurrence. The usual dose of insulin should be immediately reduced. The association between alcohol consumption and hypoglycemia should be stressed to schoolchildren and adolescents. Because hypoglycemia can occur at any time, children and adolescents are encouraged to carry a source of glucose with them, particularly when away from home or when driving a vehicle. They should always carry identification indicating that they have diabetes.

Sick days. Upper respiratory tract and gastrointestinal infections are among the most frequent illnesses of childhood. For someone who has diabetes, such infections might be accompanied by hyperglycemia and moderate or large ketonuria. Patients often feel unwell, are anorexic, or vomit. Causes other than infections, such as inadequate insulin or missing an injection, might also lead to this situation.²² A few patients experience hypoglycemia rather than hyperglycemia during these events.

Parents can be taught how to treat their children at home successfully in the event of intercurrent illnesses (Table 5).²² Teaching emphasizes that insulin must *never* be omitted for a child who is ill and that extra short-acting insulin is required when hyperglycemia is accompanied by moderate or large ketonuria. Parents are urged to call a diabetes nurse educator if their children are ill and to consult their family doctors so that infections requiring antibiotic therapy can be detected and treated early. Any signs

Table 4. Management of hypoglycemia

SEVERITY	SYMPTOMS	TREATMENT
Mild	Hunger, fatigue, pallor, trembling, sweating	Give 10-15 g of carbohydrates (ie, 125 mL of juice or two to three glucose tablets)
Moderate	Headache, abdominal pain, behaviour change, confusion, drowsiness, blurred vision	If child can swallow, give 10-15 g of carbohydrates followed by a protein and starch If child cannot swallow, rub glucose gel or syrup inside cheek between teeth and gums. Massage cheek for faster absorption
Severe	Disorientation, loss of consciousness, seizures	Administer glucagon subcutaneously: 0.5 mg if younger than 10 y, 1.0 mg if older than 10 y Repeat if no response in 10 minutes Take child to nearest hospital

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of deteriorating fluid balance will require early hospital treatment to prevent severe dehydration and DKA.

Home management of diabetic children's intercurrent illnesses is successful in most cases.²² Teaching parents how to respond to such events has led, in recent years, to a substantial reduction in the number of children requiring treatment for DKA.¹⁸

Table 5. Sick day management

Never omit insulin
Contact nurse educator and family physician
If anorexic, give calories in the form of fluid exchanges
Check blood glucose and urine for ketones every 4 hours
Give extra short-acting regular insulin every 4 hours if indicated as follows.
• Approximately 20% of total daily dose if blood glucose level is >13 mmol/L with moderate or large ketonuria
• Approximately 10% of total daily dose if blood glucose level is >20 mmol/L without ketonuria
• No extra insulin if blood glucose level is <20 mmol/L without ketonuria
Report to doctor and nurse educator if symptoms worsen or fail to resolve within 24 hours

Management of suspected DKA before transfer to a pediatric centre. Family physicians practising in isolated areas face a particular challenge when they see dehydrated, lethargic children with high blood glucose levels and blood gas changes characteristic of DKA. This is particularly true if blood gases cannot be analyzed locally and diagnosis has to rely solely on the presence of features suggesting DKA.

Characteristic features of DKA usually include polyuria and polydipsia, abdominal pain, nausea or vomiting, hyperventilation, fruity odour on the breath, dehydration, blood glucose >13 mmol/L, and moderate to large ketonuria.²³ If a child has these symptoms and signs, even if a blood gas report is unavailable, initial treatment should be aimed at alleviating further fluid losses, partly correcting dehydration, and beginning to reverse the absolute insulin deficiency that is one of the principal causes of DKA.²²

The degree of dehydration should be clinically assessed and blood pressure taken. Patients should be given normal saline intravenously. Except for patients in shock, giving a fluid bolus should be avoided. Too rapid correction of a fluid deficit, especially with hypotonic fluid, might increase risk of cerebral edema leading to permanent neurologic impairment or even death.^{22,23}

The following is a suggested plan for initial treatment of suspected DKA in children. The purpose

is to prevent further deterioration, not achieve full correction, of patients' clinical deficits.

- If a patient is in shock, give a bolus of 10 to 20 mL/kg of normal (0.9%) saline intravenously in the first 30 minutes.
- Repeat if necessary until shock is relieved.
- If patient is not in shock, give normal saline at the child's maintenance rate, plus 2 mL/kg hourly to allow for dehydration.
- If serum potassium is normal or low, add 10 mmol of potassium chloride to each 500 mL of saline when child voids.
- If blood glucose is >20 mmol/L, give 0.1 U/kg of soluble (short-acting regular) insulin subcutaneously.
- Transfer to a pediatric centre accompanied by a physician or nurse.
- Monitor blood glucose with a portable bedside monitor every 30 minutes during transport.
- Change intravenous infusion to 5% dextrose in 0.9% saline if glucose drops to ≤12 mmol/L during the journey.

A more detailed discussion of the pathophysiology and treatment of DKA in children can be found in Chase et al.²²

Ages and stages

Infants and preschoolers. Infants and preschoolers with diabetes present a unique challenge to their health care providers and their families.⁷ Unpredictable food consumption and exercise habits lead to difficulties in achieving a balance between maintaining reasonable diabetic control and avoiding hypoglycemia.

When caring for this age group, it is important to:

- set up a basic meal plan, allowing reasonable lengths of time for meals and snacks;
- avoid hypoglycemia by aiming for blood glucose levels between 6 and 12 mmol/L⁷;
- lower risk of nocturnal hypoglycemia by aiming for blood glucose levels of ≥8 mmol/L at 22:00 h; and
- provide continuous support for parents (ie, 24-hour telephone communication).

Schoolchildren. Schoolchildren generally adapt well to a diagnosis of diabetes.²⁸ This is the ideal age for children with diabetes to:

- meet new friends and rely more on others outside the home, such as teachers or coaches, to help them with their care;
- become more independent and self-reliant by taking some responsibility for their insulin injections,

glucose monitoring, and meal management with supervision⁸;

- identify impending signs of hypoglycemia and learn appropriate treatment; and
- attend diabetes camps to help them realize they are not alone in dealing with diabetes.

During adolescence, young people often increasingly resent their parents' supervision.⁹ When dealing with this age group, it is helpful to remember the following points.

- Teenagers should be interviewed alone to encourage them to verbalize personal concerns.
- Overprotective parents can cause serious problems in management.⁹
- Teenagers might act as though they do not have diabetes at all, and threats of long-term complications are unlikely to change this attitude.
- Praising them for what they are doing well and being nonjudgmental about the things they are doing wrong is more likely to yield positive responses.
- Outside factors, such as adolescent growth, hormonal changes, and insulin resistance, can affect glucose control and make diabetes difficult to manage.¹⁵

Diabetes' effect on young people

Diagnosis of diabetes in a child causes parents to experience various degrees of stress, manifested by sadness, bouts of crying, anxiety, and irritability.¹⁹ In addition to having these symptoms, young people diagnosed with diabetes also have feelings of anger and isolation.²⁰ These responses are, however, seldom extreme and resolve within 6 to 9 months.

In the longer term, children and adolescents vary in how well they adapt to having diabetes as part of their lives. A study of 74 children and adolescents with type 1 diabetes led to the following conclusions.²⁵ Adolescents with new-onset diabetes were likely to see the disease as having a negative effect on their lives. Girls were more likely than boys to report disease-related concerns. Adolescents are unlikely to place a personal value on maintaining a daily diabetes management regimen if it disrupts their lives.

The study suggests the folly of professionals' emphasizing only the importance of good metabolic control to their patients and failing to recognize that the effort required to achieve good metabolic control might of itself have negative effects on patients' lives. Such an approach could result in adolescent psychosocial distress and noncompliance. Other authors have, however, found a direct association between

maintenance of good metabolic control and good-quality lives.²⁶

Role of family physicians

Family physicians also have a role in the long-term care of patients with diabetes. The importance of this role has been emphasized in the St Vincent Declaration.¹¹ Experience of shared care between family physicians and diabetes clinics has, however, been documented only in a few studies of adults.²⁹ Nevertheless, it is clear that family physicians' relationships with children and their families provide unique opportunities for fostering attitudes that could improve day-to-day management and ultimately benefit the long-term outlook of those with diabetes.

Opportunities for intervention by family physicians include the following:

- being alert to the possibility of a diagnosis of diabetes mellitus in children who present with suggestive symptoms,
- providing assessment advice and early treatment to reduce the risk of DKA in children who develop intercurrent infections,
- in remote areas, beginning fluid resuscitation in children with suspected DKA before transfer to hospital,
- maintaining an advisory relationship with children and their families between clinic visits,
- discussing aspects of diabetes care when seeing children primarily for unrelated problems,
- being aware of adverse family situations that could lead to poor control of diabetes, and
- communicating with members of the diabetes team when necessary and ensuring that suggested changes in management are followed.

Moving from pediatric to adult care

This transition can be stressful for teenagers and their parents.²⁴ Many are overwhelmed by the demands placed on them, and some might drop out of care. This is the worst possible outcome, as it is likely to result in a deterioration in diabetic control that could lead to ocular and renal complications long before middle age.

Ideally, transition to an adult diabetes clinic should be planned well in advance and should occur only when patients are physically and emotionally stable.²⁴ Transition should take place once a child has learned to be an independent decision maker with the confidence to make necessary changes in therapy as dictated by glycemic control. In practice, despite education, many teenagers do not have this confidence,

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and they continue to rely heavily on the diabetes team for advice on management.

Successful transition can be achieved:

- by encouraging young people to take an active role in managing their diabetes from mid-childhood;
- by interviewing young people alone during clinic times and encouraging independence;
- by offering young people comprehensive education sessions, enabling them to solve problems and make good management choices;
- by offering a transition workshop close to the time of transfer;
- by transferring adolescents not by age but by maturity and by their readiness to embrace adult pursuits, such as college or job training; and
- by holding joint transition clinics attended by both pediatric and adult staff.²⁴

Conclusion

Diabetes is a formidable disease presenting daily challenges to both children and their parents. Diabetes education, the advent of home glucose monitoring, and improvements in insulin therapy, however, have together led to a reduction in the rate of complications and an improvement in prognosis.¹²

Managing children and adolescents with diabetes is very different from managing adults. Young people must be given a firm foundation on which to grow. This can be achieved only with continuous support from their families, family physicians and pediatricians, and members of the diabetes team, through continuous follow-up care.

Children with diabetes should lead normal happy lives and deserve the best we can provide. Education must be continuous and should change with various life stages, thus leading young people in the direction that enables them to make choices independently and to manage their diabetes successfully into adulthood. ❁

Acknowledgment

We thank Dr A.J. Davis for reviewing the paper, Shaila Mensinkai for assisting with literature searches, and Deborah Pantin for editing and typing the manuscript.

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References

1. Meltzer S, Leiter L, Daneman D, Gerstein HC, Lau D, Ludwig S, et al. 1998 Clinical practice guidelines for the management of diabetes in Canada. Canadian Diabetes Association. *Can Med Assoc J* 1998;159(Suppl 8):S1-29.
2. Pinhas-Hamiel O, Dolan LM, Daniels SR, Standiford D, Khoury PR, Zeitler P. Increased incidence of non-insulin-dependent diabetes mellitus among adolescents. *J Pediatr* 1996;128:608-15.

Editor's key points

- Children and adolescents usually have type 1 diabetes and are more susceptible to hypoglycemia than adults.
- Initial management is best done by a diabetic team, often in hospital; management includes education, counseling about diet and activity, and initiating insulin therapy.
- Intermediate-acting insulins should be used twice a day to start treatment. Short-acting insulins can be used for in-between, additional control. Children are very sensitive to insulin, so make changes slowly.
- Family physicians can help manage children's diabetes by supporting parents in the early stages and by promptly treating infections and other complications as they arise.
- Successfully controlling diabetes in this age group depends as much on personal and family adjustments as on insulin, diet, and exercise.

Points de repère du rédacteur

- Les enfants et les adolescents souffrent habituellement du diabète de type 1 et sont plus vulnérables à l'hypoglycémie que les adultes.
- Il vaut mieux que la prise en charge initiale soit entreprise par des équipes spécialisées en diabète, souvent à l'hôpital; la prise en charge comporte l'éducation, les conseils en matière de diète et d'activité, et l'amorce d'une insulinothérapie.
- L'insuline à action intermédiaire devrait être utilisée deux fois par jour pour commencer le traitement. L'insuline à action rapide peut être utilisée pour un contrôle additionnel entre les deux. Les enfants sont très sensibles à l'insuline et il faut donc procéder lentement à des changements.
- Les médecins de famille peuvent contribuer à la prise en charge du diabète en offrant de l'appui aux parents durant les premières étapes et en traitant sans délai les infections et les autres complications lorsqu'elles se produisent.
- Le contrôle fructueux du diabète dans ce groupe d'âge est autant tributaire de l'ajustement personnel et familial que de l'insuline, du régime alimentaire et de l'exercice physique.

3. Toomilehto J, Virtala E, Karvonen M, Lounamaa R, Pitkanieni J, Reunanen A, et al. Increase in incidence of insulin-dependent diabetes mellitus among children in Finland. *Int J Epidemiol* 1995;24:984-92.
4. Kaufman FR. Diabetes in children and adolescents: areas of controversy. *Med Clin North Am* 1998;82(4):721-38.
5. Golden MP, Hibbard RA, Ingersoll GM, Kronz KK, Fineberg NS, Marrero DG. Pediatric endocrinologic recommendations, pediatric practice and current pediatric training regarding care of children with diabetes. *Pediatrics* 1989;84(1):138-43.
6. Kushion W, Salisbury PJ, Seitz KW, Wilson BE. Issues in the care of infants and toddlers with insulin-dependent diabetes mellitus. *Diabetes Educ* 1991;17(2):107-10.

7. Daneman D, Frank M, Perlman K, Wittenberg J. The infant and toddler with diabetes: challenges of diagnosis and management. *Pediatr Child Health* 1999;4(1):57-64.
8. McNabb WL, Quinn MT, Murphy DM, Thorp FK, Cook S. Increasing children's responsibility for diabetes self-care: the In Control study. *Diabetes Educ* 1994;20(2):121-4.
9. LaHood B. Parental attitudes and their influence on the medical management of diabetic adolescents. *Clin Pediatr* 1970;9:468-71.
10. American Diabetes Association. Consensus statement on self-monitoring of blood glucose. *Diabetes Care* 1994;17:81-6.
11. Keen H, Hall M. St Vincent: a new responsibility for general practitioners? *Br J Gen Pract* 1996;46(409):447-8.
12. The Diabetes Control and Complications Trial Research Group. Effect of intensive diabetes treatment on the development and progression of long-term complications in adolescents with insulin-dependent diabetes mellitus. Diabetes Control and Complications Trial. *J Pediatr* 1994;125:177-88.
13. Swift PGF. Optimization of insulin treatment in children. *Ann Med* 1997;29:419-24.
14. Swift PGF, Hearnshaw JR, Botha JL, Wright G, Raymond NT, Jamieson KF. A decade of diabetes: keeping children out of hospital. *BMJ* 1993;307:96-8.
15. Rogers DG. Puberty and insulin-dependent diabetes mellitus. *Clin Pediatr (Phila)* 1992;31(3):168-73.
16. Sochett E, Daneman D. Early diabetes-related complications in children and adolescents with type 1 diabetes: implications for screening and intervention. *Endocrinol Metab Clin North Am* 1999;28(4):865-82.
17. Daneman D, Frank M, Perlman K, Tamm J, Ehrlich R. Severe hypoglycemia in children with insulin-dependent diabetes mellitus: frequency and predisposing factors. *J Pediatr* 1989;115:681-5.
18. Daneman D, Frank M. Defining quality of care for children and adolescents with type 1 diabetes. *Acta Paediatr Suppl* 1998;425:11-9.
19. Kovacs M, Finkelstein R, Feinberg TL, Crouse-Novak M, Paulauskas S, Pollock M. Initial psychological responses of parents to the diagnosis of insulin-dependent diabetes mellitus in their children. *Diabetes Care* 1985;8:568-75.
20. Kovacs M, Feinberg TL, Paulauskas S, Finkelstein R, Pollock M, Crouse-Novak M. Initial coping responses and psychosocial characteristics of children with insulin-dependent diabetes mellitus. *J Pediatr* 1985;106:827-34.
21. Becker D. Individualized insulin therapy in children and adolescents with type 1 diabetes. *Acta Paediatr Suppl* 1998;425:20-4.
22. Chase HP, Garg SK, Jelley DH. Diabetic ketoacidosis in children and the role of outpatient management. *Pediatr Rev* 1990;11:297-304.
23. Klekamp J, Churchwell KB. Diabetic ketoacidosis in children: initial clinical assessment and treatment. *Pediatr Ann* 1996;25(7):387-93.
24. Frank M. Rights to passage: transition from paediatric to adult diabetes care. *Beta Release* 1992;16(3):85-9.
25. Ingersoll GM, Marrero DG. A modified quality of life measure for youths: psychometric properties. *Diabetes Educ* 1991;17(2):114-8.
26. Guttman-Bauman I, Flaherty BP, Strugger M, McEvoy RC. Metabolic control and quality of life self-assessment in adolescents with IDDM. *Diabetes Care* 1998;21:915-7.
27. Almeida CM. Grief among parents of children with diabetes. *Diabetes Educ* 1995;21(6):530-2.
28. Dean H. Diabetes management in the 8-12 year old child. *Can Diabetes* 1989;2(4):1-4.
29. Greenhalgh PM. *Shared care for diabetes: a systematic review*. London, Engl: Royal College of General Practitioners; 1994.