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ISPAD CLINICAL PRACTICE CONSENSUS GUIDELINES

ISPAD Clinical Practice Consensus Guidelines 2018: Diabetes education in children and adolescents

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1 | RECOMMENDATIONS/EXECUTIVE SUMMARY

Education is the key to successful management of diabetes [E].

To maximize the effectiveness of diabetes treatment and the advances in diabetes management and technology (especially insulin pumps and continuous glucose monitoring) it is advisable that quality assured structured education is available to all young people with diabetes and their carers [E].

The content and delivery of structured education needs regular review to ensure it suits the needs of people with diabetes in that community, matches local practice, and reflects changes in diabetes management and technology [E].

Evaluation of structured educational programs should include measurement of outcomes directly related to diabetes education such as the patient's achievement of self-selected diabetes-care goals, improved psychosocial adaptation and enhanced self-efficacy, in addition to measures of glycemic control [E].

There is evidence that educational interventions in childhood and adolescent diabetes have a beneficial effect on glycemic and psychosocial outcomes [A].

Educational interventions shown to be effective include those:

- based on clear theoretical psychoeducational principles [E]
- integrated into routine clinical care (eg, as an essential integral part of intensive insulin management) [A]
- referred to as an ongoing process of provision of individualized self-management and psychosocial support [E]
- involving the continuing responsibility of parents and other carers throughout adolescence [B]
- making use of cognitive behavioral techniques most often related to problem solving, goal setting, communication skills, motivational interviewing, family conflict resolution, coping skills, and stress management [A]
- utilizing new technologies in diabetes care as one of the vehicles for educational motivation [A]

Health care professionals require appropriate specialized training in the principles and practice of teaching and education to implement successfully behavioral approaches to education designed to empower young people and carers in promoting self-management [E].

An interdisciplinary education team sharing the same philosophy and goals and speaking "with one voice" has beneficial effects on metabolic and psychosocial outcomes [B].

It is important that goals and targets for blood glucose and HbA1c align with those of ISPAD. A major task during the first 2 weeks after diagnosis of diabetes is to get the family to agree to encompass the same targets. [E]

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Mobile and web-based applications can be useful tools for diabetes self-management education to improve diabetes management. [E]

Interactive web-based educational resources designed by diabetes-related device manufacturing companies are widely used for device-specific patient training and education. [E]

Telemedicine, if available, offers an alternative method to face-to-face diabetes review for people who live in remote areas and do not have access to professional counseling and diabetes education resources locally. [B]

Diabetes peers and/or diabetes youth leaders can reinforce the principles of living well with diabetes and support the families learning especially in the resource limited setting. [E]

2 | INTRODUCTION

To maintain intensive glycemic therapy, families perform a multitude of self-management tasks on a daily basis responding to changes in activity, food, and physiology. The challenge for diabetes health care professionals is to deliver diabetes education that optimizes the families' knowledge and understanding of the condition and its treatment and assists them to adjust to living with diabetes. This challenge is even greater in less developed countries where limited resources may threaten insulin and food security and the availability of the basic tools to manage diabetes such as blood glucose and ketone monitoring equipment. Diabetes education is a critical element of diabetes therapy regardless of the intensity of the regimen adopted. Diabetes management requires frequent and high levels of educational input at diagnosis and ongoing to support children and adolescents as well as parents and other care givers.[1,2] National pediatric guidelines emphasize the importance of education, and most of them include specific chapters on education and educational principles.[3–10] Diabetes education has been shown to be a very cost-effective intervention, through savings from reduced frequency of hospital admissions and emergency presentations.[11] And people who do not receive education or do not continue to have educational contacts are more likely to suffer diabetes-related complications.[3,6,12–14] This evidence informed guideline has been adapted and updated from the ISPAD 2014 Clinical Practice Consensus Guidelines.[15] Its purpose is to describe the agreed universal principles, content and organization of diabetes education in children and adolescents and to inform consensus recommendations. Other publications which provide useful guidelines on diabetes education include the "National Standards for diabetes self-management education (DSME)",[3] the "Position statement on structured education",[16] the "International Curriculum for Diabetes Health Professional Education",[17] the "Recommendations for age-appropriate education of children and adolescents with diabetes and their parents in the European Union",[18] the "Good practice recommendations on pediatric training programs for health care professionals in the EU[19] and "The pediatric diabetes toolbox for creating centers of references".[20]

3 | UNIVERSAL PRINCIPLES

Every young person should have access to comprehensive expert-structured education to help empower them and their families to take control of their diabetes.[3–9,21]

Children and adolescents, their primary care givers,[9,20,22] and other care providers should have easy access to and be included in the educational process. Also, care givers in nurseries or kindergarten and teachers in school should have access to an appropriate structured diabetes education.[20,23]

Due to increased mobility and migration, cultural and language differences might hinder communication and diabetes education. We recommend to provide diabetes education with professional translator services and to offer educational material in the family's native language where available.

Diabetes education should be delivered by an interdisciplinary team of health care professionals with a clear understanding of the special and changing needs of young people and their families as they grow through the different stages of life.[3,6,9,19–21,24] Diabetes education needs to be adaptable and personalized to each individual's age, stage of diabetes, maturity and lifestyle, culture, and learning pace.[3,5,6,9,18,21]

Educators (pediatric endocrinologist or physician trained in the care of children and adolescents with diabetes, diabetes educators, dieticians, psychologists, social workers, and other health care providers) should have access to continuing specialized training in current principles of insulin therapy, new diabetes technologies, advances in diabetes education and educational methods.[3,5,6,9,18–20,24]

Diabetes education needs to be a continuous process and be repeated for it to be effective.[3–9,16–20] The priorities for health care professionals in diabetes education may not match those of the child and family. Thus, diabetes education should be based on a thorough assessment of the person's attitudes, beliefs, learning style, ability, readiness to learn, existing knowledge, and goals.[21]

4 | WHAT IS DIABETES EDUCATION?

The following definition of diabetes education has been proposed:

"Diabetes education is an interactive process that facilitates and supports the individual and/or their families, those who provide care or significant social contacts to acquire and apply the knowledge, confidence, and practical, problem solving and coping skills, needed to manage their life with diabetes in order to achieve the best possible outcomes within their own unique circumstances".[25]

4.1 | The benefits of structured diabetes education

There are four key criteria that characterize a structured educational program[16,18]: The Program

1. has a structured, agreed, written, and evaluated curriculum
2. uses trained educators
3. is quality assured
4. is audited.

The evidence base for the effectiveness of structured education vs informal unstructured education in improving metabolic control[26–29] and preventing severe hypoglycemia and restoring awareness of hypoglycemia[30] comes mainly from studies involving adults with diabetes. The studies have been performed mainly in North America, Australia, and Europe and have been extensively reviewed in various publications.[20,26,31–37]

Effective educational programs are carefully planned, have specific aims and learning objectives, which are shared with people with diabetes, their families, and other care givers[3,5,6,18,20] and are integrated into routine care.

It has been recommended that:

Structured education should be available to all people with diabetes at the time of initial diagnosis, and revised soon after diagnosis and then annually or more frequently as determined by formal, regular individual assessment of need.[3–10,16–21]

4.2 | Who delivers diabetes education?

Diabetes education is delivered by all members of the diabetes multidisciplinary team who complement each other by working within their scope of practice as guided by their subspecialty. All are responsible for assessing the educational needs of the family at each episode of contact and arranging referral to the most appropriate diabetes health care professional to address the families identified learning needs. The team should have a sound understanding of the principles governing teaching and learning and need to understand that education alone focusing only on acquisition of knowledge is unlikely to alter behavior particularly in those individuals where diabetes appears to be overwhelmingly difficult. The diabetes team should demonstrate skills consistent with the principles of teaching and structured education and also incorporate behavioral change management including counseling techniques into their therapeutic practice.[3,38,39]

Tertiary level diabetes education and clinical management courses are available in some countries along with accreditation programs open to health care professionals wishing to achieve credentialing or certification. Certified or credentialed diabetes educators have demonstrated expertise in clinical practice, research, diabetes education, and counseling and frequently manage the coordination, delivery and evaluation of education programs within their health facility.[40–42]

Interdisciplinary teams providing education should include, as a minimum, a pediatric endocrinologist/diabetologist or a physician trained in the care of children and adolescents with diabetes, a diabetes specialist nurse/diabetes educator/pediatric nurse, and a dietician. Furthermore, a psychologist and a social worker are recognized as essential members in the interdisciplinary team.[18]

4.3 | What does research tell us about the effectiveness of diabetes education?

It is acknowledged that interpretation of educational research is a complex science[12,24] with interventions frequently combining education, psychosocial, and psychotherapeutic methods.[26] There are also ethical and methodological limitations of performing randomized controlled trials (RCTs) on initial diabetes education at onset. The outcomes most likely to be directly affected by diabetes education are knowledge and understanding, self-management behavior, and psychosocial adaption.[3,25] These psychosocial and behavioral outcomes are key mechanisms for glycemic control.[25] Systematic reviews of psychoeducational interventions conclude that such measures have small to medium beneficial effects on glycemic control[27,31–35] and a somewhat greater effect on psychological outcomes.[43,44] The effects are more pronounced for children than for adults.[43]

Education may be seen as an interface between clinical practice and research. Research into diabetes and educational methods is important in improving clinical practice[3–6,8,9] and this should be the responsibility of each nation/state and be a national priority.[8,9,17–19]

4.4 | What methods and philosophy underpin effective diabetes education?

Methods of delivering education at diagnosis and the use of educational resources will depend on local experience, facilities, and the respective national health care system.[18,20] It will be dominated initially by individual (family) teaching, but specific age appropriate curricula for children of different cognitive levels and adolescents as well as special curricula for parents are developed and evaluated in some countries.[18,20,36,37]

The educational program should utilize appropriate patient-centered, interactive teaching methods for all people involved in the management of diabetes, particularly the affected child or adolescent,[3–10,16–20] adapted to meet the different needs, personal choices, learning styles of young people with diabetes and parents, as well as local models of care. Health professionals should learn to incorporate and deliver the education using behavioral approaches that are learner centered and not didactic.[38,45,46] All team members should provide consistent advice and promote common goals in diabetes education.[24]

Education should be viewed as an important factor in empowerment for parents,[22,47] as well as children and adolescents. This empowerment approach should enable young people to use knowledge and practical skills in problem solving and self-care, and to be in control of goal setting for better care. In essence, the persons with diabetes need to experience that they have influence over their own lives in making informed decisions about their diabetes.[3–10,16–20,45,46] In addition, promoting empowerment principles, techniques for problem solving, goal setting, and self-efficacy improve efficacy of psychoeducation.[3,5,8–10,18,20,24,27,32,48]

Table 1 summarizes the philosophy of diabetes education in children, adolescents, and their parents.[3,20,36,37,49]

4.5 | Diabetes education settings

Due to the heterogeneity of health care systems and funding of diabetes care and education there is evidence supporting both inpatient and ambulatory approaches to diabetes stabilization at diagnosis.[37,47,50–53]

TABLE 1 Principles and practice of education in children, adolescents and their parents / primary care givers

1. Motivation	- The learner needs to and/or have a desire to learn
2. Context	- Where is the learner now? - Where does the learner want to be later?
3. Environment	- Learner-centered, comfortable, trusting - Enjoyable/entertaining/interesting/ "open"
4. Significance	- Meaningful, important, links or joins up - Reward or gain
5. Concepts	- Simple to complex in gentle steps (*short attention span*)
6. Activity	- Constantly interactive - Practical (*fitting into real life*) - Goal setting and problem solving
7. Reinforcement	- Repetition, review, summarize
8. Reassess, evaluate, audit	
9. Move forward (*continuing education*)	

Continuing education will take place most often in an ambulatory (outpatient, domiciliary, community) setting.[3–10,16–20,54] Where staffing levels, expertise and local circumstances do not permit this, educational programs may be carried out in the hospital environment, either by individual teaching or in groups and whenever possible in a protected environment conducive to learning.[50,54]

Group education may be more cost effective and the educational experience may be enhanced by peer group[28,29,54] or school friendships.[36] However, there is evidence that education directed at the specific needs of individuals is at least equally effective as group education.[55]

Diabetes residential and day camps organized by local and national diabetes organizations provide an additional opportunity for learning and revision of diabetes management skills in a safe and supported environment. The organization and aims of diabetes camps have been described in detail in the ISPAD Guideline for the delivery of ambulatory care.[56] Educational activities at camp are most effective if they are matched to gender and age and embody empowerment principles.[57] Benefits include the opportunity for youth to foster relationships and share experiences in a safe environment,[58] however, formal trials comparing specific educational interventions at camps have shown mixed results in relation to knowledge attainment, feelings of self-efficacy, goal-setting, and glycemic control.[59,60] The relatively small evidence base for the effectiveness of diabetes camps makes it difficult to interpret the impact of diabetes camping on clinical and psychosocial outcomes. Further rigorous research is required.

4.6 | Diabetes education and intensive treatment methods

Matching and adjusting insulin profiles to quantified food intake and exercise levels is an important part of any intensified diabetes management. More complex modern therapeutic regimens with multiple daily injections, use of different insulins and insulin analogs, continuous subcutaneous insulin infusion (CSII, insulin pumps), as well as wearing continuous glucose measurement devices require appropriate education and training. Higher levels of education and understanding are required for these interventions to be successful and require more time, skill, and greater resources from the educational team.[3,9,10,20,61–63] Changing from one form of insulin regimen to another as the only means of intervention does not improve metabolic control.[24,27,64] In contrast, by addressing the total management package utilizing comprehensive structured education, the likelihood of success is greater,[3–9,24,27,63,65] especially if the educators are highly skilled and motivated.[12]

4.7 | Diabetes education and digital technologies

Advancements in technology combined with wide spread adoption of digital devices by people with diabetes and their clinicians have created an opportunity to leverage digital platforms to augment diabetes care. The available newer technologies include smart phone/web-based applications,[35,66–70] computer games, text messaging for information,[71] and telephone reminders and support.[72,73] These technologies are most effective when they include interactive modes,[6,26,33,74] and utilize social media. Evidence from group discussions with young people suggests that education using these newer technologies is attractive for them, and there is further scientific data to support its widespread use.[70,74]

Technology-based diabetes teaching systems are interactive and aim to engage the user by age specific, animated, and entertaining applications. They are designed to serve different purposes such as tracking and monitoring blood glucose, activity/exercise, healthy eating, medication adherence, monitoring for complications, annual screenings, and problem-solving. Calorie/carbohydrate counting smart phone applications help people to tackle the abstract concept of carbohydrate content in food. Smart phone applications have provided a comprehensive food database and easier access to nutrient data on less common foods including those found in restaurant chains.

Digital diabetes tools have been designed for coaching people with diabetes by personalized diabetes education.[75] Users define long-term goals, such as losing weight, decreasing blood glucose levels, and receive daily messages to attain specific goals and to reiterate essential concepts of diabetes education. The feedback loop sustained by two-way communication, where both sender and receiver are engaged, facilitated by way of technology offers the greatest favorable impact on glycemic control.[76]

Digital-tools may have their greatest role during four crucial times for diabetes self-management education; at diagnosis, during an annual assessment by a health care provider, when complicating factors arise, and during transitions in care (from childhood to adolescence and from adolescence to adult care).

The benefit of using technology-based diabetes education on improving patient confidence, self-management, quality of life, and glycemic control outcomes have been shown by small-scale studies for pediatric and adult patients with diabetes.[35,66–69,77–79]

Telemedicine has been particularly helpful for people with diabetes who live in remote areas and do not have access to professional counseling and diabetes education resources.[80] The communication and exchange of medical information are made possible through videoconferencing during a telemedicine session. Clinicians provide real-time problem-oriented education for patients with diabetes by using telemedicine to facilitate better decisions by patients and health care providers. Telemedicine has been successfully integrated into diabetes management by some of the diabetes centers of excellence to extend the reach of diabetes education and support when access to care is limited.[81]

There are some possible limitations to using high-tech diabetes tools for education purposes that are being addressed with the

TABLE 2 Topics to be educated on at diagnosis and ongoing

At diagnosis	Continuing curriculum
Simple explanation of how the diagnosis has been made, the cause of symptoms and need for lifelong insulin replacement. Reassure that with insulin replacement the child will regain health and energy quickly	Pathopysiology, epidemiology, classification, and metabolism
Explore feelings of guilt or blame and discuss the uncertain cause of diabetes	Explore child/adolescents understanding as they mature
Normalize grief and loss reaction to the diagnosis	Address psychological health and diabetes burnout
Discuss risk for siblings and interventions available to minimize risk	Revise as needed
Simple explanation of glucose and the relationship between food, blood glucose, and insulin	Explain other sources of glucose, that is, liver glucose
Simple explanation that insulin lowers blood glucose, rapid insulin lowers it quickly and long-acting insulin lowers it slowly	Insulin action and profile Adjustment of insulin Pump-extended bolus functions Introduction to diabetes technology (if applicable)
Discuss the role and responsibility of family in the delivery and supervision of self-management tasks and expectation for frequency of follow-up	Review who is doing what at each visit and encourage active parental involvement. Explore barriers to clinic attendance if missed appointments
Establish clear and consistent treatment targets and goals	Revise frequently Goal-setting focus on goals that are SMART: Specific, measurable, achievable, realistic, and time-based Micro- and macro-vascular complications, screening protocol, and prevention
Focus on basic "survival" skills needed to manage the diabetes from day one. Accomplishment of these skills will increase the carers/child's confidence in their ability to manage Assess competence in • SBGM and/or CGM, ketone monitoring • Insulin devices: injection, pen, or pump • Insulin injection sites/techniques • Diabetes diary: what to record and how often • Insulin bolus calculator • Carbohydrate counting tools • Insulin storage	Revise these skills • As new devices or technologies introduced • As child/adolescent takes on self-management tasks • If diabetes needs stabilization • In response to episodes of DKA or severe hypoglycemia • On diabetes camps • When new carers are introduced to the family • When child/adolescent is planning school camp/excursion • During transition to adult services • Whenever there are admissions other than due to diabetes and recurrent DKA
Basic dietetic advice including carbohydrate counting, importance of healthy eating, and meal-time routines Promotion of healthy body weight Clarification of myths about food and diabetes, as well beliefs of cure at honey moon phase	Explain effects on blood glucose levels of different food components including proteins, fats, fiber, and glycemic index; and discuss insulin therapy management strategies to optimize postprandial blood glucose levels Revise nutritional skills as the child grows and develops Adapt nutritional interventions in response to new diagnoses, for example, coeliac disease Screen for disordered eating
Explanation of hypoglycemia (symptoms, prevention, management), identity cards, necklets, bracelets, and other equipment Explanation of hyperglycemia and diabetes ketoacidosis (symptoms, prevention, management)	Revise with introduction of new activities and new carers Practice reconstitution of glucagon Risk factors: hypoglycemia unawareness, young age Precautions with alcohol, precautions, recognizing and treating hypoglycemia when driving
Diabetes during illnesses. Advice not to omit insulin and to call the diabetes team for advice	Effects of intercurrent illness, hyperglycemia, ketosis, and prevention and identification of DKA Diet and fluids of sick days Sick day management plan Management of hypoglycemia with minidose glucagon
Integration of diabetes self-management tasks into family life, social activities, sporting activities, and school	Problem-solving and adjustments to treatment in everyday life, motivation, and coping with unexpected glucose fluctuations Review and revise school management plan annually Exercise, holiday planning and travel, including educational holidays and camps
Address questions about impact on future aspirations for child, that is, career, having children	Sexuality, pregnancy planning, contraception, employment
Membership of a diabetes association and other available support services	Explore opportunities for peer support and family support
Details of emergency telephone contacts and follow-up arrangements	Update as required

TABLE 3 Concerns, challenges, and opportunities common to infants and toddlers/school age children/and adolescents with diabetes

Infants and toddlers	Total dependence on parents and care providers for injections/management of pumps, food and monitoring, and the requirement of a trusting attachment between infant and caregivers[91]
	Mothers may feel increased stress, diminished bonding and depressive feelings[85,92–94]
	Unpredictable erratic eating and activity levels
	Difficulties in distinguishing normal infant behavior from diabetes-related mood swings, for example, due to hypoglycemia[85,92–94]
	Injections, catheter insertion and BG checks seen as pain inflicted by caregivers
	Hypoglycemia is difficult for the child to communicate (see chapter on hypoglycemia) long-standing hyperglycemia may be even more harmful education on prevention, recognition, risk, and management is therefore a priority[95,96]
	Care in nursery and kindergarten
School age children	Adjusting to the change from home to school, developing self-esteem, and peer relationships[23,74]
	Increasing understanding and learning to help with injections, pump use, and monitoring
	Advising parents on the gradual development of the child's independence with progressive stepwise hand-over of appropriate responsibilities[21,91]
	Adapting diabetes to school programs, school meals, exercise and sport and negotiating supervision of diabetes management tasks
	Progressive recognition and awareness of hypoglycemic symptoms
Adolescents	Accepting the critical role of continued parental involvement and yet promoting independent, responsible self-management appropriate to the level of maturity and understanding[88,90]
	Understanding that knowledge about diabetes in adolescence is predictive of better self-care and (metabolic) control but the association is modest
	Emotional and peer group conflicts
	Body image issues and weight gain and risk for disordered eating[97,98]
	Need for problem solving strategies for dealing with dietary indiscretions, illness, hypoglycemia, blood glucose fluctuation due to puberty, sports, smoking, alcohol, drugs, reproductive and sexual health, and family planning
	Negotiating targets, goals and priorities and ensuring that the tasks taken on by the adolescent are understood, accepted, and achievable[99]
	Omission of insulin is not uncommon. There should be non-judgmental discussion about this and education on impact of missed doses
	Developing strategies to manage transition to adult services[100]
	Supportive technological tools to augment diabetes management (if applicable)

collaboration of technology experts, scientists, clinicians, and people with diabetes. Clinicians should warn their patients regarding the potential inaccuracies, potential breach of confidentiality, and the risk of being overwhelmed by web-based information and guide their patients to websites and mobile applications that are trustworthy.

4.8 | Diabetes education at diagnosis

At diagnosis families are educationally unreceptive due to the emotional stress of the diagnosis. For this reason, the education program should be tailored to meet the pace dictated by the family's readiness to learn; focus on the acquisition of the practical "survival skills" required to manage the diabetes at home; and address the immediate concerns expressed by the family. Time should be given for the skills to be practiced and basic concepts should be revised within 4 weeks of diagnosis.

The family should be given a structured plan for education so that they can arrange dedicated time for the education. At diagnosis, concepts are new and the child or adolescent will need consistent messages and support from all primary care givers. To ensure this occurs all primary care givers should be encouraged to attend the education.

Initial learning should be reinforced by written guidelines and curricula. It should be accompanied by quality assured education materials (books, booklets, leaflets, DVDs, websites, social medias, smart phone/tablet applications, games, and others) appropriate to the child's and adolescents age and maturity.[18,20] Educational (electronic or printed format) materials should use appropriate language and a style that is easily comprehensible (it is suggested that this should be at the level of a popular local or "tabloid" newspaper). For parents with limited literacy and/or poor numeracy special material focusing on diagrams, drawings, video clips, and other visual media are recommended.[82,83] All material should follow common therapeutic goals and a shared holistic approach.

Table 2 has suggestions for the basic initial content of diabetes education at diagnosis and the extension of this content to be delivered and revised at regular intervals over the course of the families contact with diabetes services. These topics provide a comprehensive basis for successful therapy and positive emotional coping for young patients and their families. They should be adapted to ensure the diabetes education is appropriate to each individual's age, maturity, learning needs, and local circumstances. Refer to the ISPAD Guidelines on Nutritional Management in children and adolescents with diabetes[84] for more detailed explanation of the content and methods of delivering nutritional education.

5 | AGE-SPECIFIC CHALLENGES AND OPPORTUNITIES

The features of normal development common to various ages and stages present unique challenges to diabetes management. For this

reason, specific curricula and appropriate education materials and tools are recommended for children and adolescents of different age groups (3-5; 5-6, 7-9, 9-12, 13-18 years, and for young adults as part of a structured transition process) as well as for parents and other primary care givers. Although there is conflicting evidence on influencing behavioral characteristics of preschool children with diabetes through education[85,86] school age children have expressed dissatisfaction that health professionals talk to parents and not to them and there is some evidence that focused age appropriate educational interventions are effective in children and families.[31–34,44,48,87–90] Table 3 identifies concerns, challenges, and learning opportunities common to the three major developmental stages. The ISPAD guidelines chapters on caring for toddlers and preschool children and the chapter on adolescents with diabetes, provide more detailed information.[101,102]

6 | CONCLUSION

In conclusion, age-appropriate, quality-assured structured diabetes education needs to be available to all young people with diabetes and their carers to maximize the effectiveness of their diabetes treatment, including the use of new diabetes technologies as they become available.

CONFLICTS OF INTEREST

K.L. has received lecture honoraria from Abbott, Bayer Vital, Lifescan, Lilly Deutschland, Menarini, Merck Serono, NovoNordisk, Roche diagnostics and Sanofi. Furthermore she received research support from Menarini, Novo Nordisk and Roche. E.C. has been a scientific advisory board member for Novo Nordisk, Adocia, MannKind, Lexicon, Arecor and a speaker for Novo Nordisk. H.P., S.E.H. and E.M. have declared no conflict.

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