

# Assessment of Knowledge of Type 1 Diabetes Mellitus Among Public Health Care Specialists Working at Schools and Analysis of Activities Directed at Providing Assistance to Children With Diabetes Mellitus in Lithuania

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**Key Words:** public health care specialists; problems at school; type 1 diabetes mellitus; children with diabetes mellitus; knowledge.

**Summary.** Schoolchildren diagnosed with type 1 diabetes mellitus sometimes have no possibility to eat and get an insulin injection on time while being at school, some of them may fear bullying and do not wish to be distinguished from others, and others are afraid to admit they have the disease. Surveys indicate that in case of hypoglycemia, schoolchildren would expect getting help from a public health care specialist working at school.

This study aimed to examine the knowledge of diabetes mellitus among public health care specialists working in educational institutions and their activities directed at providing assistance to children with diabetes.

**Material and Methods.** Respondents of the anonymous survey included 104 public health care specialists working at schools in different cities of Lithuania.

**Results.** Among the 104 surveyed, 18.3% of the public health care specialists working at schools had insufficient knowledge of diabetes self-management, 36.6% lacked knowledge about diet for people with diabetes mellitus, and 51.9% lacked adequate knowledge of acute and late-stage complications of diabetes mellitus. As much as 76% of the respondents were interested in well-being of children with diabetes mellitus at school, while 24% were never interested. Only 31.7% of the respondents informed all teachers at school about a schoolchild with diabetes mellitus, 61.5% informed only one teacher, and 20.2% reported they did not provide such information to teachers. When requested to identify problems, 26.9% of the respondents mentioned the lack of knowledge on diabetes mellitus, and 32.7% pointed out the lack of supplies necessary for assistance in case of hypoglycemia. Insufficient workload at school was seen as a problem by 17.3% of the respondents, while 37.5% of the public health care specialists indicated the lack of methodological recommendations.

**Conclusions.** Most public health care specialists working at schools lack adequate knowledge of acute and late-stage complications of diabetes mellitus and insulin therapy. Public health care specialists provide emergency assistance in case of hypoglycemia, are interested in well-being of children with diabetes mellitus, and provide information for the school community. The most frequent problems encountered by public health care specialists include insufficient supplies necessary to test the blood glucose level and provide first aid as well as the lack of uniform methodological recommendations on how to behave in cases when school is attended by a schoolchild with diabetes mellitus.

## Introduction

In Lithuania, little research has been done on the presence of an employee's responsibility for children with type 1 diabetes mellitus at school and as to whether school communities had sufficient knowledge of diabetes mellitus and were able to provide assistance in case of hypoglycemia (1). Schoolchildren with diabetes mellitus encounter a number of problems at school. Some of them are unable to eat on time, others hide in the bathroom in order

to make an insulin injection without anyone looking, others may fear bullying and do not wish to be distinguished from others, and therefore, they are afraid to admit having diabetes mellitus. Schoolchildren would expect getting nutrition advices or help in case of hypoglycemia from a public health care specialist working at school (1, 2).

For a responsible health care specialist at school, qualification requirements for public health care were approved on August 1, 2007, by the Order No. V-630

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of the Minister of Health of the Republic of Lithuania "Due to the Amendment of the Approval of the Description of Qualification Requirements for a Public Health Care Specialist Pursuing Health Care at School" (3). Legal acts on health care in schools in Lithuania do not contain any specific recommendations on the activities of public health care specialists in relation to a child with diabetes mellitus, attending school. The majority of countries have no legislation authorizing school personnel to provide assistance to children with diabetes mellitus even in case of extreme conditions such as hypoglycemia. Issues of responsibility remain unresolved in countries such as Austria, Germany, Italy, and the Netherlands. In these countries, school personnel is prohibited from giving an insulin injection, testing the blood glucose level, or assisting a child in case of hypoglycemia. In countries where there is no such specific prohibition, for instance, in Croatia, the Czech Republic, Greece, Poland, and the United Kingdom, personnel assistance is usually provided on a voluntary basis (4). In the framework of implementation of the National Diabetes Education Program, in 2011 the U.S. Department of Health published an updated guide for school personnel "Helping the Student with Diabetes Succeed." These methodological provisions specifically define the boundaries of assistance to schoolchildren with diabetes mellitus and actions for the public health care specialist. In 2009–2010, Engele et al. carried out a study, which revealed that there was a statistically significant correlation between ensuring a safe school environment for children with diabetes mellitus and the workload of the school nurse, i.e., the number of schools serviced by the same nurse (5). According to Statistics Lithuania, there were 1242 schools in Lithuania in 2012–2013 (6). According to the data of the Association of Public Health Bureaus, in August 2013, there were 33 municipal public health bureaus employing 498 public health care specialists working in schools. According to legislation in force, a public health care specialist has to provide services for two and/or more schools in order to be employed full time. For this reason, when a child with diabetes mellitus is attending or starts to attend school, access to services provided by a public health care specialist may become problematic because of insufficient workload.

### Material and Methods

The study was carried out in city and district schools of Kaunas, Panevėžys, Ukmergė, Marijampolė, and Prienai from October 2013 until March 2014. The permission (No. BEC-SLF(N)-82) was issued by the Bioethics Centre of the Lithuanian University of Health Sciences on October 9, 2013.

**Study Sample.** There were 104 public health

care specialists working at schools who responded to the questionnaire prepared by researchers. The authors were closely employed into the distribution of questionnaires; therefore, the response rate was 100%.

**The questionnaire** was developed by authors according to the literature review and personal work experience as nursing specialists in the Paediatric Diabetes School, Department of Endocrinology, Hospital of the Lithuanian University of Health Sciences.

The survey instrument was composed of 60 questions divided into 4 categories:

1. Demographic questions;

Questions that assess public health care specialists' knowledge of type 1 diabetes mellitus. There were 40 questions presented with a view to the evaluation of knowledge. The topics were as follows: diabetes self-management (10 questions), nutrition (10 questions), insulin therapy (10 questions), and acute and late-stage complications caused by diabetes (10 questions);

2. Questions on the activities of public health care specialists working with schoolchildren with type 1 diabetes mellitus at schools;

3. Questions on problems encountered by public health care specialists working with schoolchildren with type 1 diabetes mellitus at schools.

**Statistical analysis** of data was carried out by means of the SPSS 20 program. To establish statistically significant differences, the chi square ( $\chi^2$ ) criterion was applied. The normality of the distribution of quantitative variables was checked by using the Kolmogorov-Smirnov test. Relationships between qualitative variables that do not meet the assumption for normal distribution was assessed with the help of the Spearman correlation coefficient. The chosen level of statistical significance was  $P < 0.01$ .

### Results

There were 104 public health care specialists working at schools of Lithuania who took part in the survey. The mean age of the respondents was 41 years; the mean duration of work in schools was 12 years. Less than half (43.3%) of the respondents completed public health study programs and 56.7% completed a study program in the field of biomedical sciences. There was a statistically significant difference ( $P = 0.003$ ) in the level of knowledge between specialists who completed public health study programs and those who studied biomedical sciences.

### Assessment of public health care specialists' knowledge of type 1 diabetes mellitus

**Self-Management.** In the group of 10 questions on the characteristics of diabetes self-management, respondents were well aware of the answer to the

question about the recommended amount of glucose in the blood of children before a meal and 2 h after it. As much as 78.8% of the respondents correctly answered this question; 70% of the respondents did not know how indicators of the blood glucose level were affected by the child's arms that were greasy or washed but not wiped. Nearly one-fifth (18.3%) of the public health care specialists had inadequate knowledge of diabetes self-management (chose the wrong answer). Respondents who worked at schools for a longer period less frequently selected the answer option "Do not know" ( $P=0.003$ ).

**Nutrition.** Only 13.5% of the respondents knew the correct answer to the question about what amount of carbohydrates a child needed to eat when the first signs of hypoglycemia appeared. Even 50% of the public health care specialists mistakenly believed that sour apples would not increase blood glucose levels.

During the study, a connection between self-assessment of knowledge and the lack of correct answers on eating habits was revealed ( $P=0.0001$ ). It may be assumed that respondents who self-assessed their knowledge about diabetes by giving a higher score also less frequently selected the answer option "Do not know."

**Insulin Therapy.** Only 30.8% of the respondents marked the correct answer to the question about the storage of an opened insulin bottle. Less than half (42.3%) of the public health care specialists knew that insulin injections could not be made more frequently than every 2 h. A positive association between the duration of work at school and the number of correct answers to questions on insulin therapy ( $P=0.000$ ) was established. Respondents who worked at schools for a longer period more frequently selected correct answers.

**Acute and Late-Stage Complications Caused by Diabetes.** The survey results showed that more than half (51.9%) of the respondents had insufficient knowledge (those who did not provide the right answer to the current question) of acute and late-stage complications caused by diabetes.

Even 85.6% of the respondents wrongly an-

swered the question about most frequent complications caused by diabetes mellitus, and 52.9% of the respondents incorrectly indicated the most frequent complication caused by diabetes mellitus.

Table 1 presents 4 main topics for knowledge assessment and the percentage of correct answers to each question according to all 4 topics.

For the topic of diabetes self-management, 24.0% and 21.2% of the specialists answered 6 and 7 questions correctly, respectively. There were 28.8% of the specialists who correctly answered 6 other questions about proper nutrition in diabetes mellitus. The topic of acute and late-stage complications caused by diabetes was the most difficult for the respondents as only 20.2% correctly answered 3 questions.

### Activities of Public Health Care Specialists When School Is Attended by a Child With Diabetes Mellitus

In this study, 61.5% of the public health care specialists working at schools indicated that an educational institution was attended by a child with diabetes mellitus during the time of the study or earlier. The results of the study showed that 93.3% of the public health care specialists had never tested the blood glucose level for children with diabetes mellitus. Researchers tried to find out the most frequent reasons when children referred to a public health care specialist. Results revealed that 32.7% of the children visited a public health care specialist when they did not feel well because of hypoglycemia; 24% made an insulin injection in the public health care specialist's office and 10% tested the blood glucose level; 6% requested to store glucagon in the public health care specialist's office, and 5% were looking for a place to have snacks in the office.

The study showed that 40.4% of the public health care specialists asked the child about his or her well-being when they met the child at school, 24% asked teachers about the child's well-being, and 18.3% asked the child's parents. As much as 24% of the public health care specialists were not personally interested in the child's health. An open-ended ques-

Table 1. Percentage of Correct Answers to the Questions about Type 1 Diabetes Mellitus Care Provided by Public Health Care Specialists

No.	Topic	Ten Questions of Each Topic* / % of Correct Answers									
		1	2	3	4	5	6	7	8	9	10
1.	Self-management	1.0	4.8	1.9	10.6	15.4	<b>24.0</b>	<b>21.2</b>	13.5	7.6	0
2.	Nutrition	1.0	1.9	3.8	10.6	<b>21.2</b>	<b>28.8</b>	18.3	6.7	6.7	1.0
3.	Insulin therapy	8.7	5.8	9.6	12.5	<b>16.3</b>	<b>16.3</b>	<b>24.0</b>	4.9	1.9	0
4.	Acute and late-stage complications caused by diabetes	5.7	8.7	<b>20.2</b>	<b>17.3</b>	14.4	14.4	6.7	9.7	1.9	1.0

\*Questions of all 4 topics are presented in the Annex.

Table 2. Information Provided to the School Community

Type of Information and Method of Communication	% (n)
Orally informed teachers about a child with diabetes mellitus but do not provide any further comment	38.5 (40)
Provided brief information on diabetes mellitus for teachers during a meeting	29.8 (31)
Prepared a comprehensive presentation on diabetes mellitus	16.3 (17)
Briefly emphasized the characteristics of emergency assistance in case of hypoglycemia/hyperglycemia	36.5 (38)
Provided information on diabetes mellitus in the school stand	36.5 (38)
Made an entry in the electronic journal that a child with diabetes mellitus attends an educational institution	14.4 (15)
Prepared a memo (leaflet) on diabetes mellitus and distributed it to all teachers	20.2 (21)
Informed the physical education teacher about the influence of physical exercise on glycaemia	51.9 (54)

tion on assistance provided to a child with diabetes mellitus was answered in the following way: 34.7% of the respondents replied they provided assistance in case of hypoglycemia, 13% talked about damage and complications caused by diabetes mellitus, 8.6% provided an opportunity to test the blood glucose level, to get an insulin injection in their office, and 8.6% informed cafeteria employees.

This study also analyzed whether public health care specialists informed the school community about a child with diabetes mellitus. The results showed that 31.7% of the respondents informed all teachers at school; 61.5%, one teacher; 51%, the physical education teacher; 8.7%, classmates; and 24%, the head of school. However, 20.2% of the respondents provided no information to the school community about a child with diabetes mellitus. Table 2 presents the type of information provided to the school community and the method of communication about a child with diabetes mellitus.

#### **Problems Encountered by Health Care Specialists When School Is Attended by a Child With Diabetes Mellitus**

In this study, respondents identified the following problems: 26.9% of the public health care specialists mentioned the lack of knowledge on diabetes mellitus, 39.4% noted the lack of supplies necessary to test the blood glucose level, and 32.7% pointed out the lack of supplies necessary for assistance in case of hypoglycemia. Insufficient workload at school was seen as a problem by 17.3% of the public health care specialists, and 14.4% replied that there were a few children with diabetes mellitus at school; therefore, such a child was seen as a public health care specialist's problem. The lack of cooperation with an endocrinologist and/or a diabetes nurse was named by 15.4% of the respondents. The lack of methodological recommendations on what kind of information, in what cases, and to whom it should be provided was seen as a problem by 37.5% of the respondents. Furthermore, 93.3% of the respond-

ents indicated they needed methodological material on emergency assistance in case of hypoglycemia/hyperglycemia.

Up to 88.5% of the respondents would participate in seminars on diabetes mellitus, while 11.5% would not attend such seminars. A lecture given by a diabetes nurse in an educational institution attended by a child with diabetes mellitus was seen as necessary by 74% of the public health care specialists, while 12.5% of the respondents considered such a lecture unnecessary.

#### **Discussion**

According to the Order No. V-630 of the Minister of Health, dated on August 1, 2007, an individual responsible for health care in schools should either have a bachelor's degree in public health or be a graduate of one of the following study programs, namely, the doctor's assistant program, child care nursing, midwifery, general practice nursing study programs with a relevant professional qualification diploma and an additional training course of not less than 160 hours in public health care approved by the Ministry of Health of the Republic of Lithuania (3). Evaluation of specialists' knowledge, who completed public health study programs and those who studied biomedical sciences, revealed that there was a statistically significant difference in the level of knowledge since graduates in biomedical sciences had more knowledge about diabetes mellitus, were more interested in the child's well-being, were willing to inform the school community about diabetes mellitus and to cooperate with the child's family. However, the evaluation of all respondents' knowledge showed that graduates of both public health study programs and a study program in the field of biomedical sciences working at schools lacked adequate knowledge of diabetes.

Public health care specialists working at schools encounter problems in communication of information related to the child's health. It turned out that specialists working at schools were not necessarily

informed on time about a child with diabetes mellitus in their care. Hygiene norm 21:2011 "School Carrying out General Education Curricula. General Health and Safety Requirements" states that the head of school or an individual authorized by him/her has to ensure that pupils under 18 are allowed to attend school only after completion of health examination and submission of a child health certificate (Form No. 027-1/a) issued not earlier than 1 year ago. Schoolchildren who started to attend a new school have to submit the child's health certificate (Form No. 027-1/a) by September 15 of the current year. It may be assumed that if a child having a valid child's health certificate (Form No. 027-1/a) is diagnosed with diabetes mellitus, public health care specialist working at school would not receive this information (7-10).

This study has revealed that public health care specialists working at school had little interest in schoolchildren with diabetes mellitus or raising awareness of this disease in the school community. The most frequent reasons indicated by public health care specialists as to why they were not interested in the well-being of a schoolchild with diabetes mellitus were insufficient workload at a particular school and the lack of knowledge as to what activities should be carried out.

### Conclusions

The most public health care specialists working at schools lack adequate knowledge of acute and late-stage complications of diabetes mellitus and insulin therapy. Public health care specialists provide emergency assistance in case of hypoglycemia, are interested in well-being of children with diabetes, and provide information for the school community. The most frequent problems encountered by public health care specialists include insufficient supplies necessary to test the blood glucose level and provide first aid as well as the lack of uniform methodological recommendations on how to behave in cases when school is attended by a schoolchild with diabetes mellitus.

### Annex

Questions of self-management, nutrition, insulin therapy, and acute and late-stage complications caused by diabetes mellitus

1. Diabetes is well controlled if the child's blood glucose level before and 2 hours after meal is 5-8 and 5-10 mmol/L, respectively.
2. When good diabetes control is achieved, it is recommended to test the blood glucose level 3 times per day and more.
3. If the hands of a child before testing the blood glucose level must be washed, the results of the test will be less than in reality.
4. To test the blood glucose level, it is recommended to stick the side of the finger top.
5. To test the blood glucose level, the second drop of blood has to be used.
6. When the blood glucose level is >13 mmol/L, it is recommended to take up a sport.
7. During illness and fever, the blood glucose level must be tested more often.
8. A child with diabetes mellitus should fill the diary in. If he/she writes down just the results of the blood glucose level, is this enough?
9. If the hands of a child before testing the blood glucose level must be washed but not dried, the result of the test will be less than in reality.
10. Do you agree with the statement that good diabetes control depends only on the right medications prescribed?
11. Not so sweet apple increases the blood glucose level.
12. It is recommended to use more fiber-containing food for persons with diabetes mellitus.
13. A break between the main meal courses should not be longer than 6 h.
14. When the first signs of hypoglycemia appear, a child has to use 45 g of carbohydrates.
15. Does the meat contain carbohydrates?
16. The demand of minerals and vitamins for people with diabetes mellitus is the same as for healthy people.
17. One 0.5-cm slice of brown or white bread contains 15 g carbohydrates.
18. Is it recommended to exclude the products that contain carbohydrates from the meal of a child with diabetes mellitus?
19. A child with diabetes mellitus is going to have his/her lunch. He/she takes fresh salad (tomatoes, cucumbers, salad) and fish as well drinks unsweetened tea. Does he/she need insulin after such lunch?
20. Does an orange contain easily (fast) assimilative carbohydrates?
21. Heat like hot weather as well as a hot bath or a sauna increases insulin absorption and cold acts in opposite.
22. Insulin injected into the pelvis area reaches blood faster than injected in the thigh.
23. Only fast-acting insulin preparations are used with an insulin pump.
24. The blood glucose level of a child with diabetes mellitus 2 h later after breakfast is 15 mmol/L. He/she wants to eat a sandwich for lunch. Does he/she need an insulin injection?
25. Insulin injections are available more frequently than each 2 h.
26. It is recommended to inject insulin after meal.
27. It is recommended to inject short- and fast-acting insulin into the pelvis area.
28. Allergy to insulin preparations is very seldom.

29. It is recommended to keep an open insulin bottle in a refrigerator door.
30. It is recommended to exercise 2–3 h after insulin injection.
31. The most frequent complications of diabetes mellitus are diabetic nephropathy, diabetic retinopathy, diabetic neuropathy, and diabetic foot.
32. The most common complication of diabetes mellitus is hyperglycemia.
33. During intensive exercising in order to prevent hypoglycemia, it is necessary to decrease an insulin dose.
34. Alcohol consumption may be a cause for hyperglycemia.
35. Recently experienced hypoglycemia may be a cause of hyperglycemia.
36. The signs of hyperglycemia are sweating, shivering, hunger, bloodless, and low blood pressure.
37. The signs of hypoglycemia are thirst, foggy vision, anxiety, and acetone smell from the mouth.
38. If the child with diabetes mellitus feels suddenly unhealthy, it is recommended for him/her to inject 1 a.u. of insulin additionally.
39. If a patient with diabetes mellitus experiences nausea and vomiting, the amount of ketones in urine should be tested.
40. For a patient with diabetes mellitus, it is recommended to observe his/her feet once per 2 weeks.

#### Statement of Conflict of Interest

The authors state no conflict of interest.

## Mokyklose dirbančių sveikatos priežiūros specialistų žinių apie I tipo cukrinį diabetą įvertinimas bei veiklos, užtikrinančios pagalbą sergantiems vaikams, analizė

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**Raktažodžiai:** visuomenės sveikatos specialistai, problemos mokykloje, I tipo cukrinis diabetas, diabetu sergantys moksleiviai, žinios.

**Santrauka.** Moksleiviams, sergantiems I tipo cukriniu diabetu, mokykloje ne visada sudaromos tinkamos sąlygos laiku pavalgyti ir susileisti insuliną. Kai kurie moksleiviai bijo patyčių, nenori būti išskirti iš kitų, nedrįsta prisipažinti, kad serga. Apklausos rodo, kad hipoglikemijos atveju vaikai dažniausiai tikisi sulaukti pagalbos iš mokyklos sveikatos priežiūros specialisto.

*Šio tyrimo tikslas* – ištirti sveikatos priežiūros specialistų, dirbančių ugdymo įstaigose, žinias apie cukrinį diabetą bei gebėjimą užtikrinti pagalbą sergantiems vaikams.

*Metodai.* Anoniminio anketavimo būdu buvo apklausti 104 mokyklose dirbantys sveikatos priežiūros specialistai iš skirtingų Lietuvos miestų.

*Rezultatai.* Nustatyta, kad 18,3 proc. sveikatos priežiūros specialistų, dirbančių mokykloje, nepakanka žinių apie cukrinio diabeto savikontrolę, 36,6 proc. trūksta žinių apie sergančiojo diabetu mitybą, 51,9 proc. neturi užtekintai žinių apie ūmines ir vėlyvasias cukrinio diabeto komplikacijas. 76 proc. apklaustųjų domisi cukriniu diabetu sergančio vaiko savijauta mokykloje, 24,0 proc. – niekada nesidomi. Paaiškėjo, kad tik 31,7 proc. tiriamųjų informuoja visus mokyklos pedagogus apie cukriniu diabetu sergantį mokinį, 61,5 proc. informuoja tik klasės auklėtoją, o 20,2 proc. teigia, kad tokios informacijos pedagogams neteikia. Paprašyti įvardyti problemas 26,9 proc. apklaustųjų nurodo, jog stokoja žinių apie cukrinį diabetą, 32,7 proc. pastebi priemonių, reikalingų suteikiant pagalbą hipoglikemijos atveju, trūkumą. Per mažas darbo krūvis mokykloje buvo įvardytas kaip problema 17,3 proc. apklaustųjų, o metodinių rekomendacijų trūkumas – 37,5 proc. apklaustųjų.

*Išvados.* Sveikatos priežiūros specialistams, dirbantiems mokykloje, labiausiai trūksta žinių apie ūmines ir vėlyvasias cukrinio diabeto komplikacijas bei insulino terapiją. Sveikatos priežiūros specialistai teikia pirmąją pagalbą hipoglikemijos atveju, domisi sergančio vaiko savijauta, informuoja mokyklos bendruomenę. Dažniausiai kylančios problemos buvo: priemonių gliukozės kiekiui nustatyti ir pirmajai pagalbai teikti trūkumas ir bendrų metodinių rekomendacijų, kaip elgtis, kai ugdymo įstaigą lanko cukriniu diabetu sergantis vaikas, nebuvimas.

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