



Teachers' Perspectives on Children With Type 1 Diabetes in German Kindergartens and Schools

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The number of children with type 1 diabetes is rising, and these children must manage their diabetes during the day while in kindergarten or school. A total of 678 German kindergarten and school teachers (89% female) attended a structured training program for supporting children with type 1 diabetes in their diabetes management. The teachers completed questionnaires on their overall self-perception of their ability to handle diabetes and institutional factors supporting children with type 1 diabetes. Of these teachers, 251 who were currently working with a child with type 1 diabetes provided further insight into the experiences of children with diabetes in school and kindergarten. Teachers reported deficits in three areas: knowledge about diabetes and diabetes management, institutional support, and communication with parents and health professionals. On average, they gave themselves only fair ratings on both their knowledge about diabetes (3.60 ± 1.10 on a 5-point scale) and their ability to assist children with their diabetes management (3.67 ± 1.09). Whereas general information about supporting children with type 1 diabetes seemed to have been provided by almost half of the institutions (43%), specific school policies for sports (30%), extracurricular activities such as field trips (20%), or activities including sleepovers (16%) were rare. Poor communication between teachers, parents, and health professionals was reported. These deficits indicated by kindergarten and school teachers underline the importance of structured trainings and written policies on type 1 diabetes to improve the status of children with type 1 diabetes in school and kindergarten.

Type 1 diabetes is one of the most common chronic health conditions in children. In Germany, the prevalence of type 1 diabetes in children aged 0–14 years is 0.14%, and predictions expect an increase in the prevalence rate up to 0.27% by 2026 (1). This trend seems to apply especially to children <5 years of age (2).

Worldwide, many countries have clear legal guidelines for supporting chronically ill children in the education system, and especially those with diabetes (3). In Germany, there are anti-discrimination laws, but many federal states lack explicit legal guidelines on how to support children with type 1 diabetes in kindergarten and school. Hereby, “kindergarten” refers to the German preschool educational institution, including children 3–5 years of age. Rhineland-Palatinate is one state that provides a clear legal framework to guide the integration of children with type 1 diabetes in kindergarten and school (4).

Children with type 1 diabetes in kindergarten and school need to manage their diabetes throughout the day. This

means checking their blood glucose levels multiple times each day, potentially administering insulin in the case of a high glucose reading, and eating a snack when the glucose level is low (5). Young children in particular depend on their teachers' support (6,7).

Diabetes management for children in kindergarten and school and the growing effort to facilitate integration of chronically ill children in these institutions are challenging for the teachers who need to be able to support these children. Recent reviews, however, have found a substantial lack of knowledge in teachers regarding the adequate management of diabetes in school settings (8–10). Teachers themselves have expressed their need to know more about diabetes and to receive training in supporting children's diabetes management (11–13). Yet, in Germany, there is no implemented training of teachers in caring for children with type 1 diabetes (14,15). In line with teachers' self-evaluation, parents and children also want teachers to be more knowledgeable about diabetes (3,16–18).

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Teacher knowledge seems to be an important prerequisite for practically supporting children in kindergarten and school. Providing teachers with adequate knowledge about diabetes and its consequences was found to correspond to increased teacher competence in supporting children in their diabetes management (15). Yet, teachers' perceptions of supporting children with type 1 diabetes in kindergarten or school have been investigated only in an Egyptian study (19). These teachers indicated having little knowledge about diabetes, felt insecure about diabetes management, and reported not having received any kind of training, but further studies are needed. Meanwhile, children with type 1 diabetes and their parents say they want help from teachers with diabetes management tasks such as assessing low blood glucose levels (20,21).

Both the German Diabetes Society (22) and the American Diabetes Association (23) have highly recommended comprehensive information and training for kindergarten and school personnel, as well as the implementation of related school policies. These school policies should cover appropriate response to and management of hypoglycemia and hyperglycemia, enabling and supporting diabetes management in kindergarten and school, allowing for children to participate in physical activities, and the establishment of emergency plans (5).

In Germany, diabetologists are strongly advised to provide institutions with such individualized plans (5). One way to enable teachers to ably assist children in kindergarten and school is to provide them with written instructions on what to do when hypoglycemic episodes occur (6) and how to help integrate children with type 1 diabetes in educational settings (24,25). Another way could be to employ school nurses. However, in Germany, this option is rare (3). Additionally, regular contact between teachers and parents might further enhance teachers' knowledge (6,10,26–29). However, 18% of Swedish parents of children with type 1 diabetes reported having no contact at all with school staff (18), thus hindering communication and, subsequently, adequate support. The extent of parent-teacher or teacher-physician communication in Germany is unknown, even though it appears to be highly relevant for children with type 1 diabetes.

In summary, a lack of adequate training and appropriate information for teachers and unsatisfactory communication between teachers and parents were found to be the main barriers to adequate support of children with type 1 diabetes in kindergarten and school (27). Although schools could provide valuable resources in supporting children with type 1 diabetes, this seems to be a neglected area of research.

To date, there are no available data on the status of children with type 1 diabetes in Germany from the teachers' perspective. Thus, the aim of this study was to provide insight on teachers' perspectives of children's experiences with their diabetes in German kindergartens and schools. After the summary of study results, possible ways to improve children's experiences in kindergarten and school are addressed.

Research Design and Methods

Between 2015 and 2017, 41 structured 1-day trainings for teachers took place in the federal state of Rhineland-Palatinate in Germany to facilitate support of children with type 1 diabetes at school. Teachers could apply to these seminars regardless of whether they had a child with type 1 diabetes in their group or class.

In total, 678 teachers participated in the seminars (mean age 41.13 ± 10.6 years, range 19–63 years). Most of the teachers (534, or 78.7%) were female, 68 (10.0%) were male, and sex was not specified for 76 (11.2%). The majority of the teachers worked in kindergartens ($n = 265$, 39.1%) and primary schools ($n = 205$, 30.2%), and 14.6% ($n = 99$) were secondary school teachers. A substantial percentage of participants did not report their affiliation (16.1%, $n = 109$). Teachers reported an average work experience of 14 ± 10.62 years (range 0–43 years).

Of the participating teachers, 56% had never worked with a child with type 1 diabetes before. Of the teachers who had worked with at least one child with type 1 diabetes, on average, they had worked for 1 year with such a child (SD 2.35 years, range 0–22 years). The average number of children with type 1 diabetes that teachers had worked with was 0.85 ± 1.41 (range 0–15). Four teachers who were employees of a specialized boarding school and had worked with up to 100 children with type 1 diabetes were excluded from the analyses.

To assess current support for children with type 1 diabetes in kindergartens and schools, teachers were asked to complete questionnaires before the seminars (Table 1). The questionnaires covered their general self-perceived competence in the context of diabetes, specific skills in diabetes management, institutional support, and information about the child or children with type 1 diabetes in the teachers' classes. These questionnaires were developed after a literature review and then discussed with medical professionals with diabetes expertise. Responses were given either on a dichotomous scale (yes/no), on a 5-point Likert scale (response format depended on the items, either ranging from 1 [agree completely] to 5 [do not agree at all] or, like German school grades, from 1 [very

TABLE 1 Questionnaire

Below you will find some questions about you and the child's type 1 diabetes.

	Very good	Good	Satisfactory	Fair	Poor
1. How would you rate your knowledge about diabetes?	1	2	3	4	5
2. How would you rate your ability to handle diabetes?	1	2	3	4	5
3. How would you rate your knowledge about the biological basis of diabetes?	1	2	3	4	5
4. How would you rate your ability to recognize symptoms of low blood glucose levels?	1	2	3	4	5
	Agree completely			Do not agree at all	
5. I know whom to call when I have questions.	1	2	3	4	5
6. I feel safe handling diabetes.	1	2	3	4	5
7. I feel safe calculating the right amount of insulin.	1	2	3	4	5
8. I feel safe supporting the child administering his/her insulin.	1	2	3	4	5
9. I always carry some juice or snacks with me in case of low blood glucose levels.	1	2	3	4	5
10. I feel confident having a child with type 1 diabetes in my group during field trips.	1	2	3	4	5
11. I took a child with diabetes on field trips during the last 6 months.	<input type="checkbox"/> Yes			<input type="checkbox"/> No	
12. I feel confident having a child with type 1 diabetes in my group during activities, including a sleepover.	1	2	3	4	5
13. I communicate with parents to meet medical needs.	1	2	3	4	5
14. I communicate with physicians for problems.	<input type="checkbox"/> Yes			<input type="checkbox"/> No	
15. How would you rate your experience working with children with type 1 diabetes?	<input type="checkbox"/> Very good <input type="checkbox"/> Good <input type="checkbox"/> Satisfactory <input type="checkbox"/> Bad <input type="checkbox"/> Very bad				

Below you will find some questions about the institution you work in.

1. Are there written instructions to deal with diabetes?	<input type="checkbox"/> Yes	<input type="checkbox"/> No
2. Are there specific policies for physical education activities?	<input type="checkbox"/> Yes	<input type="checkbox"/> No
3. Are there specific policies for field trips?	<input type="checkbox"/> Yes	<input type="checkbox"/> No
4. Are there specific policies for activities with sleepovers?	<input type="checkbox"/> Yes	<input type="checkbox"/> No
5. Is there glucose or juice available in class, gym, and school office?	<input type="checkbox"/> Yes	<input type="checkbox"/> No
6. Are physical education teachers able to recognize a hypoglycemic episode?	<input type="checkbox"/> Yes	<input type="checkbox"/> No
7. Do you think that more information about type 1 diabetes would improve children's integration at school?	<input type="checkbox"/> Yes	<input type="checkbox"/> No
8. Should the other teachers receive this information?	<input type="checkbox"/> Yes	<input type="checkbox"/> No
9. Should the other children in class receive this information?	<input type="checkbox"/> Yes	<input type="checkbox"/> No
10. If the child could not do an exam, was there another opportunity for him/her to do it?	<input type="checkbox"/> Yes	<input type="checkbox"/> No

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TABLE 1 Questionnaire

Below you will find some questions about the child with diabetes you care for.

1. Does the child require glucose monitoring at school?	<input type="checkbox"/> Yes	<input type="checkbox"/> No
2. Does the child calculate his/her amount of insulin?	<input type="checkbox"/> Yes	<input type="checkbox"/> No
3. Does the child need insulin administration at school?	<input type="checkbox"/> Yes	<input type="checkbox"/> No
4. If it is needed, who helps the child perform glucose monitoring?	<input type="checkbox"/> Child performs this him- or herself	
	<input type="checkbox"/> Teacher	
	<input type="checkbox"/> Other: _____	
5. If it is needed, who helps the child calculate his/her amount of insulin?	<input type="checkbox"/> Child calculates this him- or herself	
	<input type="checkbox"/> Teacher	
	<input type="checkbox"/> Other: _____	
6. If it is needed, who helps the child administer his/her insulin?	<input type="checkbox"/> Child administers insulin him- or herself	
	<input type="checkbox"/> Teacher	
	<input type="checkbox"/> Other: _____	
7. Has the child ever experienced a hypoglycemic episode before or during an exam?	<input type="checkbox"/> Yes	<input type="checkbox"/> No

good] to 5 [poor]). Some items about the child’s diabetes management were multiple-choice questions.

For the rating of self-perceived competence in the context of diabetes, the responses of all participants were considered. If several teachers of one child took part, the answers of only one teacher were included, resulting in a reduced sample of 251 teachers. This was the case with the items related to children’s diabetes management (Table 2) and institutional support (Table 3).

Significance of mean differences was analyzed using *t* tests, and effect sizes were computed using Cohen’s *d* (30). An effect size of 0.2 is considered a small effect, 0.5 a medium effect, and 0.8 a strong effect (30). Significance levels were set at $P < 0.05$.

Results

Overall Self-Perception of Competence in the Context of Diabetes

Teachers who had a child with type 1 diabetes in their class reported knowing significantly more about diabetes, its underlying biological mechanisms, and diabetes management compared with teachers with no child with type 1 diabetes in their class. Compared with those without a child in their class, teachers with a child with type 1 diabetes felt significantly more able to recognize symptoms of low blood glucose. Table 4 presents teachers’ self-rated competence in different aspects of diabetes and diabetes management.

Specific Skills Supporting Children With Diabetes

Teachers indicated that, when dealing with diabetes, they felt insecure when performing concrete steps in diabetes management. These included helping the child calculate the necessary dose of insulin (mean score 4.17 ± 1.18) and administering insulin (mean score 3.68 ± 1.32). Results on including children with type 1 diabetes in school activities are reported in Table 5.

We then examined teacher-parent-physician communication. Teachers somewhat agreed on knowing whom to call when questions arose (mean score 2.44 ± 1.24). To meet medical needs, teachers reported sometimes communicating with parents (mean score 2.98 ± 1.46). One in four teachers (26.4% of the 545 teachers who replied to this question) reported communicating with physicians in the event of problems.

Caring for Children With Type 1 Diabetes

Teachers’ ratings about children’s diabetes management and experiences at school are presented in Table 2. Teachers indicated that a majority of children with type 1 diabetes in their class required diabetes management in school (e.g., monitoring their glucose levels and administering insulin). If help was needed and a child was not able to handle this diabetes management, teachers reported being the first contact person to support children with their diabetes management. Overall, teachers rated the integration of children with type 1 diabetes between very good and good (mean score 1.64 ± 0.71).

TABLE 2 Teachers' Ratings About the Child's Diabetes Management and Experiences at School

Item	Response (%)
Does the child require glucose monitoring at school?	
Yes	77.39
No	22.61
Does the child calculate his/her amount of insulin?	
Yes	34.75
No	65.25
Does the child need insulin administration at school?	
Yes	55.37
No	44.63
If it is needed, who helps the child perform glucose monitoring?	
Child performs this him- or herself	50.00
Teacher	38.50
Other*	11.50
If it is needed, who helps the child calculate his/her amount of insulin?	
Child calculates this him- or herself	28.20
Teacher	37.20
Other*	34.60
If it is needed, who helps the child administer his/her insulin?	
Child administers insulin him- or herself	38.90
Teacher	33.60
Other*	27.50
Has the child ever experienced a hypoglycemic episode before or during an exam?	
Yes	14.20
No	85.80

*Refers to parent, nurse, social or health services provider, or technical support (e.g., for an insulin pump).

Institutional Support

Table 3 shows teachers' responses regarding institutional support for children with type 1 diabetes. They reported that, in a majority of institutions, written instructions or guidelines on how to deal with diabetes are lacking. Teachers stated that specific policies on supporting children with type 1 diabetes during activities such as field trips (20.1%) or activities with sleepovers (15.8%) did exist in a minority of institutions. Most of the teachers assessed (91%) stated that their colleagues need further information about diabetes, and 78% of the teachers indicated that more information about type 1 diabetes would improve children's integration at school.

Discussion

The aim of this study was to gain insight into teachers' perceptions of children's experiences with diabetes in

German kindergartens and schools. Teachers caring for a child with type 1 diabetes felt more confident in their diabetes management skills than those who did not have a child with diabetes in their class. Nevertheless, the majority of the teachers reported that they were not very confident caring for a child with type 1 diabetes. Teachers' main concern and a source of great uncertainty was not knowing what to do in emergencies. This lack of knowledge about how to handle diabetes-specific emergencies such as episodes of low or high blood glucose is in line with previous studies (11,14,31,32).

On average, teachers rated their experiences in working with children with type 1 diabetes as not satisfactory. They seem to need practical support and clear guidance when it comes to supporting children with type 1 diabetes in managing their disease.

Examining the perspectives of teachers currently working with a child with type 1 diabetes leads to interesting insights. For example, about one in three teachers reported helping the child calculate the correct amount of insulin. This finding seems to be consistent with other research showing greater teacher involvement with young children (6,7). However, teachers in our study reported not feeling competent to calculate the right amount of insulin. A previous literature review found that similar insecurity led to parents or health care or social services providers being called to administer insulin to children at school (33).

Teachers further indicated that they knew whom to call when questions about diabetes arose, but they rarely took advantage of this access to information. In this study, just 20% of the teachers completely agreed when asked if they communicate with parents about medical needs, compared with 80% of teachers in an Ohio study who reported communicating often or very often with parents (24). Only a minority (26%) of teachers in this study reported communicating with physicians. This is in line with the results from Schwartz et al. (24), who reported that one-fourth of teachers communicated often or very often with physicians.

The low percentage of teachers communicating with parents and physicians in this study might be explained by either physicians or parents having already provided sufficient information, reducing the need for further inquiries. Also, schools might perceive no need to communicate with parents and physicians about a child's special needs in school. Improved communication regarding the amount of information shared, child-specific care, emergency plans, and regular exchanges among all

TABLE 3 Teachers' Responses Regarding Institutional Support for Children With Type 1 Diabetes

Item	Response (%)	
	Yes	No
Are there written instructions to deal with diabetes?	40.3	59.7
Are there specific policies for physical education activities?	30.3	69.7
Are there specific policies for field trips?	20.1	79.9
Are there specific policies for activities with sleepovers?	15.8	84.2
Is there glucose or juice available in class, gym, and school office?	57.9	32.1
Are physical education teachers able to recognize a hypoglycemic episode?	53.2	46.8
Do you think that more information about type 1 diabetes would improve children's integration at school?	79.1	20.9
For the other teachers	91.4	8.6
For the other children in class	31.2	68.8
If the child could not do an exam, was there another opportunity for him/her to do it?	93.3	6.7

parties (teachers, parents, and physicians) was one of the recommendations from a recent review on adolescents' experiences of support with their diabetes management at school (10) and has been linked to better A1C scores (34).

Specific information or school policies regarding supporting children with type 1 diabetes in general seem to be more common in German schools (40%), as indicated in the teachers' reports, than in, for example, Italy, where only 17% of teachers reported that their school had specific precautions to support children with diabetes (25). However, based on this finding in our study, the majority of German

kindergartens and schools still do not provide information for their staff on how to support children with type 1 diabetes.

Furthermore, an alarming majority of German institutions seem to lack specific policies for their employees on how to support children with type 1 diabetes in specific situations such as extracurricular activities. According to 70% of teachers in our study, there are no specific policies for physical education activities. In the United States, similar results were found in the Ohio area, where 80% of teachers reported no existing policies (24).

In Spain, 81% of teachers surveyed thought information could improve children's integration at school (16). This is similar to our study, in which 78% of teachers thought that supplying colleagues and classmates with information would be beneficial. Given that a large majority of German teachers pointed out the lack of policies with regard to field trips (80%) or activities that include sleepovers (84%), existing policies seem to be insufficient and should be improved in collaborations between schools and diabetes experts.

Strengths and Limitations

The strength of this study was its systematic and structured approach to capturing the status of children with type 1 diabetes from their teachers' perspectives. This study not only described the current situation but also aimed to provide guidance on how to make improvements and support teachers, and therefore children with type 1 diabetes, in kindergartens and schools.

However, there were limitations that might hinder generalization of our results. First, we cannot rule out an effect of selection bias. Both taking part in the training and taking part in the survey were voluntary; thus, highly motivated teachers might have been oversampled in this study, and lower motivation in others might have led to

TABLE 4 Means, SDs, Mean Differences (*t*), and Effect Sizes (Cohen's *d*) of Self-Perceived Competence Regarding Diabetes of Teachers With and Without Children With Type 1 Diabetes in Their Care

Question	All	With Child	Without Child	<i>t</i>	<i>d</i>
	Mean (SD)	Mean (SD)	Mean (SD)		
How would you rate your . . .					
Knowledge about diabetes?	3.60 (1.10)	3.52 (1.08)	3.80 (1.11)	2.96*	0.26
Ability to handle diabetes?	3.67 (1.09)	3.60 (1.07)	3.89 (1.08)	2.714*	0.24
Knowledge about the biological basis of diabetes?	3.52 (1.12)	3.46 (1.09)	3.67 (1.20)	2.148*	0.19
Ability to recognize symptoms of low blood glucose levels?	3.57 (1.09)	3.52 (1.09)	3.70 (1.09)	1.831**	0.17

Questions were rated using German school grades: 1 (very good) to 5 (poor). **P* < 0.01. ***P* < 0.05.

TABLE 5 Means, SDs, and Levels of Agreement (%) of Teachers Caring for a Child With Type 1 Diabetes Regarding Dealing With Diabetes ($n = 545$)

Item	Mean	SD	%
I know whom to call when I have questions.	2.44	1.24	
I feel safe handling diabetes.	3.69	1.04	
I feel safe calculating the right amount of insulin.	4.17	1.18	
I feel safe supporting the child administering his/her insulin.	3.68	1.32	
I always carry some juice or snacks with me in case of low blood glucose levels.	2.65	1.67	
I feel confident having a child with type 1 diabetes in my group during field trips.	3.10	1.46	
I took a child with diabetes on field trips during the last 6 months.			
Yes ($n = 132$)			19.1
No ($n = 489$)			71.0
No answer ($n = 68$)			9.9
I feel confident having a child with type 1 diabetes in my group during activities including a sleepover.	3.65	1.39	
I communicate with parents to meet medical needs.	2.98	1.46	
I communicate with physicians for problems.			
Yes ($n = 144$)			20.9
No ($n = 401$)			58.2
No answer ($n = 144$)			20.9
How would you rate your experience working with children with type 1 diabetes?	3.53	0.96	

All rated items were completed on a scale of 1 (agree completely) to 5 (do not agree at all) with the exception of the last item (experience working with children), which was rated on a scale of 1 (very good) to 5 (very bad).

low response rates on some questions. Also, because of the voluntary nature of this training, institution-specific attendance rates could not be calculated. Second, our sample consisted of mainly kindergarten and primary school teachers (84.5%); thus, secondary school teachers were not as well represented. Third, the trainings took place in the federal state of Rhineland-Palatinate. In Germany, it is the federal state's responsibility to oversee education; hence, our ability to draw conclusions about the experience of German children with type 1 diabetes in general were limited. Fourth, assessment of teachers did not cover factors such as teachers' employment status or education level. On the child level, we did not assess information regarding the ages of the children with diabetes or the kind of diabetes treatment they received from teachers.

Implications and Conclusion

In summary, teachers reported a lack of information about diabetes, inadequate training, and poor communication among teachers, parents, and physicians. In the context of

increasing prevalence rates of type 1 diabetes and to improve the status of children with this disease in schools and kindergartens, several implications can be drawn from this research.

First, structured trainings for teachers should be emphasized. These trainings provide teachers with basic knowledge about diabetes and its consequences as they care for children with type 1 diabetes in kindergartens and schools. Trainings should also cover practical instructions on how to support children with their diabetes management (8) and should be offered by diabetes specialists such as doctors or trained nurses to all teachers, including physical education teachers (10). Because such training is effective in providing teachers with diabetes-specific knowledge and strengthening their overall self-confidence when dealing with type 1 diabetes (16), continuation of existing structured training on this topic for kindergarten and school teachers is highly recommended.

In Germany, such trainings lack structural implementation and secured funding (15). Thus, a strong collaboration among health professionals, politicians, and members of

the educational system is required to achieve sustained success in supporting children with type 1 diabetes in kindergartens and schools.

Second, written school policies must be implemented in all kindergartens and schools to ensure appropriate support and integration of children with type 1 diabetes (22,23). These policies should include details about adequate diabetes management (e.g., the frequency of and circumstances in which to perform blood glucose checks, appropriate times to administer insulin, planning for food intake and timing of snacks, recognition and management of symptoms of hypoglycemia and hyperglycemia, emergency plans and contacts, and information about participation in physical activities). The U.S. (35), Spanish (36), and Austrian (37) guidelines might serve as good examples.

Third, teachers in this study indicated clear deficits in communication among teachers, parents, and physicians compared with other countries. The institution of school policies that address communication might improve existing communication and, in the long run, further enhance children's integration in kindergartens and schools (29). School nurses might further improve communication among parents, institutions, and health care professionals.

Putting all of these recommendations into practice might have a positive impact on children's experiences and lead to better integration of children with type 1 diabetes in German kindergartens and schools.

DUALITY OF INTEREST

No potential conflicts of interest relevant to this article were reported.

AUTHOR CONTRIBUTIONS

R.F.G. and T.I.-A. designed the study. R.F.G. collected and analyzed data and wrote the manuscript. M.N. and T.I.-A. contributed to the drafting and revision of the manuscript. All authors read and approved the final manuscript. R.F.G. is the guarantor of this work and, as such, had full access to all the data in the study and takes responsibility for the integrity of the data and the accuracy of the data analysis.

REFERENCES

1. Danne T, Ziegler R, Kapellen T. Diabetes in children and adolescents. In *German Diabetes Health Report 2019*. German Diabetes Association (DDG) and German Diabetes Aid, Eds. Mainz, Germany, Verlag Kirchheim and Co., 2019, p. 124–135 [in German]
2. Patterson CC, Dahlquist GG, Gyürüs E, Green A, Soltész G; EURODIAB Study Group. Incidence trends for childhood type 1 diabetes in Europe during 1989–2003 and predicted new cases 2005–20: a multicentre prospective registration study. *Lancet* 2009;373:2027–2033
3. Lange K, Jackson C, Deeb L. Diabetes care in schools: the disturbing facts. *Pediatr Diabetes* 2009;10(Suppl. 13):28–36
4. Ministry of Education, Science, Training and Culture. *Chronic Illness in Children and Adolescents: Recommended Procedures and Framework Requirements for Daily Routines in Schools*. Rhineland-Palatinate, Mainz, Germany, Ministry of Education, Science, Training and Culture, 2014 [in German]

5. Neu A, Bürger-Büsing J, Danne T, et al. Diagnosis, therapy and follow-up of diabetes mellitus in children and adolescents. *Exp Clin Endocrinol Diabetes* 2019;127(Suppl. 1):S39–S72
6. Nabors L, Lehmkuhl H, Christos N, Andreone TL. Children with diabetes: perceptions of supports for self-management at school. *J Sch Health* 2003;73:216–221
7. Marks A, Wilson V, Crisp J. The management of type 1 diabetes in Australian primary schools. *Issues Compr Pediatr Nurs* 2014;37:168–182
8. Edwards D, Noyes J, Lowes L, Haf Spencer L, Gregory JW. An ongoing struggle: a mixed-method systematic review of interventions, barriers and facilitators to achieving optimal self-care by children and young people with type 1 diabetes in educational settings. *BMC Pediatr* 2014;14:228
9. Pansier B, Schulz PJ. School-based diabetes interventions and their outcomes: a systematic literature review. *J Public Health Res* 2015;4:467
10. Kise SS, Hopkins A, Burke S. Improving school experiences for adolescents with type 1 diabetes. *J Sch Health* 2017;87:363–375
11. Cunningham MM, Wodrich DL. The effect of sharing health information on teachers' production of classroom accommodations. *Psychol Sch* 2006;43:553–564
12. Olson AL, Seidler AB, Goodman D, Gaelic S, Nordgren R. School professionals' perceptions about the impact of chronic illness in the classroom. *Arch Pediatr Adolesc Med* 2004;158:53–58
13. Bechara GM, Castelo Branco F, Rodrigues AL, et al. "KiDS and Diabetes in Schools" project: experience with an international educational intervention among parents and school professionals. *Pediatr Diabetes* 2018;19:756–760
14. Hiermann P, Wendenburg J, von Sengbusch S, et al. Who is delivering diabetes training for persons that care for children in kindergarten, day care and school? Results from a questionnaire and a statement on the situation in Germany. *Diabetologie und Stoffwechsel* 2016;11:350–356 [in German]
15. Gutzweiler RF, Neese M, Reichert D, Kraus LM, In-Albon T. Evaluation of a structured training for caregivers and teachers on supporting children and adolescents with type 1 diabetes in Rhineland-Palatinate, Germany. *Diabetologie und Stoffwechsel* 2019;14:124–131 [in German]
16. Amillategui B, Mora E, Calle JR, Giralt P. Special needs of children with type 1 diabetes at primary school: perceptions from parents, children, and teachers. *Pediatr Diabetes* 2009;10:67–73
17. Tatman MA, Lessing DN. Can we improve diabetes care in schools? *Arch Dis Child* 1993;69:450–451
18. Särnblad S, Berg L, Detlofsson I, Jönsson A, Forsander G. Diabetes management in Swedish schools: a national survey of attitudes of parents, children, and diabetes teams. *Pediatr Diabetes* 2014;15:550–556
19. Abdel Gawwad ES. Teacher's knowledge, attitudes and management practices about diabetes care in Riyadh's schools. *J Egypt Public Health Assoc* 2008;83:205–222
20. Lehmkuhl H, Nabors L. Children with diabetes: satisfaction with school support, illness perceptions and HbA_{1c} levels. *J Dev Phys Disabil* 2008;20:101–114
21. Jacquez F, Stout S, Alvarez-Salvat R, et al. Parent perspectives of diabetes management in schools. *Diabetes Educ* 2008;34:996–1003
22. German Diabetes Association, Working Group on Pediatric Diabetology. Diagnosis and management of diabetes mellitus in childhood and adolescence. Available from https://www.awmf.org/uploads/tx_szleitlinien/057-016_S3_Diabetes_mellitus_Kinder_Jugendliche_2017-02.pdf [in German]. Accessed 7 August 2019

23. Jackson CC, Albanese-O'Neill A, Butler KL, et al. Diabetes care in the school setting: a position statement of the American Diabetes Association. *Diabetes Care* 2015;38:1958–1963
24. Schwartz FL, Denham S, Heh V, Wapner A, Shubrook J. Experiences of children and adolescents with type 1 diabetes in school: survey of children, parents, and schools. *Diabetes Spectr* 2010;23:47–55
25. Pinelli L, Zaffani S, Cappa M, et al. The ALBA project: an evaluation of needs, management, fears of Italian young patients with type 1 diabetes in a school setting and an evaluation of parents' and teachers' perceptions. *Pediatr Diabetes* 2011;12:485–493
26. Nabors L, Troillett A, Nash T, Masiulis B. School nurse perceptions of barriers and supports for children with diabetes. *J Sch Health* 2005;75:119–124
27. Lewis DW, Powers PA, Goodenough MF, Poth MA. Inadequacy of in-school support for diabetic children. *Diabetes Technol Ther* 2003;5:45–56
28. Amillategui B, Calle JR, Alvarez MA, Cardiel MA, Barrio R. Identifying the special needs of children with type 1 diabetes in the school setting: an overview of parents' perceptions. *Diabet Med* 2007;24:1073–1079
29. Boden S, Lloyd CE, Gosden C, Macdougall C, Brown N, Matyka K. The concerns of school staff in caring for children with diabetes in primary school. *Pediatr Diabetes* 2012;13:e6–e13
30. Cohen J. *Statistical Power Analysis for the Behavioral Sciences*. Hillsdale, NJ, Lawrence Earlbaum Associates, 1988
31. Gutiérrez-Manzanedo JV, Carral-San Laureano F, Moreno-Vides P, de Castro-Maqueda G, Fernández-Santos JR, Ponce-González JG. Teachers' knowledge about type 1 diabetes in south of Spain public schools. *Diabetes Res Clin Pract* 2018;143:140–145
32. Tomé Pérez Y, Barroso Martínez V, Félix-Redondo FJ, Tobajas Belvis L, Cordón Arroyo AM. Needs of schoolchildren with type 1 diabetes in Extremadura: family perceptions. *An Pediatr (Barc)* 2019;90:173–179 [in Spanish]
33. Marks A, Wilson V, Crisp J. The management of type 1 diabetes in primary school: review of the literature. *Issues Compr Pediatr Nurs* 2013;36:98–119
34. Wysocki T, Lochrie A, Antal H, Buckloh LM. Youth and parent knowledge and communication about major complications of type 1 diabetes: associations with diabetes outcomes. *Diabetes Care* 2011;34:1701–1705
35. Clarke W, Deeb LC, Jameson P, et al.; American Diabetes Association. Diabetes care in the school and day care setting. *Diabetes Care* 2013;36(Suppl. 1):S75–S79
36. Velasco MJM, Galán MGS, Martín ED. Global standards and local policies for school diabetes care. *Health (N Y)* 2015;7:1642–1650
37. Hofer SE, Rami-Merhar B, Fröhlich-Reiterer E, Damm L, Karall D, Kautzky-Willer A. Common position paper of the Austrian Diabetes Association (ÖDG), the Austrian Society of Pediatrics & Adolescent Medicine (ÖGKJ), and the Working Group for Pediatric Endocrinology and Diabetes (APEDÖ): care of children and adolescents with diabetes in Austria's schools. Available from <https://www.oedg.at/pdf/1812-positionspapier.pdf>. Accessed 14 February 2020 [in German]