



Research Article

Attitudes of Parents and Children to Screening for the Risk of Developing Type 1 Diabetes. The ABIS General Population Study

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Abstract

Aims: Detection of children with high risk of getting type 1 diabetes may decrease the risk of keto-acidosis at onset but may have negative psychological consequences. The aim is to elucidate the views of parents and their children on screening of type 1 diabetes.

Methods: As part of ABIS (All Babies in Southeast Sweden) 3228 parents from the general population, and 5851 children (50.3% girls) aged 10-12 years, answered questionnaires regarding their view on screening for risk of getting type 1 diabetes.

Results: Only 52.7% wanted their child to be screened and still less agreed to screening when there is no preventive treatment available. Parents with high education were more negative to screening ($p < 0.001$). Although more positive than the general population ($p = 0.002$) still only 61.0 % of parents with type 1 diabetes in the family wanted their child to be screened. The children were more positive even without existing preventive treatment, girls more than boys ($p < 0.001$). Parents did not expect the children to participate in the decision.

Conclusion: A large proportion of parents to 10-13 years old children do not want children to be screened for T1D, especially as long as there is no good preventive treatment.

Keywords: ABIS; Attitudes; Children; Ethics; Risks; Screening; Type 1 diabetes

Introduction

The pro and cons for screening of risk of developing type 1 diabetes have been discussed for several decades since it became possible to identify risk individuals with autoantibodies [1-3], not least when the optimism was great to be able to prevent the disease e.g., by Nicotinamide [4] or by insulin treatment [5]. Both interventions failed [6, 7], although oral insulin seemed to have had some efficacy [8]. Beside the aspects of too low sensitivity

and specificity, and practical costs of screening, it was realized that screening inevitably leads to ethical problems [9]. Studies showed that most individuals do not seem to become very scared by the possibility to get the information of a future serious disease, type 1 diabetes, but still quite many individuals would worry, get anxiety [10,11]. When both Nicotinamide [7], sc insulin [6], peroral insulin [6,8] and intranasal insulin [12] failed to prevent or postpone type 1 diabetes, the discussion was dampened. However, it was recognized that screening causes psychological problems, although in some populations rather mild [13], so the need for psychological support was underlined [14,15].

Several birth cohort studies such as DIPP, Daisy, Baby-Diab and TEDDY, trying to elucidate the cause of type 1 diabetes, are restricted to individuals with high genetic risk and with relatives with type 1 diabetes. In these studies individuals' autoantibodies have been determined and individuals with increased risk of developing type 1 diabetes have been identified. The disease process has been categorized into stage 1 with only autoantibodies, stage 2 with additional glucose intolerance, and stage 3 the manifest clinical diabetes [16], and it has been found that the incidence of Diabetic Keto-Acidosis (DKA) at diagnosis has been lower in this group of identified risk individuals than in the general population with very limited knowledge of type 1 diabetes [17,18], C-peptide concentrations have been higher at diagnosis and beta cell function seems to last for longer time, and it has therefore been proposed that the very early diagnosis may increase the chances to get a milder disease with longer residuals beta cell function [19]. However, even in studies such as the TEDDY study with families aware of type 1 diabetes pronounced maternal anxiety is common in response to the information that a child is at increased risk for type 1 diabetes. Mothers who have experienced recent negative serious life events, and not least those who accurately understand their child's risk may get high levels of anxiety [20,21].

Recently, the question of screening has become a highly topical issue as it has been shown that Teplizumab can postpone the diagnosis of type 1 diabetes [22] and this treatment has been approved by Food and Drug Administration in USA. In several areas screening of the general population has started and new methods using big data and artificial intelligence to improve prediction has been proposed [23]. It is relevant to investigate the view of adults in the general population on screening, and also of the children themselves, not least in families without specific genetic risk of getting the disease and with no family history of type 1 diabetes and therefore most often low awareness of diabetes. ABIS (All Babies in Southeast Sweden) offers this opportunity as this is a unique birth cohort following a general population aiming to investigate prediction of type 1 diabetes, and how environmental and genetic factors influence the development of this disease. We found early that the general attitude to participating in ABIS was very positive [24] and several follow-ups of the attitudes to participating in ABIS, a study with possibilities to identify risk of type 1 diabetes, showed that the majority of parents were either positive or had a neutral view [25, 26]. Similar results have been found in another Swedish birth cohort study of individuals with increased risk of getting type 1 diabetes [27]. However, it seems to be a problem that parents have difficulties to make a realistic estimation of the risk, which is especially true for individuals with low education and no diabetes in the family [28]. This may contribute to the lack of motivation to participate in follow-up programs [29].

As screening program usually will include very young patients, it is important to know the attitudes of parents, but it is also important to know more about the attitudes of children themselves. Now when there is an efficacious, clinically available method for prevention of type 1 diabetes, screening for risk of type

1 diabetes may start not only in children with type 1 diabetes in the family, but also in the general populations. Then we need to know the attitudes of people in the general population which is the aim of the present study.

Participants and methods

ABIS is a birth cohort with a general population aiming to study prediction and development of type 1 diabetes and other immune mediated diseases. Out of 21700 children born 1st of Oct 1997-1st of Oct 1999 17055 (78.6%) were included after the parents' informed consent. At birth of the children and then after 1, 2.5-3, 5, 8, 10-13 years biological samples were collected and the parents' completed questionnaires about, but not restricted to, eating habits, physical activity, psychosocial situation, physical environment, infections, and also questions on attitudes to screening. Before the 5-year follow-up, information was given to the parents through information letters and through the ABIS website (www.abis-studien.se) and when the children were 5 years old, they received a short brochure describing the ABIS study. At 8 years of age, the children got further information through the ABIS website in a special section for children. The web pages contained more in-depth information about the study, and clarified that the study aimed to identify factors leading to type 1 diabetes. The children received their first own questionnaire when they were 8 years old

Before 10-13-year data collection, the children got a more detailed letter of information, and an information video was provided at the website. First questionnaires to both children and parents and collection of a sample of hair from the child were distributed. This first data collection was accomplished with help from schools as research material had been sent to the schools after consent from headmaster and class teachers. The children were asked to bring home a package with a written information (including the video link), and questionnaires to the parents. Those parents who did not want their child to participate were asked to complete the form and give it to the teacher. Thus, children were included in the 10- to 13-year follow-up based on either (a) parental consent implied by the parents filling out the parental questionnaire before the child took part in any ABIS activities at school or after a new parental written consent A second data collection included mailed questionnaires to both children and parents to families who had completed at least two follow-up questionnaires prior to the 10- to 13-year child questionnaire, and where at least one blood sample had been collected.

The questionnaires to the parents and to the children included a large number of questions on egg eating habits, sleep, diet, physical activity, and quality of life but also included 8 questions to the parents on their attitudes to screening for type 1 diabetes (Table 1a). The questionnaire given to children consisted of a total 60 questions on and to the children four questions on attitudes regarding screening for type 1 diabetes (Table 1b) [30,31]. In total 3228 parents answered the questionnaires and 5851 children.

Table 1(a): Questions to the parents.

	Questions	Missing	Valid
A	Children and young people under the age of 18 should be offered screening and testing for their risk of developing type 1 diabetes.	2 (0.10%)	3226
B	Parents should decide whether their child should be screened and tested for risk of developing type 1 diabetes, regardless of the doctor's opinion.	2 (0.10%)	3226
C	Although symptoms associated with type 1 diabetes do not appear until children are older, newborns, and younger children should still be offered screening and testing for the risk of developing type 1 diabetes.	3 (0.10%)	3225
D	The children should be involved in making the decision if they want to participate in screening and testing for type 1 diabetes.	3 (0.10%)	3226
F	If newborns and children are tested and considered to have an increased risk (more than normal) of developing type 1 diabetes, the children should be informed of the test results during childhood.	3 (0.10%)	3225
G	Although there are currently no preventive measures or cures to offer, newborns and children should still be offered screening and testing for increased diabetes risk.	1 (0.03%)	3227
I	I want my child/children to be screened and tested for increased risk of developing type 1 diabetes before he/she/they turn 18.	4 (0.10%)	3224
J	If the children are screened and tested for diabetes and they are considered to have an increased risk, more than normal, the children should be informed immediately about the results.	3 (0.10%)	3225

Table 1(b): Questions to the children.

Questions	Boys	Girls	Total
How important do you think it is that children your age should be involved in deciding whether to be tested for the risk of diabetes?	2094 (49.5%)	2135 (50.5%)	4229
Do you think it is good to find out if you have a higher risk of possibly getting diabetes, even if you don't know if you will get sick?	2078 (49.4%)	2125 (50.6%)	4203
Do you think it is good that you should be told if you are at risk of getting diabetes?	2078 (49.4%)	2125 (50.6%)	4203
Do you think it's good to find out if you have a higher risk of possibly getting diabetes, even if the doctors don't have any medicine that will make you healthy?	2078 (49.4%)	2125 (50.6%)	4203

Statistics

Descriptive statistics were used to summarize participant characteristics and important variables. Inductive statistics, including binary variables, were used to evaluate the attitudes of parents and children towards medical research, information assistance, choice-making, and behavioral impacts. The analysis involved Pearson chi-square tests to investigate relationships between categorical variables, with Cramer's V used as a metric of association strength. The multivariate approach likely involved regression analysis to investigate variables influencing children's perspectives. A p-value of less than 0.05 was considered statistically significant.

Ethics

The parents were given oral, written, and video information before giving their informed consent to participate in ABIS which was approved by the research ethics committees at Linköping University (Dnr 96-287, Dnr 99-321, and Dnr 03-092) and Lund University (LU 83-97) in Sweden. Connection of the ABIS registers to National Registers was approved by the Research Ethics Committee in Linköping (Dnr 2013/253-32). The children were given special information, both oral and written and web-site information before their questionnaires at the age of 8 and 11 years of age as described above. \

Results

The ABIS 10- to 13-year parents' questionnaires were answered by 3228 parents, and the child questionnaires were answered by 5851 children, 50.3% girls and 49.7% boys. 24% of the children were 10 to 11 years, 71.9% were between 11 and 13 years (mean=12.16, SD=0.86). Out of responding children 72.3% (n=4,230) had participated earlier in the ABIS study, while 27.7% (n=1,621) participated for the first time.

The attitudes described by the answers to the different questions to parents are shown in Figure 1. Even if a majority (69.7%) agreed to the sentence "Children and young people under

the age of 18 should be offered screening and testing for their risk of developing type 1 diabetes", only 52.6 % agreed to that their own children should be screened, and even less (50.1 %) agreed to the sentence "Although there are currently no preventive measures or cures to offer, newborns and children should still be offered screening and testing for increased diabetes risk.", while 18.4% disagreed.

There was a more positive attitude to screening among parents with low education ($p < .001$) (Suppl Table 1), while only 43.9% of respondents when mother had higher education, agreed to screening when there is no method to prevent T1D, and only 40,0% of respondents when fathers had high education. The attitude did not differ very much for those with type 1 diabetes in the family (Figure 2), even if they were more inclined to agree to question A, on screening in general (76.2%; $p = .009$), to question G on screening when there is no prevention treatment available (55.4%; $p = .037$), and to question I regarding screening of their own children (61.0%; $p = .002$), compared to the general population.

Children aged 10-13 years had a more positive attitude to screening for diabetes risk (Suppl Table 2, Figure 3), girls being more positive than boys to the question "How important do you think it is that children your age should be involved in deciding whether to be tested for the risk of diabetes?". ($p < .001$) In addition, girls answered "very good" more often than boys, "to the questions "Do you think it is good to find out if you have a higher risk of possibly getting diabetes, even if you don't know if you will get sick?", "Do you think it is good that you should be told if you are at risk of getting diabetes?", and "Do you think it's good to find out if you have a higher risk of possibly getting diabetes, even if the doctors don't have any medicine that will make you healthy? ($p < .001$). However, it should be noted that the majority of parents did not think children should take part in the decision to be screened (Figure 1, question D).

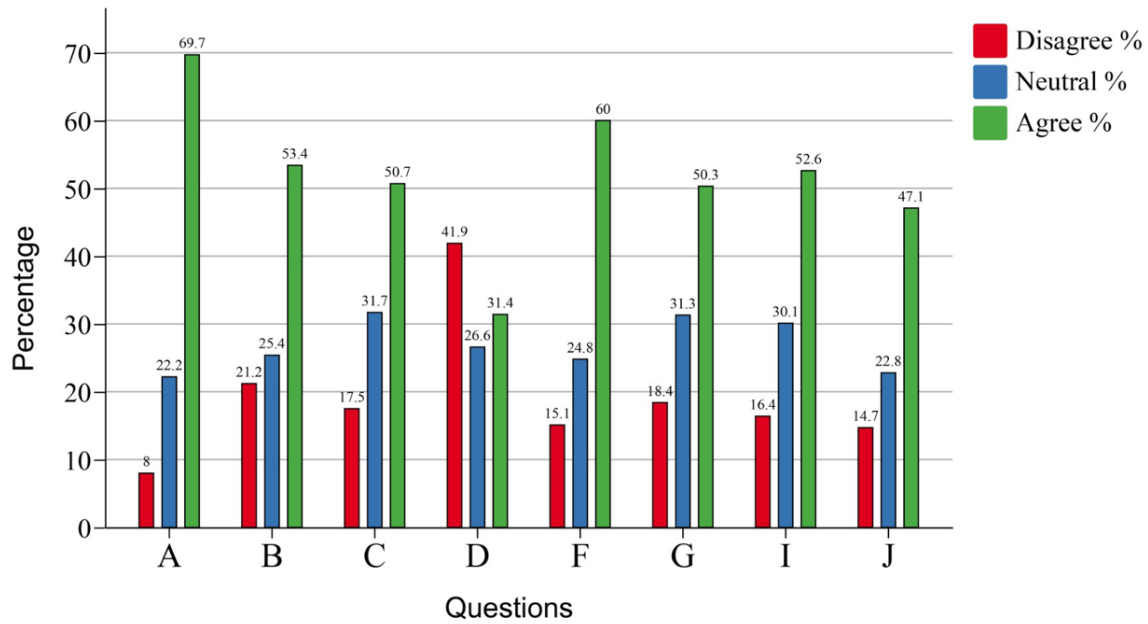


Figure 1: Percentage of parents who disagree, are neutral or agree to the questions A-J (see questions table 1a).

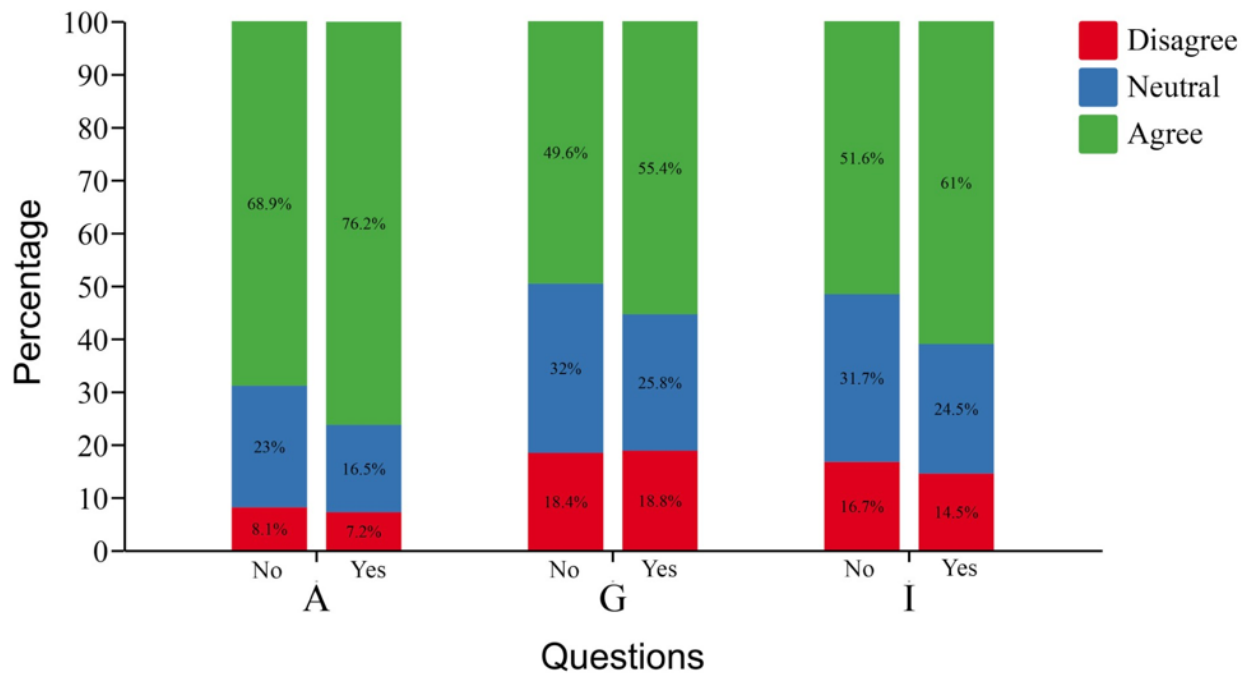


Figure 2: Percentage of parents without resp with diabetes in the family who disagree, are neutral or agree to questions A,G, I (see questions table 1a)

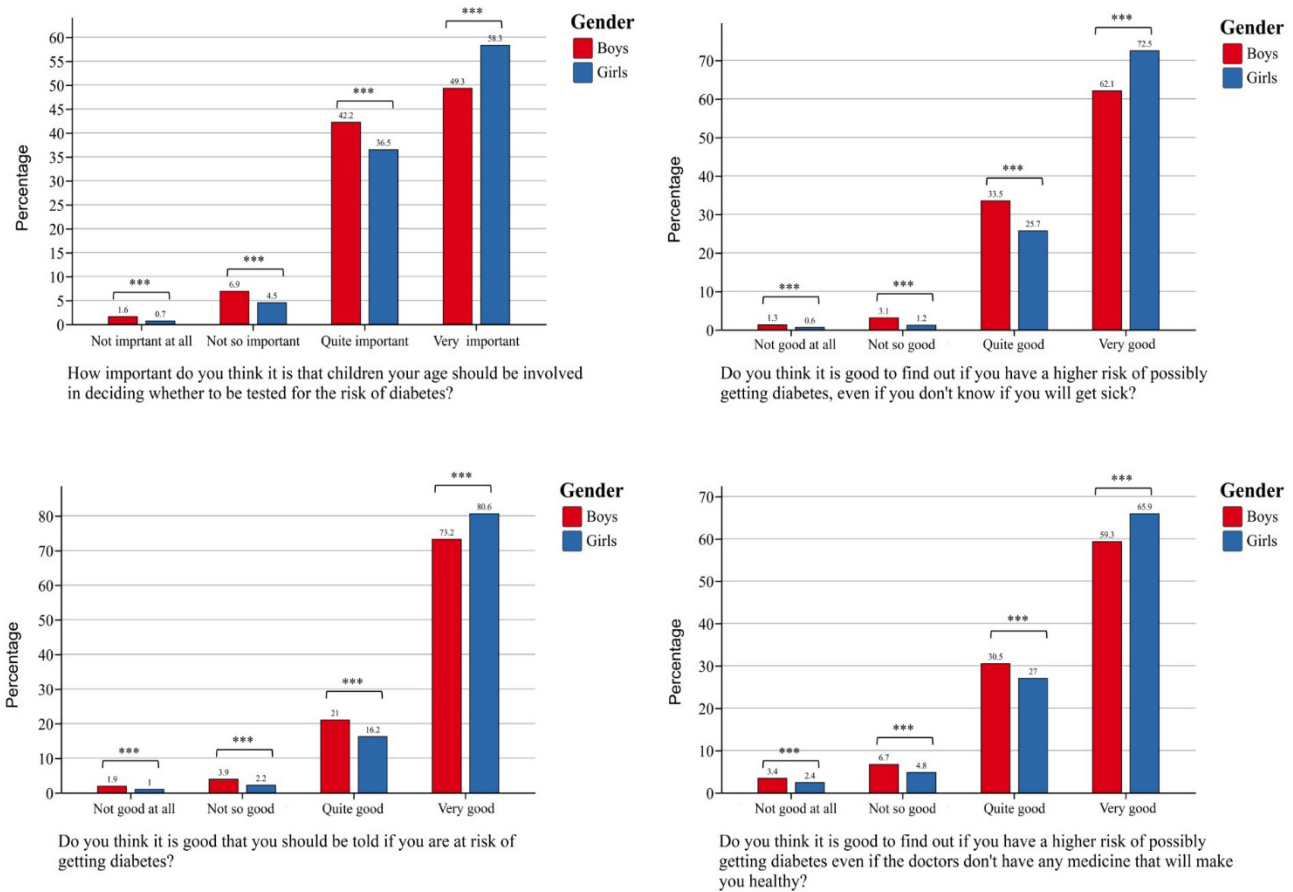


Figure 3: Response rate (percentage) of children (boys and girls) to some important questions on screening for type 1 diabetes.

Discussion

Our study shows that only about half of parents in the general population were positive to screening for type 1 diabetes, when the question deals with their own children, and even less proportion of parents with high education were positive. In contrast to previous studies [32] those with diabetes in the family were more positive, but even in that group a considerable proportion of parents do not like screening for risk of getting type 1 diabetes, especially when there is no available preventive treatment. How parents would react when offered a treatment with common, sometimes severe, adverse events, future risks, or a treatment which means a rather heavy burden we do not know.

In previous studies on attitudes to participating in ABIS we have found mainly positive opinions. Practical matters, rather than lack of trust, seemed to explain dropouts [33]. There have been different views regarding how much parents should consider the opinion of the children themselves regarding participating in

research [34]. The children wanted to get information and to be involved in decisions [35]. Now we report that children aged 10-13 years showed a more positive attitude to screening for risk of developing T1D than that of parents. However, the children of lower ages cannot be expected to be part of the decision according to the opinion of the majority of parents.

Screening for increased risk of getting type 1 diabetes has become a topical question since treatment for secondary prevention of the disease is available, at least in USA. Furthermore, screening to find high risk individuals will be of value when designing studies on secondary prevention. To identify high risk individuals when a treatment to prevent can be offered, has been regarded as ethically justified, especially in families with members who already have type 1 diabetes, and therefore already are aware and often worried about the increased risk of the family members to get T1D. The existing clinically approved treatment with Teplizumab [22] can be given when children are in stage 2 of the disease, while screening usually starts earlier to find individuals in stage 1 [16], with

multiple autoantibodies, which usually means that risk individuals are identified many years before any treatment is available in stage 2 with glucose intolerance. Screening may still be regarded as justified because of other possible benefits of decreasing the risk of diabetic ketoacidosis [17,18] and possible prolongations of residual beta cell function by early diagnosis [19]. However, to identify children with high risk of getting diabetes without type 1 diabetes in the family, in families without being worried for this disease, may cause anxiety during many years both in the child and the parents until preventive treatment becomes available [22,35]. It can be questioned whether the possible benefit of somewhat earlier diagnosis outweigh the psychological burden both for children and their parents, to be regarded as ill, or as somebody who will get a serious disease, during many years of childhood [36]. Our study suggests that parents with higher education recognize these negative consequences more clearly. If screening of the general population should start, it will be crucial to first organize that psychological support can be given to both children, siblings and parents, especially to those families when parents did not foresee the negative effects.

Strengths and limitations

It is a strength that ABIS is a large birth cohort including a general population. However, there are limitations of this study, as only those have answered who are especially interested in participating in ABIS which has the aim of prediction of Type 1 diabetes and investigating genetic and environmental factors of importance for development of immunemediated diseases. This minority (3228/17055) can be expected to be more positive to screening than the part of the ABIS population who had dropped out. On the other hand, the answers from this report were given around 2010, when there was less knowledge of possible interventions to prevent the disease, which might influence the attitudes. We have not asked about the attitude to screening when the available intervention is burdensome, and means adverse events and risks. Furthermore, the answers represent attitudes in Sweden, with a very high incidence of Type 1 diabetes in children, and the results should be generalized to other countries and populations with caution.

Conclusions

Large scale screening for risk of developing clinically manifest Type 1 diabetes has become a burning question. Our study should be interpreted with caution, but shows that large proportions of a general population of parents are not prepared to let their children participate in such screening. The attitude was less positive the higher education the parents have, and less positive when the question deals with their own child. Children aged 10-13 years were more positive, but parents do not expect the children to decide whether they should be screened or not. In families where

somebody already has T1D, the attitude was more positive, and it is reasonable to concentrate screening to these families until there are safe interventions, simple for both children, parents and health care. When large scale screening is introduced, it is important to be able to offer psychological support.

Disclosure

Conflicts of interest: There is no conflict of interest for any of the authors.

Data availability: Data can be received from the corresponding author on reasonable request after ethical approval.

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Author contributions: JL had the idea, designed and created ABIS, got the funding, acquired all data, designed this study, interpreted the results of the statistical analyses, wrote the first draft of the manuscript. NS made the statistical analyses, and produced tables and figures. Both approved the final manuscript.

Highlights

- Screening for developing type 1 diabetes (T1D stage 3) may decrease DKA
- Screening of general population cause psychological problems
- Only half of parents in the general population wanted their child to be screened
- Parents with T1D in the family were slightly more positive to screening (61.0 %)
- Children aged 10-13 years were positive to screening.

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