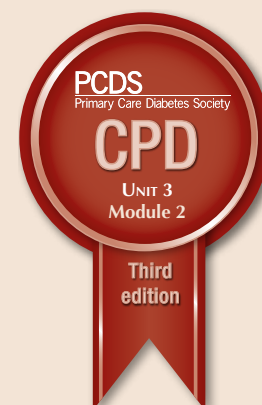


UNIT 3 Special care groups

Children and young people with diabetes: A practical guide for primary care



Carole Gelder

Diabetes is not uncommon in childhood, affecting 1 in 450 children, with the majority (96%) having type 1 diabetes. The incidence of both type 1 and type 2 diabetes combined is increasing in those under the age of 24, but it is likely that a large UK general practice will see only one newly diagnosed child every 2 years. Treatment of this complicated condition can be challenging for children, their families and healthcare professionals and treatment priorities and strategies will need to adapt as the child grows. This article reviews some of the common clinical issues in managing diabetes in children and young people. Illustrative case examples are presented in Boxes 1 and 2.

In the most recent National Paediatric Diabetes Audit of England and Wales for 2015/16 (Royal College of Paediatrics and Child Health [RCPCH], 2017), 28 439 children and young people up to the age of 24 years were known to have diabetes and were under the care of a consultant paediatrician (96% with type 1 diabetes, 2.2% with type 2 diabetes and 1% with other types of diabetes or unknown). According to the audit, paediatric diabetes care in England and Wales has improved dramatically but still lags behind some European counterparts; however, the proportion of those with type 1 diabetes who are achieving an HbA_{1c} <58 mmol/mol (7.5%) has increased since the 2014/15 audit (23.5% to 26.6%; RCPCH, 2017). Although this long-awaited improvement is very welcome, variation between and within services persists with particularly poor outcomes noted in deprived areas, non-white ethnicity, adolescents and females (RCPCH, 2017).

Although most diabetes management for

children and young people (CYP) occurs in secondary care in specialist units, primary care plays an integral part in the rapid referral of suspected diabetes in CYP, providing day-to-day support for parents, ensuring access to specialist support when needed acutely, and continuing care once an adolescent has transitioned to adulthood and adult services. This article provides an overview of the care and management of CYP with diabetes.

Symptoms and diagnosis

Type 1 diabetes

A large UK general practice will see only one newly diagnosed child every 2 years (Ali et al, 2011). Most CYP with type 1 diabetes will present in primary care with the classic symptoms of polyuria, polydipsia, weight loss and excessive tiredness (NICE, 2015). However, healthcare professionals do not always consider diabetes in childhood, and many parents may suspect diabetes but delay seeking medical help

Online learning

Visit diabetesonthenet.com/cpd to gain a certificate of continuing professional development for participating in this module.

See page 87

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Learning objectives

After reading this article, the participant should be able to:

1. Identify and refer a child or young person with type 1 or type 2 diabetes presenting in primary care.
2. Outline the dietary recommendations for children and young people with type 1 or type 2 diabetes.
3. Discuss insulin treatment for children and young people with type 1 diabetes including during puberty.
4. Describe optimal management of diabetes at pre-school, school and during adolescence.

Key words

- Children and young people
- Insulin
- Technologies
- Transition

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Diabetic ketoacidosis signs and symptoms

- Dehydration
- Tachycardia
- Nausea or vomiting
- Tachypnoea (may be mistaken for pneumonia or asthma)
- Deep sighing (Kussmaul respirations)
- Breath smells of acetone (often described as the odour of nail varnish remover or pear drops)
- Abdominal pain
- Confusion, drowsiness, progressive reduction in level of consciousness and eventually loss of consciousness

because they do not want to believe this could happen to their child (Lowes et al, 2005). This is problematic, particularly considering the life-threatening consequences of untreated diabetes and diabetic ketoacidosis (DKA). If type 1 diabetes or DKA is suspected in primary care, the CYP should be referred immediately (on the same day) to a multidisciplinary paediatric diabetes team with the competencies needed to confirm diagnosis and to provide immediate care (NICE, 2015). A random blood glucose of >11 mmol/L is indicative of a need for urgent specialist care. Management of suspected DKA in those with type 1 diabetes is covered on page 84.

Parents may have concerns that the young child or infant is fretful, restless or irritable, but questioning will reveal a story of increased or constant milk feeding and heavy, soaking nappies. Older children may present with secondary nocturnal enuresis. DKA will cause Kussmaul breathing, leading to a diagnosis of chest infection, or abdominal pain that may be

mistaken for an acute surgical emergency. Urine testing for glucose and ketones is easy in most children as they will be polyuric if they have diabetes. In infants, collecting a sample can be difficult as nappies are very absorbent. Urine bags can be applied to clean dry skin with close observation by a family member or carer so the sample can be obtained before leakage occurs. Another strategy is to reverse the nappy, but again, close monitoring will be required.

Once in secondary care, the World Health Organization (2006) criteria state a random capillary blood glucose >11.1 mmol/L or a fasting glucose >7 mmol/L confirms diagnosis of type 1 diabetes (Alberti et al, 2004).

Other types of diabetes

A number of other forms of diabetes are increasingly being diagnosed. However, type 1 diabetes should be presumed and a subsequent diagnosis of type 2 diabetes or monogenic diabetes should be made by the specialist paediatric team (NICE, 2015).

Table 1. Presentation, investigation to identify type of diabetes, and treatment.

Type of diabetes	Presentation	Investigation	Treatment
Type 1	<ul style="list-style-type: none"> ● Onset 6 months to young adulthood ● Polyuria/polydipsia ● Loss of weight ● Usually lean 	<ul style="list-style-type: none"> ● Random blood glucose >11 mmol/L ● Ketonuria ● GAD/IA2 antibody positive 	<ul style="list-style-type: none"> ● Insulin
Type 2	<ul style="list-style-type: none"> ● Onset usually pubertal (or later) ● Obese ● Ethnic minority background ● Strong family history of type 2 diabetes ● Acanthosis nigricans ● Other features of metabolic syndrome (such as polycystic ovary syndrome, high blood pressure, abnormal lipids) ● May be incidental finding 	<ul style="list-style-type: none"> ● Random blood glucose >11 mmol/L ● May have ketonuria ● GAD/IA2 antibody negative 	<ul style="list-style-type: none"> ● Always seek further advice ● Metformin as first-line treatment ● Insulin may be necessary if diagnostic uncertainty, blood glucose concentration very high or in the presence of ketones
MODY	<ul style="list-style-type: none"> ● Onset often postpubertal ● Polyuria/polydipsia ● Loss of weight ● Family history of early-onset type 2 diabetes in close relatives (<25 years of age) ● Usually lean 	<ul style="list-style-type: none"> ● Random blood glucose >11 mmol/L ● May have ketonuria ● GAD/IA2 antibody negative 	<ul style="list-style-type: none"> ● Further investigations usually undertaken by the local paediatric diabetes team ● Insulin may be necessary if diagnostic uncertainty or blood glucose concentration very high ● Some forms of MODY respond to sulfonylurea treatment ● Always seek further advice
Disease-specific associated diabetes	<ul style="list-style-type: none"> ● Cystic fibrosis ● Chemotherapy ● Genetic syndromes, such as Bardet-Biedl, Prader-Willi and Down's 	<ul style="list-style-type: none"> ● Further investigations to be undertaken by specialist teams or with local paediatric diabetes team 	

Adapted from Porter and Barrett (2004) and Craig et al (2014).
 GAD=glutamic acid decarboxylase; IA2=insulin antibody; MODY=maturity-onset diabetes of the young.

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Table 1 highlights clinical characteristics of type 1, type 2 and monogenic diabetes (Craig et al, 2014). However, it is important that primary care teams do not try to diagnose CYP. Diagnosis of diabetes in this age group is a specialist role and any CYP suspected of diabetes requires immediate specialist assessment. Secondary diabetes related to cystic fibrosis or high-dose steroid replacement is also a well-recognised condition.

Type 2 diabetes

The clinical presentation of CYP with type 2 diabetes can be similar to that of CYP with type 1 diabetes, and cases with ketosis have been described, although this is often mild. Making a confident diagnosis of type 2 over type 1 diabetes can be a challenge even for an experienced paediatrician and should never be attempted in primary care. NICE (2015) guidance recommends type 1 diabetes is assumed unless there are strong indications for type 2, so the only safe approach is same-day review by a multidisciplinary paediatric diabetes team who will initiate insulin therapy. This is likely to be necessary where blood glucose levels are in double figures or significant ketonaemia is present. Once the child is safely on treatment and stabilised, the diagnosis can then be reviewed regularly in the relative safety of the specialist diabetes clinic.

As in type 1 diabetes, the prevalence of type 2 diabetes is higher in females compared to males and the majority of children with type 2 diabetes in the UK are from Black and Asian ethnic origin (RCPCH, 2017) and have a strong family history of type 2 diabetes (Zeitler et al, 2014). The numbers are still relatively small as only 621 cases were identified in England and Wales (RCPCH, 2017), with most CYP with type 2 diabetes living in deprived areas. However, it is thought that there may be more cases that are being treated in primary care rather than a paediatric diabetes unit.

Management

Education

Type 1 diabetes

CYP with type 1 diabetes should be offered

Box 1. Case report.

Narrative

SP is an 11-year-old boy who has been brought to the practice with a possible urinary tract infection, which caused him to wet the bed at night and left him very run down and tired over the last few days. His mother says he has lost weight even though he's eating lots at home. He's also been very thirsty. His mother thinks these symptoms might be down to the effort he is putting into the rugby and football after-school clubs he's recently joined.

Discussion

When SP attends the medical practice, the practice nurse remembers the Diabetes UK poster she has recently put up in the waiting room and realises that this history of polyuria, thirst and weight loss in a boy of this age could also fit a new diagnosis of type 1 diabetes. She manages to elicit key information to support the diagnosis and that there is no family history of type 1 diabetes, and undertakes urinalysis. Although the urine shows no evidence of infection, there is glucose +++. She then liaises with the GP and a capillary blood test for blood glucose and ketone testing are undertaken.

If the random blood glucose reading is >11 mmol/L (it was 15 mmol/L in this case), the secondary care team should be immediately contacted with the results to arrange same-day review, irrespective of the ketone result, which in this case was reassuringly normal at 0.3 mmol/L. Both the GP and the nurse provided information to the child and mother about the likely diagnosis, and promptly organised review in the paediatric assessment unit.

Provision of information about what's happening is important, as is providing reassurance of the joined-up working between primary and secondary care to continue to support SP and his family following diagnosis, through education and training and beyond.

level 3 carbohydrate-counting education with insulin adjustments from diagnosis, which is reviewed at regular intervals. Level 3 carbohydrate-counting is for those using multiple daily injections or insulin pump therapy. It involves calculating the insulin to carbohydrate ratio (ICR) and individualising according to age, sex, puberty, duration of diabetes and activity levels (Smart et al, 2014). National recommendations (NICE, 2015) emphasise that families benefit from intensive management and support from diagnosis, so members and carers should also be offered education. Carbohydrate-counting should be complemented by a knowledge of how nutrition affects diabetes. Smart et al (2011) recommend the diet comprises 50–55% carbohydrate, of which sucrose can be up to 10% of total daily energy intake; 30–35% fat, with <10% coming from saturated or trans-fatty acid sources; and 10–15% protein. Salt intake should be <6 g per day. In regard to diabetes, evidence suggests low glycaemic index foods improve blood glucose, reduce risk of hypoglycaemia and can, over time, reduce cardiovascular risk (NICE, 2015).

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“The NICE (2015) guideline recommends an HbA_{1c} target of ≤48 mmol/mol (6.5%) is ideal to minimise the risk of long-term complications”.

Randomised controlled trial evidence on structured education for CYP remains elusive apart from those with an HbA_{1c} >80 mmol/mol (9.5%), who showed a significant reduction of 9 mmol/mol after attending the Kids in Control of Food (KICk-OFF) course (Price et al, 2016). Evaluating the impact of the group dynamic, an interactive developmentally appropriate curriculum, peer support and parental involvement could add value to future studies and facilitate coping with the isolation of a long-term condition (Gelder, 2016). Digital solutions, such as websites (e.g. www.digibete.org), e-learning and mobile applications, may engage those who find face-to-face encounters too challenging. However, it is important to ensure such programmes are evidence based, reflect age-specific needs and support gradually increasing self-care.

Type 2 diabetes

Core topics for type 2 diabetes management should cover the effects of diet and physical activity and should be delivered “sensitively”. Discussing the benefits of maintaining a healthy weight and managing obesity should be included at each contact, with life goals agreed (NICE, 2015).

Insulin requirement

The NICE (2015) guideline recommends that an HbA_{1c} target of ≤48 mmol/mol (6.5%) is ideal to minimise the risk of long-term complications. As in most areas of paediatrics, doses of medication are initially based on body weight, and, at diagnosis, prescriptions are informed “estimates” of likely need. Most centres are likely to start doses at the lower end of the estimated range to avoid provoking hypoglycaemia soon after diagnosis. Most CYP will be quite insulin resistant for the first 1–3 weeks after diagnosis, owing to the preceding persistent hyperglycaemia and doses may need to be increased quite rapidly in the early stages. The ISPAD 2014 consensus guideline suggests total daily insulin requirement will vary from <0.5 units/kg/day during the partial remission phase and 0.7–1.0 units/kg/day for prepubertal children (Danne et al, 2014).

For those going through puberty, insulin requirement may be as high as 1.2–2.0 units/kg/day during the rapid growth phase – usually mid-to-late puberty (Danne et al, 2014) – due to increased growth hormone secretion, which increases insulin resistance (Rizza et al, 1982). Total daily doses of insulin are also likely to be very high during puberty, as young people also significantly increase their calorie intake to fuel normal growth (a 60-kg boy could need up to 120 units/day). Despite these large doses of insulin, even adolescents who are very engaged with their diabetes management can struggle to achieve tight glycaemic control and it can be a worrying time for families and carers.

Despite the DCCT (Diabetes Control and Complications Trial) taking place over 20 years ago, the findings are still relevant today and highlight the difficulties for adolescents with type 1 diabetes. Although the beneficial effect of improved glycaemic control was evident, adolescents (aged 13–17 years) found it more difficult to achieve lower HbA_{1c} levels than their adult counterparts (64±1.4 mmol/mol [8.06±0.13%] versus 54±0.3 mmol/mol [7.12±0.03%], respectively; $P<0.001$), yet they had a greater tendency to develop severe hypoglycaemia (85.7 events per 100 person-years versus 56.9 events per 100 person-years in the adult cohort; DCCT Research Group, 1994). More recent studies suggest a rate of 5–20 hypoglycaemic events per 100-person years (Ly et al, 2009), perhaps due to newer insulins and pumps; however, this study recognised that children remain at higher risk than adults for hypoglycaemic impairment and hypoglycaemic events.

Insulin regimen

A large cohort study in Germany spanning 20 years confirmed the recommendation of intensive insulin regimens by either multiple daily injections (MDIs) or insulin pump therapy from diagnosis (Hofer et al, 2014; NICE, 2015). Children under the age of 5 years, who may eat unpredictably with respect to both timing and quantity of food, as well as adolescents, who tend to have less

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structure to their lives and value spontaneity, are likely to benefit from either MDIs or insulin pumps.

Many outpatient consultations with adolescents will involve negotiations about how to fit diabetes around their lives. Short-term compromise, such as twice-daily mixed insulin or MDIs with extra long-acting insulins to mitigate missed insulin, as well as predetermined, fixed doses of fast-acting insulin with meals, rather than carbohydrate-counted adjusted doses, may be appropriate for dietitians and diabetes specialist nurses to discuss with the adolescents and their families. Fast-acting insulin should be given 15 minutes before food where possible (NICE, 2015), although as ultra-fast insulins become available, injecting immediately before may become possible.

Injection technique and lipohypertrophy

Correct injection technique should be refreshed at least annually (NICE, 2015). CYP with diabetes generally need the shortest needle length available (currently 4 mm); however, this will need to be assessed for each individual. The importance of using a new needle each time should also be emphasised in order to reduce the risk of lipohypertrophy (LH; Vardar and Kizilci, 2007).

Rotating injections fully within each site before moving to a new site is recommended to reduce the risk of LH (Blanco et al, 2013; Forum for Injection Technique [FIT] UK, 2016). For CYP, LH can impact body image due to actual or perceived disfiguring, and lead to unpredictable and delayed absorption resulting in glycaemic variation (Blanco et al, 2013).

Insulin pump therapy

Insulin pump therapy has been approved by NICE for use in childhood (NICE, 2008). The guideline states that a child under 12 years of age will qualify for continuous subcutaneous insulin infusion (CSII) therapy if an MDI regimen is considered impractical or inappropriate. For CYP over the age of 12 years, they would need to fulfil the adult

criteria to be eligible for an insulin pump (NICE, 2008).

Glucose monitoring

A minimum of five blood glucose checks each day with insulin adjustment from diagnosis regardless of insulin regimen is now recommended by NICE (2015). Technologies such as continuous glucose monitoring (CGM) and sensor-augmented pump therapy (SAPT) have been recognised by NICE (2016a) as having potential to transform daily management and long-term outcomes in specific circumstances, such as hypoglycaemic unawareness.

Hypoglycaemia

The risk of hypoglycaemia (blood glucose <4 mmol/L) can be a significant barrier to achieving optimal glycaemic control in CYP with type 1 diabetes (Ly et al, 2009), but reassurance that glycaemic control can be achieved without frequent or severe hypoglycaemia is vital. In young children, subtle behavioural changes that are difficult to detect (such as tantrums or quietness) may signal hypoglycaemia. Nocturnal hypoglycaemia and impaired awareness should be discussed at each specialist paediatric consultation, and glucagon training should be offered to parents and carers (NICE, 2015), particularly where there is increased risk.

Of particular importance for older adolescents and primary care staff is to be aware of the regulations concerning diabetes and driving, as many will ask their GP to provide a “medical” reference. The regulations now state that people on insulin must notify the Driver and Vehicle Licensing Agency (DVLA; in England, Scotland and Wales) or the Driver and Vehicle Agency (DVA; in Northern Ireland) if they use insulin. They must also have awareness of hypoglycaemia and must not have had more than one episode of severe hypoglycaemia in the last 12 months (Gov UK, 2016). Signposting to resources such as www.diabetesuk.org.uk can be helpful.

Intercurrent illness and sick day rules

As CYP are generally more susceptible to illness,

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Box 2. Case report.

Narrative

CG is a 4-year-old girl who has recently been diagnosed with type 1 diabetes. She is brought to the practice as she has had diarrhoea and vomiting for 24 hours. She is now refusing to eat or drink and her mother is worried.

Discussion

The management of any child or young person with an intercurrent illness requires more frequent blood glucose monitoring, ketone testing (usually blood ketone testing) and regular contact with a healthcare professional. Families who are more confident with diabetes management are likely to need less support than those with a very recent diagnosis. The biggest concern is the development of diabetic ketoacidosis, as the physiological stress response triggered by illness can lead to insulin resistance and hyperglycaemia, even in the absence of any carbohydrate intake. Polyuria will occur and poor oral fluid intake will rapidly lead to significant dehydration. However, gastroenteritis often does not provoke a systemic response, and significant hypoglycaemia can occur. This child will need a clinical assessment and immediate discussion with the paediatric diabetes healthcare team. All children and young people and their families should have 24-hour access to their diabetes team.

access to a 24-hour emergency advice line to the CYP diabetes team for specialist advice is usual practice. Nevertheless, GPs and practice nurses will see CYP when they are unwell and are ideally placed to provide advice and support in terms of same-day appointments, tailored advice, additional supplies of blood glucose and ketone monitoring strips or even prompt referral to secondary care if indicated (Gelder, 2017). The most important sick day rule is that CYP keep taking their insulin. They should also keep testing blood glucose and ketones, and keep eating and drinking sugar-free fluids.

When the symptoms of DKA are observed in a CYP with known diabetes (nausea or vomiting, abdominal pain, hyperventilation, dehydration, reduced level of consciousness), blood ketones should be measured. A blood glucose reading of >14 mmol/mol with blood ketones >3 mmol/mol is indicative of same-day, emergency paediatric assessment (NICE, 2015). It is important to be aware that DKA can occur in a CYP with diabetes who is taking insulin with normal blood glucose levels.

Diabetes review

Within secondary care, NICE (2015) guidance recommends that every 3 months CYP should have a clinic appointment, where HbA_{1c},

height and weight are measured, and healthy eating, exercise and injection sites discussed. Regular monitoring of dyslipidaemia by measuring total cholesterol, HDL-cholesterol, non-HDL-cholesterol and triglycerides is now recommended for type 2 diabetes, and so too is maintaining privacy when weighing CYP with diabetes. Over the age of 12 years, an “annual review” with screening for microvascular complications, including blood pressure checks, retinal screening, urine screening for microalbuminuria and a blood test for assessment of renal function, is appropriate. At this review, they should also be screened for autoimmune thyroiditis, which occurs in up to 10% of those with type 1 diabetes. Foot and dental health should also be monitored annually, and a refresher on sick day guidance and using glucagon given. Coeliac disease is more prevalent among people with diabetes, and children should be screened at diagnosis and every 3 years or sooner if symptoms develop.

Management of diabetes at school

Children spend almost half of their waking hours in school (Pihoker et al, 2014) and with an increasing emphasis on intensive insulin regimens, schools are being asked to do more for children with diabetes, especially primary school children who are unable to do their own injections and need someone to administer insulin or, at the very least, need adult supervision. The *Child and Family Act* (The Stationery Office, 2014) states schools have a legal duty to support pupils with long-term conditions, such as diabetes, and have a policy, a care plan and suitable insurance, which is reviewed and audited. Basic and advanced e-learning resources (www.jdrf.org.uk) have been developed specifically for school staff, but can be useful for anyone coming into occasional contact with CYP.

Adolescence and transition

During adolescence and into young adulthood, it is particularly important to cover worries about weight and body image, sexual health, pre-conception care, smoking and alcohol use

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at every contact (Viner and Barker, 2005). Imparting the right information and approach (see *Box 3* for a selection of resources) at this stage can improve outcomes in the long term and prevent the young person being lost to follow up (Sheehan et al, 2014). Primary care plays a vital role in delivering contraception advice to young people with diabetes, and counselling young women with diabetes that suboptimal control can carry a high risk of congenital malformation and stillbirth is essential (Scott et al, 2017). When planning a pregnancy, review of medication, starting folic acid at 5 mg/day and achieving HbA_{1c} <48 mmol/L (6.5%) should be the aim. If someone discloses they are pregnant, same-day referral to the adult diabetes specialist team is required. In young men, impotence, erectile dysfunction and the impact of sub-optimal HbA_{1c} should be discussed.

Transitioning from childhood, emerging adulthood and ultimately to adulthood should be a gradual process rather than an abrupt transfer of responsibility and self management (Gleeson and Turner, 2012; Care Quality Commission, 2014; NICE, 2016b). Adolescent brain development studies (Blakemore and Choudhury, 2006) suggest transitioning to adulthood continues up to the age of 25 years, and, as a result, calls have been made for NHS England to extend CYP services to an older age.

Sufficient time should be given for young people with diabetes to familiarise themselves with the practicalities of the transition from paediatric to adult services because this improves clinic attendance. Opportunities to develop involvement in person-centred care include attending part of the clinic consultation alone from the age of 12 onwards to build confidence with asking and answering questions and making decisions (NICE, 2016b). The individual's emotional maturity, physical development and health should all be taken into account when considering the optimum time and process to transition to adult services.

Conclusion

Primary care teams have a vital role in considering a new diagnosis of type 1 diabetes in all sick children and in ensuring same day

Box 3. Useful resources

Useful resources for children and young people (CYP) with diabetes

- **Diabetes UK: Resources for CYP and their families and carers.**
 - www.diabetes.org.uk/Guide-to-diabetes/Kids
 - www.diabetes.org.uk/Guide-to-diabetes/Your-child-and-diabetes/Top-teen-tips/#talking
- **JDRF: Information packs and leaflets.**
 - www.jdrf.org.uk/living-with-type-1
- **Ready Steady Go transition programme: A programme to help CYP gain the knowledge and skills to manage their diabetes as they transition to adult services.**
 - <http://bit.ly/2nlVqw3>
- **Mindmate: Information on low mood, self-harm, anger, relationships and resilience.**
 - www.mindmate.org.uk
- **C-card: Free condoms for young people between the ages of 13–24 years.**
 - www.c-card.areyougettingit.com/Default.aspx

Useful resources for healthcare professionals

- **Goals of diabetes education: A structured educational programme for CYP with type 1 diabetes.**
 - <http://bit.ly/1UtFi4n> (Novo Nordisk, 2016)
- **HEADSSS: Psychosocial interview technique for adolescents.**
 - Goldenring and Cohen (1988)

specialist assessment for those with elevated point of care testing. Collaboration between primary care and specialist CYP's diabetes teams and ongoing integrative working is essential to optimise care. ■

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Alberti G, Zimmet P, Shaw J et al (2004) Type 2 diabetes in the young: the evolving epidemic. The international diabetes federation consensus workshop. *Diabetes Care* **27**: 1798–811

Ali K, Harnden A, Edge JA (2011) Type 1 diabetes in children. *BMJ* **342**: d294

Blakemore S, Choudhury S (2006) Development of the adolescent brain: implications for executive function and social cognition. *J Child Psychol Psychiatry* **47**: 3–4

Blanco M, Hernández MT, Strauss KW, Amaya M (2013) Prevalence and risk factors of lipohypertrophy in insulin-injecting patients with diabetes. *Diabetes Metab* **39**: 445–53

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- Care Quality Commission (2014) *From the Pond into the Sea. Children’s Transition to adult health services*. CQC, London. Available at: www.mefirst.org.uk (accessed 09.03.17)
- Craig M, Jefferies C, Dabelee D (2014) Definition, epidemiology and classification of diabetes in children and adolescents. *Pediatr Diabetes* **15**(Suppl 20): 4–17
- Danne T, Bangstad H-J, Deeb L et al (2014) Chapter 9: Insulin treatment. *Pediatr Diabetes* **15**(Suppl 20): 115–34
- DCCT Research Group (1994) 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* **125**: 177–88
- Forum for Injection Technique UK (2016) *The UK Injection and Infusion Technique Recommendations* (4th edition). FIT UK, London
- Gelder C (2013) Diabetes in children and young people: Optimising management throughout the care pathway. *Journal of Diabetes Nursing* **17**: 294–301
- Gelder C (2016) Group-based educational interventions in 11–16-year olds can be effective in supporting suboptimal diabetes control. *Evidenced Based Nursing* **19**: 120–1
- Gelder (2017) Caring for Children and young people with diabetes. In: Phillips A (eds). *Principles of Diabetes Care: evidence based management for health professionals* (2nd edition). Quay books, London, UK: 297–311
- Gov UK (2016) *Diabetes and driving*. Gov UK, London. Available at: <https://www.gov.uk/diabetes-driving> (accessed 09.03.17)
- Gleeson H, Turner G (2012) Best practice Adolescent focus: transition to adult services. *Arch Dis Child Educ Pract* **97**: 86–92
- Goldenring J and Cohen E (1988) Getting into adolescent heads. *Contemporary Pediatrics* **21**: 64–90
- Hofer S, Raile K, Frohlich-Reiterer E et al (2014) Tracking of metabolic control from childhood to young adulthood in type 1 diabetes. *J Paediatr* **165**: 956–61
- Lowes L, Gregory J, Lyne P (2005) Newly diagnosed childhood diabetes: a psychosocial transition for parents? *J Adv Nurs* **50**: 253–61
- Ly TT, Gallego PH, Davis EA, Jones TW (2009) Impaired awareness of hypoglycemia in a population-based sample of children and adolescents with type 1 diabetes. *Diabetes Care* **32**: 1802–6
- NICE (2008) *Continuous subcutaneous insulin infusion for the treatment of diabetes mellitus* (TA151). NICE, London. Available at: www.nice.org.uk/ta151 (accessed 26.04.17)
- NICE (2015) *Diabetes (type 1 and type 2) in children and young people: diagnosis and management* (NG18). NICE, London
- NICE (2016a) *Integrated sensor-augmented pump therapy systems for managing blood glucose levels in type 1 diabetes (the MiniMed Paradigm Veo system and the Vibe and G4 PLATINUM CGM system)* (DG21). NICE, London. Available at: www.nice.org.uk/dg21 (accessed 27.04.17)
- NICE (2016b) *Transition from children’s to adults services for young people using health or social care services* (NG43). NICE, London
- Pihoker C, Forsander G, Fantahun B (2014) ISPAD Clinical Practice Consensus Guidelines 2014 Compendium: The delivery of ambulatory diabetes care to children and adolescents with diabetes. *Pediatric Diabetes* **15**(Suppl 20): 86–101
- Porter JR, Barrett TG (2004) Acquired non-type 1 diabetes in childhood: subtypes, diagnosis, and management. *Arch Dis Child* **89**: 1138–44
- Price KJ, Knowles JA, Fox M et al (2016) Effectiveness of the Kids in Control of Food (KiCK-OFF) structured education course for 11-16 year olds with Type 1 diabetes. *Diabet Med* **33**:192–203
- RCPCH (2017) *National Paediatric Diabetes Audit Report 2015-2016*. Royal College of Paediatrics and Child Health, London
- Rizza RA, Mandarino LJ, Gerich JE (1982) Effects of growth hormone on insulin action in man. Mechanisms of insulin resistance, impaired suppression of glucose production, and impaired stimulation of glucose utilization. *Diabetes* **31**: 663–9
- Scott E, Hawthorne G (2017) Pre-conception care in diabetes. In: Phillips A (eds). *Principles of Diabetes Care: evidence based management for health professionals* (2nd edition). Quay books, London, UK: 287–97
- Sheehan A, While A, Coyne I (2014) The experiences and impact of transition from child to adult healthcare services for young people with type 1 diabetes: a systematic review. *Diabet Med* **32**: 440–58
- Smart C, Aslander-van Vliet E, Waldron S, Swift P (2011) Nutritional management. In: *Global IDF/ISPAD Guideline for Diabetes in Childhood and Adolescence*. International Diabetes Federation, Brussels, Belgium: 66–9
- Smart CE, Annan F, Bruno LP et al (2014) Nutritional management in children and adolescents with diabetes. *Pediatr Diabetes* **15**(Suppl 20): 135–53
- The Stationery Office (2014) *Children and Families Act 2014*. HMSO, London
- Vardar B, Kizilci S (2007) Incidence of lipohypertrophy in diabetic patients and a study of influencing factors. *Diabetes Res Clin Pract* **77**: 231–6
- Viner R, Barker M (2005) Young people’s health: the need for action. *BMJ* **330**: 901–3
- World Health Organization (2006) *Definition and diagnosis of diabetes mellitus and intermediate hyperglycaemia*. WHO, Geneva, Switzerland. Available at: http://www.who.int/diabetes/publications/diagnosis_diabetes2006/en/ (accessed 06.04.17)
- Zeitler P, Fu J, Tandon N et al (2014) Type 2 diabetes in the child and adolescent. *Paediatr Diabetes* **15**(Suppl 20): 26–46

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Online CPD activity

Visit www.diabetesonthenet.com/cpd to record your answers and gain a certificate of participation

Participants should read the preceding article before answering the multiple choice questions below. There is ONE correct answer to each question. After submitting your answers online, you will be immediately notified of your score. A pass mark of 70% is required to obtain a certificate of successful participation; however, it is possible to take the test a maximum of three times. A short explanation of the correct answer is provided. Before accessing your certificate, you will be given the opportunity to evaluate the activity and reflect on the module, stating how you will use what you have learnt in practice. The CPD centre keeps a record of your CPD activities and provides the option to add items to an action plan, which will help you to collate evidence for your annual appraisal.

- What **APPROXIMATE** proportion of children have diabetes?
Select **ONE** option only.
 - 1:250
 - 1:500
 - 1:1000
 - 1:2500
 - 1:5000
- According to a recent national audit, what **APPROXIMATE** percentage of CYP with diabetes have type 2 diabetes? Select **ONE** option only.
 - 2%
 - 5%
 - 10%
 - 15%
 - 20%
- A 6-year-old girl has developed secondary nocturnal enuresis, urinary frequency and abdominal discomfort over the past 3 days. Abdominal examination appears normal and her temperature is 37.9 °C. Urinalysis shows: wcc +++, nitrites +, protein +, blood trace, glucose –, ketones –. Which is the **SINGLE MOST** likely diagnosis?
Select **ONE** option only.
 - Appendicitis
 - Non-specific abdominal pain
 - Type 1 diabetes
 - Type 2 diabetes
 - Urinary tract infection
- Which of the following childhood conditions is **MOST LIKELY** to have an **INCREASED** risk of developing diabetes?
Select **ONE** option only.
 - Autistic spectrum disorder
 - Down's syndrome
 - Juvenile idiopathic arthritis
 - Muscular dystrophy
 - Sickle cell
- What is the random capillary blood glucose **THRESHOLD** level (mmol/L) **ABOVE** which a diagnosis of type 1 diabetes in CYP is confirmed in secondary care?
Select **ONE** option only.
 - 5.3
 - 5.8
 - 7
 - 7.8
 - 11.1
- An 11-year-old girl has become acutely unwell over the past few days. Her fasting glucose is 19 mmol/L and urinary ketones are strongly positive. Her BMI is 19 kg/m². She has a past medical history of asthma treated with salbutamol and inhaled corticosteroids. Which is the **SINGLE MOST** likely diagnosis?
Select **ONE** option only.
 - Maturity onset diabetes of the young (MODY)
 - Type 1 diabetes
 - Type 2 diabetes
 - Steroid-induced diabetes
- According to NICE (2015), what is the ideal HbA_{1c} threshold **TARGET** (mmol/mol) to minimise the risk of long-term complications for CYP with diabetes?
Select **ONE** option only.
 - 43
 - 48
 - 53
 - 58
 - 63
- A 14-year-old girl has type 1 diabetes. She weighs 50 kg. Although this will be managed by a specialist team, according to Danne et al (2014), what is the expected **MAXIMUM** daily dose of insulin (units) she may require during puberty?
Select **ONE** option only.
 - 25
 - 50
 - 100
 - 150
 - 200
- According to NICE (2015), what is the **MINIMUM** recommended frequency of blood glucose checking each day for a CYP with type 1 diabetes?
Select **ONE** option only.
 - 4
 - 5
 - 6
 - 7
 - 8
- A 9-year-old boy has recently been diagnosed with type 1 diabetes. He is otherwise well. Which is the **SINGLE MOST** appropriate screening investigation?
Select **ONE** option only.
 - IgA tissue transglutaminase (tTG)
 - Echocardiogram
 - Ferritin
 - Renal ultrasound
 - Vitamin B12