Parental Reactions to Information About Increased Genetic Risk of Type 1 Diabetes Mellitus in Infants

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Objective: To assess the anxiety, emotions, thoughts, and coping behaviors of parents 1 week after they receive the results of screening of their infant’s genetic risk of type 1 diabetes mellitus.

Design: Survey.

Setting: The population-based Type 1 Diabetes Prediction and Prevention project conducted in Turku.

Participants: Parents of 443 consecutive high-risk infants and 506 next-born low-risk infants.

Interventions: An infant’s genetic risk of type 1 diabetes mellitus was measured from cord blood. High-risk information was delivered by telephone and low-risk information by mail 4 weeks later.

Main Outcome Measures: Anxiety measured using the state anxiety scale of the State-Trait Anxiety Inventory and Prevention project conducted in Turku.

Results: One week after obtaining the results, 67% of mothers and 63% of fathers of high-risk children and 58% of mothers and 54% of fathers of low-risk children had returned the questionnaire. Anxiety levels of parents of high-risk infants were similar to those of parents of low-risk infants (P=.86). More than 90% of the parents thought that it was good to know about the risk. Fifty-five percent of mothers and 37% of fathers of high-risk infants expressed modest worry. Increased anxiety was connected with other stressful life events, catastrophizing thoughts of diabetes mellitus risk, and emotion-focused or avoiding coping attitudes.

Conclusions: Learning about their infant’s genetic diabetes mellitus risk induces only mild anxiety in most parents. Identifying the few parents with stronger anxiety helps focus intensified counseling.

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ADVANCED BIOTECHNOLOGY has made population-based genetic screening of several diseases possible. Although the prevention of type 1 diabetes mellitus (T1DM), a multifactorial, polygenic disease, remains a dream, screening for genetic risk combined with follow-up of high-risk individuals has been accepted to enhance our understanding of the etiopathogenesis of diabetes mellitus and to expedite the discovery of preventive measures. By nature, T1DM differs markedly from single-gene disorders commonly searched for in conventional infant screening. Information of increased T1DM risk received soon after a child’s birth may have a strong psychological impact on the family and the child. Most parents first react with anxiety or worry, but the intensity and duration of the psychological sequelae are likely to vary markedly.

Johnson and coworkers1,2 studied individuals at risk for T1DM because they had islet cell antibodies, which are regarded as immune markers of the disease. Such knowledge induced anxiety that dissipated to normal levels across time in islet cell autoantibody–positive individuals and their families. The impact of risk screening probably depends on the disease and its genetic features, the velocity of progression, the prognosis, the availability of prevention or treatment, the background of the family, and other factors.

In population-based genetic T1DM risk screening, at best, only approximately 75% of future cases are detected. Most individuals at risk never develop T1DM, and the family has to wait years to learn whether their child will develop β-cell autoimmunity as a marker of prediabetes. We have been conducting a population-based infant screening study for 11½ years to recognize children with genetic T1DM risk. We hypothesized that the parents will accept the risk information with tolerable anxiety and that high anxiety scores indicate recent exposure also to other stressful events. To test these hypotheses...
and explore the impact of screening, we assessed the anxiety, psychosocial reactions, and coping behaviors of parents who had just learned that their infant is at genetic risk and compared these findings with those from families who had just learned that their infant has no increased risk.

**METHODS**

**PROCEDURE**

The population-based Type 1 Diabetes Prediction and Prevention project was launched in Turku on November 7, 1994, and was soon expanded to Oulu and Tampere. The risk and protective HLA-DQ gene alleles of newborns are analyzed in cord blood, and children at genetic risk are observed for islet-specific autoimmunity and T1DM. The project is expected to identify 70% of the children who will develop T1DM before 15 years of age. Although the T1DM risk before this age in Finland is 0.75%, the risk in at-risk children varies from 3% to 7% according to the genotype. This project comprises a double-blind, placebo-controlled trial evaluating the efficacy of nasal insulin therapy in T1DM prevention.

The ethics committee of Turku University Hospital approved the study. The parents were asked before postpartum hospital discharge whether they wanted their infant’s genetic T1DM risk assessed. The sample was analyzed only after the parents had received information about T1DM and the study and had consented to the screening. Only 1.4% of the families refused.

Parents of infants at genetic risk (“high-risk parents”) received the risk information by telephone 4 weeks after the child’s birth. The parents were offered a counseling appointment with a study physician to discuss the risk and potential follow-up within a few days of the telephone call. The “low-risk parents” were informed of the result by mail. The letter also reminded the parents that not all children who will develop T1DM are found by screening, and it described the symptoms and signs of T1DM. The physician delivered the questionnaire to the mother and father of the high-risk infant and asked them to return it by mail within a week. The questionnaires were completed when the infant was aged 1 to 1 1/2 months, and the parents had been aware of the risk for 1 to 2 weeks. In most families, the mother and father both attended the counseling. For each high-risk infant, the parents of the next-born infant without T1DM risk were approached via mail requesting that they also complete similar questionnaires and return them within a week.

**PARTICIPANTS**

The study group comprised the parents of infants born at Turku University Hospital between April 13, 1995, and June 12, 1996, who had defined HLA-DQ risk alleles. Altogether, 523 high-risk infants were identified; 88.5% of the families with a high-risk infant attended the counseling session, and 84.7% (n = 443) continued in follow-up. They were the high-risk parents of the present study, whereas the low-risk parents were those whose infant was born in the same hospital, was screened next after the high-risk child, but was found not to be at high risk for T1DM (n = 506).

**MEASUREMENTS**

**Social Readjustment Scale**

Ten events from the Social Readjustment Scale of Holmes and Rahe were selected to establish a stress sum variable for rating parents’ stressful life events in the preceding year. Although widely used, this shortened scale remains to be validated.

**State-Trait Anxiety Inventory**

This standardized measure was used to collect information on the parents’ anxiety level. The State-Trait Anxiety Inventory (STAI) comprises self-report scales for 2 anxiety concepts in healthy adults: state anxiety (A-State) and trait anxiety. We used the A-State scale, which refers to a transitory emotional state or condition characterized by subjective, consciously perceived feelings of tension and apprehension and increased autonomic nervous system activity. It consists of 20 statements that indicate how the individual feels at a particular moment. The scales were scored as directed in the manual. The reliability coefficients for the A-State scale have ranged from 0.83 to 0.92 and are typically higher under psychological stress. Our data led to a Cronbach coefficient of 0.94 for high-risk parents and 0.92 for low-risk parents. The validity of the STAI A-State scale has been previously documented.

**Parents’ Feelings, Thoughts, and Behaviors**

The emotional reactions, thoughts, and coping strategies of parents of high-risk children were assessed using questions designed for this study within the framework of the Lazarus and Folkman stress theory. Low-risk parents were asked what they thought about screening for genetic illnesses and how they supposed such information would affect parents. Questions concerning emotions were based on the 15 different emotions identified by Lazarus. Questions about coping behavior were drawn from a standardized measure, the Ways of Coping checklist, but they were formulated to fit the situation of the study. The questions represented the 8 factors found in a previous factor analytic study: confrontational coping, distancing, self-control, seeking social support, accepting responsibility, escape-avoidance, planned problem solving, and positive reappraisal. The participants indicated on a 4-point Likert scale the extent to which each stave was involved. A possibility to answer “I don’t know” was also included.

**STATISTICAL ANALYSIS**

The data were analyzed using a software program (SAS; SAS Institute Inc, Cary, NC). Unanswered items and “I don’t know” answers were removed and analyzed separately, resulting in a slight variation in the number of observations. Analysis of variance was applied to compare data between the groups. The χ² test was used to compare the distributions of classified variables between the 2 groups, and the 2-tailed t test was used to compare the group means.

**RESULTS**

A total of 67.3% of mothers and 63.0% of fathers of high-risk infants and 57.5% of mothers and 54.0% of fathers of low-risk infants returned the questionnaires. The ages of the parents and the incidence of diabetes mellitus in the family in the 2 groups did not differ between those who returned or did not return the questionnaire. Those who did not return the questionnaire had a lower education level and more children than those who returned the questionnaire (P < .01 for both). The number of children in the family, the sex of the infant, and the age, ba-
sics education, or vocational education of the parents did not differ between high- and low-risk families (Table).

PARENTS OF AT-RISK INFANTS IN FOLLOW-UP VS THOSE WHO LEFT THE STUDY

Eighteen families attended the counseling and returned the questionnaires but did not join the follow-up. The STAI A-State measure showed no difference in the anxiety scores between parents who continued in the study and those who did not ($P = .14$). The mean (SD) anxiety score of mothers of high-risk children who did not continue in the study was 36.4 (11.8), and that of fathers was 36.1 (9.6). However, parents of high-risk children who did not continue in the study had higher stress sum scores than those who continued ($P < .001$), and they were also younger ($P = .04$).

### Table. Characteristics of Families of Infants at Increased Genetic Risk for Type 1 Diabetes Mellitus (High-Risk Infants) and of Infants Without Such Increased Risk (Low-Risk Infants)*

<table>
<thead>
<tr>
<th></th>
<th>With High-Risk Infants</th>
<th>With Low-Risk Infants</th>
</tr>
</thead>
<tbody>
<tr>
<td>Families, No.</td>
<td>519-554† 513-552†</td>
<td></td>
</tr>
<tr>
<td>Parental age, mean (SD), y</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Mother</td>
<td>29.0 (4.6)</td>
<td>29.3 (4.6)</td>
</tr>
<tr>
<td>Father</td>
<td>30.9 (6.4)</td>
<td>31.6 (5.5)</td>
</tr>
<tr>
<td>Basic education, %‡</td>
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<tr>
<td>1</td>
<td>1.1</td>
<td>0.6</td>
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<tr>
<td>2</td>
<td>38.7</td>
<td>40.8</td>
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<tr>
<td>3</td>
<td>6.1</td>
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<tr>
<td>4</td>
<td>54.1</td>
<td>53.4</td>
</tr>
<tr>
<td>Vocational education, %§</td>
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<td></td>
</tr>
<tr>
<td>1</td>
<td>7.9</td>
<td>7.2</td>
</tr>
<tr>
<td>2</td>
<td>27.6</td>
<td>28.5</td>
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<tr>
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<td>14.8</td>
<td>14.0</td>
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<tr>
<td>5</td>
<td>9.4</td>
<td>8.5</td>
</tr>
<tr>
<td>6</td>
<td>15.4</td>
<td>18.8</td>
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<td>Sex of the infant, %</td>
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<td></td>
</tr>
<tr>
<td>M</td>
<td>52.8</td>
<td>53.3</td>
</tr>
<tr>
<td>F</td>
<td>47.2</td>
<td>46.7</td>
</tr>
<tr>
<td>No. of children in the family, %</td>
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<td></td>
</tr>
<tr>
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<td>43.5</td>
<td>44.0</td>
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<td>2</td>
<td>36.2</td>
<td>36.2</td>
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<tr>
<td>3</td>
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<td>14.0</td>
</tr>
<tr>
<td>4</td>
<td>4.2</td>
<td>5.8</td>
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<tr>
<td>Stress sum score, mean (SD)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Mother</td>
<td>9.3 (5.6)</td>
<td>8.9 (4.6)</td>
</tr>
<tr>
<td>Father</td>
<td>7.9 (4.6)</td>
<td>7.9 (4.8)</td>
</tr>
</tbody>
</table>

*All differences in means and distributions are nonsignificant.
†The number varies because the background information of 35 families was incomplete.
‡Scale: 1 = less than comprehensive school, 2 = comprehensive school, 3 = part of upper secondary school, and 4 = upper secondary school.
§Scale: 1 = no vocational education, 2 = vocational school or course, 3 = upper secondary-level vocational qualification, 4 = postsecondary-level vocational qualification, 5 = academic studies without degree, and 6 = academic degree.
||Stress index: the sum of experienced stress caused by the birth of the infant, divorce, unemployment, illness or accident, death of a loved one, or any problems with social relations, alcohol, mental health, economy, or something else.

PARENTS OF HIGH-RISK INFANTS VS PARENTS OF LOW-RISK INFANTS

Social Readjustment Rating Scale

The stress sum score did not differ between high- and low-risk parents ($P = .61$ by analysis of variance).

A-State Scale

The standardized STAI A-State measure showed no difference in the scores between high- and low-risk parents 1 to 2 weeks after they had learned about their infant’s screening results. The mean (SD) anxiety scores of mothers ($n = 291$) and fathers ($n = 272$) of high-risk infants were 34.9 (11.4) and 32.1 (9.0), respectively, and those of mothers ($n = 290$) and fathers ($n = 266$) of low-risk children were 33.9 (9.0) and 32.3 (8.9), respectively ($P = .86$ by analysis of variance). Similarly, no difference was observed when high-risk mothers were compared with low-risk mothers and high-risk fathers with low-risk fathers (Figure). However, high-risk mothers showed higher anxiety than high-risk fathers ($P < .001$), and the same sex difference was seen when low-risk mothers and fathers were compared ($P < .01$).

Parents’ Thoughts

Ninety-two percent of high-risk mothers (96% of low-risk mothers; $P = .01$ by χ² test) and 95% of high-risk...
fathers (95% of low-risk fathers) thought that it was good to know about the infant’s T1DM risk. Most parents were satisfied with the fact that their child had participated in the screening, but the rate of satisfaction was lower in high-risk mothers (88%) and fathers (89%) than in low-risk mothers (98%) and fathers (96%) (P < .001 by χ² test for both). Ninety-six percent of low-risk mothers and fathers stated that they would have continued in the study if their infant had had increased risk. When parents were asked to estimate the risk of the infant, a larger proportion of parents of high-risk infants than of low-risk infants considered the actual T1DM risk to be small (high-risk vs low-risk mothers: 83% vs 66%; high-risk vs low-risk fathers: 87% vs 64%; P < .001 for both). Low-risk parents more likely believed that knowing about the child’s risk would make the parents overprotective (high-risk vs low-risk mothers: 8% vs 17%; high-risk vs low-risk fathers: 14% vs 28%; P < .001 for both).

MOTHERS VS FATHERS OF HIGH-RISK INFANTS

Feelings and Behaviors of Mothers and Fathers of High-Risk Infants

Although the A-State scores of high- and low-risk parents did not differ, many high-risk parents expressed negative emotions, most commonly worry (mothers, 55%; fathers, 37%). Mothers were more worried than fathers (P < .001 by χ² test). Of the mothers, 30%, 25%, and 24% had felt depressed, shocked, and helpless, respectively, and the respective percentages of fathers were 12%, 12%, and 12% (P < .001 for the difference between the sexes in all tests). However, 64% of the mothers (64% of the fathers) reported that they were happy because the study offered hope that T1DM can be prevented some day.

The most common way for high-risk parents to cope with the news about their infant’s risk status was to seek social support from the spouse. More than 90% of the parents had discussed the infant’s risk with the spouse. Mothers (85%) discussed the matter with other relatives or friends more often than fathers (59%) (P < .001). Most mothers (64%) and fathers (61%) had also been thinking about how the risk is going to affect the future life of their child, and more than half of the mothers and fathers (56% and 52%, respectively) decided to do everything they can to prevent T1DM. Mothers had cried more often than fathers (10% vs 1%), and fathers had decided to keep feelings to themselves more often than mothers (14% vs 10%) (P < .001 for both).

Anxious vs Nonanxious Parents of High-Risk Infants

Mothers and fathers of high-risk children were then classified as anxious or nonanxious. Owing to the lack of STAI norms for Finland, the parents were classified using the mean + 1.5 SD STAI A-State score as the lower limit for the anxious group (score ≥ 47 for 17% of the mothers; score ≥ 46 for 8% of the fathers). Parents with scores below these values were considered nonanxious. The mean (SD) anxiety score of anxious mothers was 55.3 (7.7) and of anxious fathers was 53.5 (5.8).

Scores of anxious and nonanxious parents of high-risk infants showed an association with the amount of stress they reported having experienced lately. The higher stress sum score of anxious vs nonanxious parents was not explained by differences in age, education or vocational education of the parents, number of children in the family, prevalence of T1DM among family members, or the infant’s sex (P < .001). When anxious and nonanxious parents of low-risk infants were compared, the findings were similar, and anxiety scores showed an association with stress sum scores (P < .001).

The thoughts of anxious parents could be defined as catastrophizing. They felt more often than nonanxious parents that they were losing control of their life, that their infant already had T1DM, and that the chances of the infant getting T1DM were very high (P < .001 for the difference between the 2 groups of mothers and the 2 groups of fathers). Anxious parents also thought more often than nonanxious parents that the information they had received makes parents overprotective (P < .001 for mothers and for fathers). The coping behavior of anxious parents was more emotion-focused or avoiding than that of nonanxious parents, and they also cried and felt angry more often (P < .001 for both features in mothers and fathers). Furthermore, they more often developed substitute activities and hoped that the screening result would be incorrect (P < .001 for mothers and for fathers). A larger proportion of anxious than nonanxious parents also began to look after their infant more carefully once they had heard of the risk (P < .01 for mothers and P < .001 for fathers). Anxious fathers reported more often than nonanxious fathers that they did not tell others about their feelings (P < .001).

COMMENT

These data suggest that learning about increased T1DM risk of the infant through a telephone call and in a subsequent counseling session does not induce serious parental anxiety according to a standardized anxiety questionnaire when studied at the child’s age of 1 to 1 1/2 months, 1 to 2 weeks after the parents had heard of the risk and discussed its implications with a physician. However, more than half of the mothers and a third of the fathers of high-risk children felt worried, and one quarter of the mothers reported depressive feelings, shock, or helplessness. Mothers of high-risk children reported more positive and negative feelings than fathers.

In studies regarding single-gene disorders, such as cystic fibrosis, anxiety in pregnant women associated with information of being a carrier disappeared when their male partners had negative test results, and the carriers reported no anxiety 6 months later. Also, screening for Tay-Sachs disease carriers among high school students resulted in anxiety among the carriers, but 1 year later anxiety levels of carriers and noncarriers showed no difference. After genetic testing for Huntington chorea, most people experienced major emotional distress, but no severe psychiatric responses were observed. However, in Sweden, neonatal screening for α₁-antitrypsin deficiency was discontinued because of negative psychologi-
The parents reported immediate and long-lasting worrying, anxiety, and fear, which were still recognizable after 5 to 7 years. Prenatal detection of a serious fetal defect always induced traumatic reactions in parents, but parents coped with the news using similar strategies as parents in the present study.

The impact of information concerning the genetic risk of Huntington chorea, Tay-Sachs disease, or cystic fibrosis differs from this study because the risk can be expressed accurately, in some cases with 100% certainty. In contrast to studies of carriers of some monogenic diseases, information regarding the T1DM risk of the infant induced no more than modest anxiety in parents. Because data on parental anxiety after testing for genetic T1DM risk in infants are scanty, the present findings are important for T1DM prediction and prevention programs. Bennett Johnson and Tercyak interviewed by telephone older children and adults soon after they had been told that they were islet cell autoantibody positive but had not met with a physician to discuss the implications of the results in detail. The participants also completed the A-State questionnaire, and they were asked to respond to the questions about diabetes mellitus risk. In the present study, parents returned the questionnaire by mail after they had met with the study physician and learned that the child's absolute risk of developing T1DM before age 15 years was 3% to 7%, a risk 4 to 10 times higher than that in the background population but still rather small.

Almost all the parents of children with or without increased T1DM risk thought that it was good to be aware of the child's risk and were happy that they took part in the study. These data support the findings suggesting that the attitude of the general population in Finland is favorable toward genetic screening.

Parents of high-risk children believed that the child's actual risk of getting T1DM was smaller than what parents of low-risk children thought of the risk of high-risk children. Parents of low-risk children also more commonly believed that the infant's risk of T1DM would increase parental overprotectiveness. However, parents of high-risk children had received risk information and counseling to a different extent. Furthermore, low-risk parents were asked to answer the questions as they believed they would answer if they had an infant at risk.

Parents of diabetic children regard T1DM as a less serious disease than parents of unaffected children. Close acquaintance with a disease changes one's view of its severity, suggesting that proper information about the risk of multifactorial diseases may alleviate the overly pessimistic opinion of the risk.

Mothers of high-risk children used more emotion-focused coping than fathers, who used more avoiding. These sex-associated strategies may partly explain the higher anxiety scores of mothers, as mothers probably more readily reveal their emotions. The most common coping behavior of parents was to seek social support from the spouse, and more than half of the parents decided to do everything they can to prevent T1DM. This tendency to try some means of T1DM prevention has to be taken into account in T1DM prediction and prevention trials.

High anxiety scores were linked with existing life stresses rather than with the information of the infant's T1DM risk per se. Anxiety was also associated with catastrophizing thoughts of the infant's T1DM risk and emotion-focused coping strategies. According to the stress theory of Lazarus, the outcome of the evaluative first phase of coping, the appraisal phase, makes the person respond to stress with certain coping strategies and also affects the emotions evoked in that situation. Individuals who thought that the new situation was a catastrophe mainly used emotion-focused coping strategies and were prone to high anxiety scores. Because the anxiety levels of the parents, including symptoms of postpartum depression, remain unknown from the time before they learned about the child's risk, the possibility exists that parents who were more anxious beforehand were more prone to find the situation catastrophic, leading often to passive coping strategies.

A brief anxiety assessment when a pediatrician or a nurse meets with the parents of a child with increased disease risk is likely to help identify those most in need of assistance in coping with the risk information. Cognitive behavioral therapy has also shown long-term promise in such circumstances. The different ways mothers and fathers react should also be remembered, and fathers should probably be encouraged to accompany mothers to the appointments.

Although we think that the key findings of this study are generalizable, some limitations may exist. Among others, the participating families may not entirely represent the general population, although the number of families recruited was reasonably large and the enrollment rate was excellent. The participating families were all from Finland, with a closely similar cultural background, living circumstances, and features of mentality, which differ from those in other countries. Finally, the T1DM incidence is markedly higher in Finland than in other countries, suggesting that the disease may be better known in Finland than elsewhere. Because screening for genetic T1DM risk has recently been initiated in many countries, we should soon know whether the findings of this study are valid in other populations as well.

In conclusion, the results of this study suggest that the infant's genetic T1DM risk information does not lead to differences in anxiety levels between parents of high- and low-risk infants. However, reactions such as worrying and depressive feelings do occur, and they have to be assessed when the long-term impact of screening on the families is evaluated. As the at-risk children in this study grow older, it also becomes possible to analyze the children's own views and feelings about having been screened as a newborn. The general population also needs to be informed about the nature of screening of genetic risk for multifactorial diseases to prevent unnecessary labeling of individuals at risk and to decrease information-induced unnecessary worries in the family.

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**REFERENCES**


“I was 1 of 6 children, and when you travel in a pack like that, your early memories of your father all involve discipline. For the longest time, my dad was simply a black-haired arm reaching into the backseat of the car to grab one of us.”

—Conan O’Brien discussing fatherhood