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ORIGINAL PAPER

Impact of maternal anxiety level on the childhood vaccination coverage

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Abstract The mother's mental state as a risk factor for the children's vaccination status in developing countries has received little attention. The aim of this study was to determine the association between childhood vaccination coverage and maternal anxiety. A total of 195 consecutive infants and their mothers attending a tertiary teaching hospital, department of pediatric outpatient center between January 2008 and September 2009 were included in the study. One hundred five infants who have incomplete vaccination schedule (according to the National Immunization Schedule) were matched with 90 controls (fully vaccinated) and their mothers self-report measure of anxiety level using the State-Trait Anxiety Inventory (STAI), a psychiatric screening instrument. The chi-square test and the logistic regression were used in the statistical analysis. High maternal anxiety levels determined by STAI was associated with increased risk of incomplete vaccination status in infants (odds ratio 4.35, 95% confidence interval 1.87–8.79).This association remained significant after controlling for socio-demographic factors. High maternal anxiety scores may result in incomplete vaccination status in children younger than 3 years.

Keywords Maternal anxiety · Infant vaccination · Coverage · Smoking

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Introduction

The prevention of childhood infectious disease through immunization is one of the most cost-effective public interventions in use in developing countries. High vaccination coverage is important in control and elimination of vaccine-preventable disease in childhood. In Turkey, the Expanded Program of Immunization (EPI) aims for 95% coverage for each antigen and complete vaccination schedules for 90% of children 1 year of age [18]. Although the coverage of all vaccines in our country is increased especially in the last 10 years, EPI targets have not been achieved yet [12, 17]. Nonetheless, the reasons for incomplete vaccination and non-update of immunization are poorly understood.

In developing countries, the mother is the central figure in child survival programs [7]. She is expected to initiate preventive measures such as breastfeeding, weaning, and immunization. If the child is unwell, the mother is expected to recognize the illness, provide care, and implement the treatment. Clearly, the mother's mental state is an important determinant of how well she is able to perform these functions. There is substantial research evidence indicating the potentially negative impact of the birth of baby on a

mother's physical and mental health [4, 9]. In developing countries, the mother's mental state as a risk factor for the children's vaccination status has received little attention [14]. However, the association between a mother's anxiety level and her pattern of seeking vaccination coverage for her children has not been previously been examined. This study aims to determine the association between mother's anxiety level and her action of seeking vaccination for her child younger than 3 years.

Methods

Study design

A cross-sectional survey was conducted at the Vakif Gureba Hospital, a major tertiary hospital located in urban Istanbul, between January 2008 and September 2009. The completeness and correctness of child's vaccination schedules were checked according to the National Vaccination Schedule (NVS). The recommended NVS includes the following: one dose of Bacillus Calmette-Guérin (BCG), three doses of hepatitis B, four doses of oral poliovirus, diphtheria pertussis tetanus, one dose of measles mumps rubella (MMR), and four dose of Haemophilus influenza type b. Vaccine charts that had been officially filled out with information about the vaccines were considered. Verbal information about vaccines that were not recorded in the vaccination charts was also included to improve the validity of vaccination coverage estimates. Childrens vaccination status is accepted as completely vaccinated if he/ she has had full age-appropriate vaccines according to the NVS. Participants involved in the study completed a brief and structured questionnaire: including some sociodemographic characteristics (maternal education level, maternal age, family income, number of siblings, maternal cigarette smoking, birthplace of infants, place of residence, and child's full vaccination history). The place of residence was classified as urban or rural and provides a population breakdown by villages, towns, and cities. Also, the child's vaccination dates, number of doses, and dates of other visit to the health facility were obtained from official vaccination charts. After obtaining information about vaccination status, we compared anxiety levels of mothers whose children have complete vaccination (controls) with those of mothers whose children have incomplete vaccination according to the age-appropriate vaccination schedule (case group).

Study population and sampling

Mothers with children younger than 3 years, who have official vaccination chart and are attending to the pediatric outpatient clinic for simple disease (anemia, upper respiratory tract infection, urinary tract infection, and preoperative examination for elective surgery, i.e., inguinal hernia and adenoidectomy), were included in the study. Mothers (or any other member of the family, e.g., father or siblings) with chronic diseases and those with history of use of psychotrophic medications and history of any disease negatively affecting their mental state in the past 1 year were not included in the study. Informed consent was obtained from the mothers after explaining the aims of the study. After the submission of written informed consent, the vaccination chart information and measurement of anxiety level of the mothers were subsequently obtained. The study protocol was approved by the Vakif Gureba Hospital's ethics committee.

Measurement of mothers' anxiety level

State-Trait Anxiety Inventory (STAI) was developed in 1970 by Spielberg et al. [16] and adapted to Turkish people by Oner and Compte [13]. This scale is the one that is self-done by the individual. It consists of two subscales, each consisting of 20 items. Subgroup 1: State-Trait Anxiety Inventory defines how an individual feels at a certain moment and in certain conditions. Subgroup 2: continuous anxiety inventory defines how an individual feels generally regardless of the state and conditions of the moment. Scores from both scales range between 20 and 80. Higher scores indicate higher levels of anxiety. Cutoff point for validity safety in Turkey has been determined as 36. Points equal to or above 60 indicate a high level of anxiety.

Data analyses

The data were analyzed using the STATA 7 statistical package (Stata Corp., 2001, TX, USA). The seven potential confounding variables were dichotomized on the basis of a priori criteria: (1) maternal education level, (2) family income, (3) number of siblings, (4) maternal age, (5) gender of infant, (6) maternal smoking, and (7) place of residence.

Odds ratio (OR) was used to compare differences between case and controls. Stratified analysis to test for individual confounders was performed using the Mantel-Haenszel chi-square test. Results from different strata are combined in a Mantel-Haenszel adjusted OR by calculating a pooled summary estimate to remove confounding caused by variables for stratification. To investigate relative importance of the variables in relation to the dependent factors and any confounding between them, they were fitted. The simultaneous effects of mothers' anxiety level and some sociodemographic factors on the vaccination status of the infant were analyzed using logistic regression analysis. A P value of less than 0.05 or OR with a 95%

confidence interval (CI) that did not include 1.00 was considered significant.

Results

A total of 195 subjects (105 cases and 90 controls) were enrolled in the study. The mean age of the cases (15.67 months, ±SD=1.14) and controls (16.56 months, ±SD=0.98) was similar. The gender distribution was uniform, with 55% of cases and 52% of controls were male. The prevalence of high anxiety level (STAI score of 60 or more) in the study group of mothers was higher (62%) than that of the controls, although high cutoff point was used. At this cutoff score, the STAI has a positive predictive value, which means that a high proportion of these mothers suffered from mental distress. Our results also showed that mothers' high anxiety scores were also associated with child's incomplete vaccination status (OR=4.35, 95% CI=1.87–8.79). Table 1 show that 65% of the mothers in the study group had high anxiety levels as measured by the STAI, compared with only 25% of the controls. The rate of smoking status of mothers was 75% in the cases and 15% in the controls, OR=4.6 (95% CI=1.3–18.7). There was no statistical difference between the controls and cases for the following sociodemographic variables: mother's age, educational level, family income, place of residence, number of siblings, and gender of children (Table 1).

Distribution of the frequency missed vaccines in the study groups are as follows: BCG in 45 children, one dose of DTP in 26 children, and MMR in 24 children, and ten children had more than one vaccine missed as identified in their immunization schedule.

In bivarite analysis, there was no statistical association with vaccination status and gender of child, maternal education level, place of residence, number of siblings, family income, and maternal smoking (data were not shown). Although the stratum-specific OR seems to differ, these differences (i.e., as indicator of effect modification or interaction) are not statistically significant. However, this may result from the small number in some of the strata.

Table 1 Crude odds ratio (OR) of the association between vaccination status of infants and risk factors

Category	Cases (incomplete vaccination) n=105 n (%)	Controls (full vaccination) n=90 n (%)	OR	95% CI	p
Mother's anxiety score (STAI)					
≥60	65 (62)	24 (26)	4.35	1.87–8.79	0.001
<60	40 (38)	66 (73)			
Maternal smoking					
Yes	79 (75)	22 (25)	4.7	1.4–18.6	0.001
No	26 (25)	68 (75)			
Family income					
≥350€	36 (34)	52 (64)	1.7	0.8–5.8	0.22
<340€	69 (66)	32 (36)			
Mother's education (year)					
<5 years	15 (14)	13 (14)	0.7	0.3–1.9	0.56
6–8 year	72 (68)	63 (70)			
>8 years	18 (17)	14 (16)			
Mother's age					
≥30	24(23)	19(24)	0.7	0.3–1.5	0.86
<30	81(77)	69(76)			
Place of residence					
Urban	16 (15)	12 (13)	0.2	0.07–0.46	0.52
Rural	89 (85)	78 (87)			
Number of siblings					
None					0.35
1	33 (22)	29 (32)	0.8	0.4–1.5	
2+	72 (68)	61 (68)			
Gender of infant					
Female	47 (45)	43 (48)	0.9	0.5–1.6	0.75
Male	58 (55)	47 (52)			

To study the combined effects of these variables on the risk of having an incomplete vaccination in children, a logistic regression model was constructed. In this analysis, only those variables that had a significant effect in the univariate analysis were included in the model. These include maternal anxiety level, maternal smoking, maternal education level, and number of siblings. Family income also was included because associaton was present, although not statistically significant. Table 2 shows that the fully adjusted OR of 3.2 (95% CI=1.4–6.8) for mother's anxiety level (although less than the crude OR of 4.35 calculated by univariate analysis) was still statistically significant ($p<0.05$). The only other factor that was statistically significant at 95% level was maternal smoking (OR 4.2, 95% CI=1.2–16.3).

Discussion

The main finding of this study is that high level of maternal anxiety levels is associated with the risk of incomplete vaccination status of children younger than 3 years. When interpreting these results, however, it must be born in mind that this study is cross-sectional in nature. It is therefore not possible to establish a straightforward cause-effect relationship or direction of the association. The data used in our study were obtained by interviewing mothers who attended the pediatric outpatient clinic in a large hospital for simple diseases. For this reason, our results cannot be generalized because of this selective data-gathering mechanism, which may be another limitation of our study.

Few studies have assessed the relationship between maternal mental health and maternal use of health services and preventive practices, that is, infants' vaccination, for their children [5, 19]. This study assessed the relationship between maternal anxiety level and children's vaccination status among women living in a metropolitan city, Istanbul, Turkey. Our hypothesis was that high maternal anxiety level negatively influences infants' vaccination status. In support of our hypothesis, we found that mothers with high anxiety level were more likely to have incomplete vaccination of their infant. Infants of mothers with high anxiety scores were nearly four times more likely to have incomplete child's vaccination status than were infants of mothers with low anxiety scores. According to our results, no sociodemographic variable except maternal cigarette smoking was related to whether the children were vaccinated fully. There was no evidence to support that child gender had any impact on vaccine uptake or in defining incomplete vaccination in our study area. In some societies with cultural discrimination against female children, boys have a greater chance to be vaccinated [10]. Also, the age of mothers was not seen to be associated with the vaccination status. In some studies, both younger [1] and older mothers [15] have been reported to be associated with incomplete vaccination.

The low education level of mothers has been previously associated with low infant vaccination uptake [2, 3]. In the present study, the educational level of mothers was not strongly associated with vaccination status of infants. All the vaccines included in the NVS are provided free of charge in the primary health services all over Turkey. For this reason, we cannot find a significant association between monthly family income and vaccination status of children. In fact, Anand and Bärnighausen recently showed that, consistent with our results, the level of income does not contribute toward improved immunization coverage [3]. According to our results, place of residence did not have an effect on the child's vaccination status. This showed that the primary health service or clinics were well distributed across the city. Our study also showed that mothers with high anxiety scores were also more likely to have a cigarette smoking status than were mothers without high anxiety scores. This finding was consistent with some studies [11, 20]. Interestingly, our results also showed that there was a significant association between maternal smoking status and incomplete vaccination status of children. Children of mothers with cigarette smoking were four times more likely to have incomplete vaccination status in the first 3 years of life than were children of mother with no history of cigarette smoking. According to this finding, maternal smoking may be a predictor for estimating incomplete vaccination status of children younger than 3 years. One hypothesis for this finding is that smoking serves as a signal for an underlying risk preference of mothers. Mothers who smoke are putting not only their health but also their children's health at risk.

Childhood vaccination cannot be separated from the broader social context of the individuals involved, particularly if strategies for effecting change are to be implemented at both individual and public health policy level.

Table 2 Estimates of simultaneous effect of mother's anxiety level, maternal smoking, family income, number of siblings, and maternal education level on the vaccination status of children (through logistic regression)

	Odds ratio	95% CI	*P* value
Mother's anxiety level	3.2	1.4–6.8	<0.05
Maternal smoking	4.2	1.4–14.6	<0.05
Family income	1.5	0.7–3.8	0.356
Number of siblings	1.4	0.96–3.6	0.347
Maternal education level	1.6	0.95–2.93	0.256

Our study also showed some implications concerning the effectiveness of EPI in developing countries. The impact of these programs must include functional capacity of mothers, their receptivity to the vaccination messages, and uptake of intervention offered. Addressing the mental well being of mothers, which has been shown to be possible in the primary care setting could not only reduce the burden of disease in women but also impact upon morbidity and mortality rates from vaccine-preventable diseases in their children [6, 8].

There are likely to be complex interaction between factors in the child's social and economic environment, home environment, mother, and the child. While the interaction between these factors may be important than any one individual risk factors, our results suggest that anxiety of the mother is a strong predictor of whether the child becomes immunized. In our study, we did not determine the reason for incomplete vaccination status of the children in the case group; therefore, it is difficult to say to what extent the incomplete vaccination were preventable or related only to the mothers' anxiety level. Because of this, it is not evident whether the anxiety and low coverage are cause and effect or are independently linked to a common precursor such as poverty. Further population-based studies of a longitudinal nature are required to clarify the precise nature of this potentially important association.

Healthcare professionals who provide child care, that is, pediatricians, family physicians, and primary health providers, have an obligation to control infants' vaccination status. The concept of measuring a mother's anxiety level to predict if she might fail to have her child immunized may be seen impractical, but at the pediatric outpatient setting, pediatricians can play a role in detecting signs of poor mental health of mothers who have children with incomplete vaccination status and can serve as advocates for their patients or refer to them to mental healthcare providers.

In conclusion, the only significant factor found between the cases and controls in our study were not a structural, economic, or demographic factor but a psychological one—the anxiety level of the mother. The mothers of children who have incomplete vaccination schedule were experiencing a high anxiety status. Our study provides additional evidence that maternal anxiety level has negative effects on child's vaccination status as an important preventive health measure for their children. Additional studies are needed to determine why children of mothers with high anxiety scores are more likely to have incomplete vaccination than children of mothers with normal anxiety scores.

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