Denver Developmental Test Findings and their Relationship with Sociodemographic Variables in a Large Community Sample of 0–4-Year-Old Children

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ABSTRACT

Introduction: The aim of this study was to investigate the prevalence of developmental problems and relationship with sociodemographic variables in a community sample of young children.

Methods: Participants included 1000 children (558 males, 442 females, age range 1–48 months, mean 18.4 months, SD 7.8 months). Children were referred generally by their parents for developmental evaluation and consultation in response to a public announcement in a district area in İstanbul, Turkey. An interview form and the Denver Developmental Screening Test II (DDST) were used for sociodemographic data and developmental evaluation. The χ^2 test and Pearson's correlation test were used for data analysis.

Results: Seven hundred forty-one out of 1000 children (74.1%) had normal, 140 (14%) had risky, and 119 (11.9%) had abnormal findings on

the DDST results. The probability of abnormal findings on the DDST results was significantly higher in males ($p=0.003$), the 2–4-year-old group ($p<0.05$), families with more than one child ($p=0.001$), consanguineous marriages ($p<0.01$), low parental educational levels and low household income ($p<0.01$), and in children without a history of breastfeeding ($p=0.000$). Immigration status and delivery mode did not have a significant effect on the probability of abnormal findings on the DDST results ($p>0.05$).

Conclusion: Sociodemographic factors have a noteworthy impact on development. Determining these factors is important especially during the first years of life.

Keywords: Children, development, Denver, sociodemographic factors

INTRODUCTION

Early childhood is an important stage for developmental milestones of motor, social-emotional, cognitive, and language skills. Many factors affect these skills leading to a wide range of developmental problems. The early recognition of developmental problems is fundamental for timely intervention (1,2,3); however, it was reported that only 30% of children with developmental problems are identified before they begin school in a community-based study (4). Therefore, identifying the potential factors and interactions among these factors that influence early developmental skills become more significant during this period of life.

Several studies examining the risks related to the development of preschool children have demonstrated a range of biological and environmental risk factors. Factors such as gender, age, number of siblings, gestational and maternal age at birth, household income, parental education level, birth weight, and breast feeding were found to have a substantial impact on early development during childhood. In a sample of 398 children aged 0-12 months, Cunha et al. (5) found that a developmental delay is associated with lower family income, gestational age less than 38 weeks, mother's age and education level, and use of drugs. Veleza et al. (6) reported similar findings associated with a delay in children's development in their study in the same country.

There are few national studies on the development of early childhood in other developing countries. Stunting, inadequate cognitive stimulation, severe poverty, and iodine and iron deficiency were identified as risk factors detrimentally affecting the children under the age of 5 years based on studies supported by UNICEF (7,8).

Despite increasing data on the developmental outcome of early childhood in the world, the number of related studies in our country is inadequate. Ozkan et al. (9) found that risk factors including low-level parental education level and household income, ≥ 3 children in the family, low birth weight and premature birth, and gestational age and maternal age at birth <20 years were associated with abnormal development. They stated that socioeconomic risk factors have the same importance levels as biological risk factors in the development of preschool children.

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Because many studies have demonstrated the negative effects of social and economic deprivation on children, developmental screening is crucially needed to ascertain children with developmental problems early in life. The aim of the present study is to investigate the prevalence of developmental problems and its relationship with sociodemographic features in a large community sample of 0-4-year-old children. We hypothesized that infants, toddlers, or young children with developmental problems would have more frequent psychosocial adversities.

METHODS

Study Site and Subjects

This study was conducted between March 2008 and December 2010 in the Psychosocial Support Center for Families, Women and Disabled (AKDEM) located in Zeytinburnu district in the city center of Istanbul. This center was founded and supported by the Zeytinburnu Municipality Administration. One of the aims of this center is to conduct research on screening and recognizing early developmental problems in very young children. The subjects in this study were randomly recruited among infants, toddlers, or preschoolers who were 0-4-years old and born between 2005 and 2010. The overall number of live births between 2005 and 2010 in Zeytinburnu district was 5795. One thousand children from this total population (17.2%; 1000/5795) were included in the study. Children whose parents did not accept to participate in the study and children with vision or hearing impairment were excluded.

Instruments

Interview form: This form was developed by the authors to assess the sociodemographic features of the subjects and families such as age, gender, mode of delivery, and history of breast feeding of the subjects, and parental education level, consanguinity, number of children per family, household income, and immigration status. Consanguinity is defined as the union of individuals having a common ancestor; and here it was categorized as first, second, and third degree in terms of subtypes of cousin marriages. Monthly household income was evaluated in two categories as below or above the minimum wage of our country (978 Turkish liras, which is equal to 550 US dollars). Minimum wage is the minimum amount of salary for an unqualified employee that is officially determined by the government.

Denver Developmental Screening Test II: The Denver Developmental Screening Test II (DDST) is used to screen children's development. Four areas (fine motor, gross motor, personal-social, and language) of functioning were assessed. It consists of 125 items, and the development of a child is measured based on these 125 items. The test usually takes 10-20 min to perform, and the child is classified as within normal range, suspect, or delayed based on the test results. The Turkish version of DDST was used in this study (10).

Statistical Analysis

The parents of subjects who referred to AKDEM were informed about the study. Parents who accepted to take part in the study were interviewed. During the initial interview, they were asked for sociodemographic and developmental information about their children. After the evaluation of descriptive knowledge, DDST was applied to examine the developmental levels of children. Developmental assessment in all subjects was conducted by an experienced psychologist.

Statistical analysis of the results was conducted using Statistical Package for the Social Sciences (SPSS Inc., Chicago, IL, USA). Fisher's Exact χ^2 test and Pearson's correlation test were used for data analysis, and $p < 0.05$ was

accepted to be statistically significant. The odds ratio (OR) and 95% confidence interval (CI) for each independent variable were also calculated.

RESULTS

Sociodemographics

The study sample comprised 1000 children aged 1-48 months (18.4 ± 7.8 months; 558 males, 55.8%; 442 females, 44.2%). Moreover, 13.1% of the parents had a consanguineous marriage, and there were two or more children in 49.3% of the families. Both parents had only primary school education in 38.3% of the subjects, whereas both parents had a university degree in 10.3% of the subjects. In total, 46.8% of the participating families were considered as immigrants, and 29.7% of families had a household income lower than the minimum wage. Furthermore, 56.3% of the children were born via cesarean section, and 3.2% of the children had no history of breast feeding. The ages of mothers ranged from 17 to 46 years (29.9 ± 5.2) and of fathers ranged from 21 to 57 years (33.7 ± 5.4). Table 1 shows the sociodemographic characteristics for children and parents.

DDST Results

In regard to developmental assessment, 741 out of the 1000 subjects (74.1%) had normal, 140 (14%) had risky, and 119 (11.9%) had abnormal findings on the DDST results. Table 2 shows the DDST results with all four domains.

The probability of suspect and abnormal findings on the DDST results in males was significantly higher than that in females (OR, 1.71; 95% CI, 1.14-2.57; $p = 0.003$). When the children were grouped according to age (0-2 and 2-4 years), the abnormal findings were significantly higher in the 2-4-year age group than those in the 0-2-year age group ($p < 0.05$). As compared with the children having no siblings, the probability of abnormal findings on the DDST results was significantly higher in children with one or more siblings (OR, 1.99; 95% CI, 1.33-2.97; $p = 0.001$). There was a meaningful correlation between the degrees of consanguinity and DDST results ($p < 0.01$). The abnormal percentages of DDST findings for third, second, and first degree consanguinity were 11.1%, 20.3% and 25.0%, respectively. A significant correlation was also found in parental education level and household income. The abnormal findings on the DDST results decrease when parental education levels and household income increase ($p < 0.01$). The probability of abnormal findings on the DDST results in children with a history of breast feeding was significantly lower than in those without a history of breast feeding (OR, 0.25; 95% CI, 0.12-0.55; $p = 0.000$). Immigration status and delivery mode did not have a significant effect on the probability of abnormal finding on the DDST results ($p > 0.05$). A Kruskal-Wallis test did not reveal significant associations between the mother or fathers' age and DDST results ($p = 0.508$ or $p = 0.610$). Table 3 summarizes the statistical relationship between all sociodemographic variables and general DDST results.

DISCUSSION

The present findings demonstrate that sociodemographic factors have a noteworthy impact on the development of young children. According to the findings of this study, factors such as gender, age, number of children in the family, consanguineous marriage, parental education level, household income, and history of breast feeding were found to affect early childhood development, whereas immigration status and delivery mode did not have a significant effect on the developmental parameters.

Males were more likely to have suspect and abnormal findings on the DDST results compared with those in females in the study. There have been different reports about the effect of gender on development in li- 181

Table 1. Sociodemographic data for children and parents

	n	%
Sex		
Female	442	44.2
Male	558	55.8
Age (months)		
0-12	201	20.1
12-24	272	27.2
24-36	346	34.6
36-48	181	18.1
Number of children per family		
1	507	50.7
2	346	34.6
3	138	13.8
4 or more	9	0.9
Consanguinity		
First degree	36	3.6
Second degree	59	5.9
Third degree	36	3.6
None	869	86.9
Immigration status		
Present	468	46.8
None	532	53.2
Parental education level		
Both primary	383	38.3
High school (at least one of them)	514	51.4
Both university	103	10.3
Household income		
<Minimum wage	297	29.7
>Minimum wage	703	70.3
Mode of delivery		
Normal	437	43.7
Cesarean section	563	56.3
History of breast feeding		
No	32	3.2
Yes	968	96.8

terature. Brito et al. (11) found that male gender is associated with cognitive and neuromotor delays in preschoolers, whereas Ozkan et al. (9) demonstrated that there are no differences between genders in regard to DDST results of children aged between 3 and 60 months. It is well known that developmental disorders are more common in males, but it is unclear whether the effect of gender in the study may be attributed to this finding.

Older children (aged 2-4 years) had a higher percentage of abnormal findings on the DDST results compared with those in younger children (aged 0-2 years). This is probably because of the administration of DDST items as there are more items being administered to older children than in with

Table 2. Denver Developmental Screening Test results

DDST	Normal (n, %)	Risky (n, %)	Abnormal (n, %)
Total score	741 (74.1)	140 (14.0)	119 (11.9)
Language skills	786 (78.6)	106 (10.6)	108 (10.8)
Personal-social skills	933 (93.3)	27 (2.7)	40 (4.0)
Fine motor skills	923 (92.3)	31 (3.1)	46 (4.6)
Gross motor skills	930 (93.0)	32 (3.2)	38 (3.8)
DDST: Denver Developmental Screening Test			

younger ones. Brito et al. (11) also reported that preschool children have a higher abnormal developmental performance on DDST as they were getting older in their study.

One-third of the parents had only primary school education, and the low educational level of parents was found to be associated with abnormal findings on the DDST results in this study. Maternal education is considered to be an important factor in child development in previous studies (9,10,12). Studies showed that mothers with low education level have difficulties in stimulating their children because of inadequate intellectual resources, leading to poor developmental attainment in those children (10,12). It has also been suggested that targeted interventions can increase the child's intellectual development (13,14). Although earlier studies emphasized the importance of maternal education level, the present study observed that parental (both maternal and paternal) education level was also an important factor for child development. The probability of abnormal findings on the DDST results in children whose parents were both primary school graduates was 2.4-fold greater than in those whose parents were post-primary school graduates.

Approximately 30% of the families had an income below the minimum wage. In their study on the investigation of early development, Lugo-Gil et al. (15) found that children's performance on language outcomes and academic achievement are indirectly affected by economic resources and socioeconomic status. Similar to other studies emphasizing low family income as a risk factor on early development, the present study also demonstrated that the lower the household income was, the higher was the abnormality on development.

Furthermore, Abubakar et al. (16) reported that mother's gravidity increases the risk of poor developmental outcome in subsequent children. Similarly, this study observed that the probability of abnormal findings on the DDST results in children from families with ≥ 2 children was approximately 2-fold greater than in those from families with one child. Therefore, clinicians should tend to be more aware about the increased risk of a family with low household income or low education level or more than two children and should also aim to increase the developmental levels of risky children with screening and intervention programs.

Consanguineous marriages may increase the risk of some genetic-inherited diseases and mental retardation (17). The study findings showed that the consanguinity degree of parents negatively affected the developmental levels of children. First degree consanguineous marriages were mostly associated with the abnormal findings on the DDST results. Because there is no adequate data explaining the relationship between consanguinity and early development in literature, it is not possible to compare the findings in the present study.

The present study indicated that the rate of abnormal findings on the DDST results was significantly higher in children without a history of breast milk

Table 3. Comparison of Denver Developmental Screening Test results in regard to sociodemographic variables

Variables	Normal (n, %)	Abnormal (n, %)	Risky (n, %)	p
Sex				
Female	351 (79.4)	41 (9.3)	50 (11.3)	0.003*
Male	390 (69.9)	78 (14.0)	90 (16.1)	
Total	741 (74.1)	119 (11.9)	140 (14.0)	
Age groups				
0–2 years	391 (94.2)	24 (5.8)		0.000*
2–4 years	350 (78.7)	95 (21.3)		
Number of children				
1	406 (90.0)	45 (10.0)		0.001*
2 or more	335 (81.9)	74 (18.1)		
Consanguinity				
First degree	16 (44.4)	9 (25.0)	11 (30.6)	0.000**
Second degree	35 (59.3)	12 (20.3)	12 (20.3)	
Third degree	28 (77.8)	4 (11.1)	4 (11.1)	
None	662 (76.2)	94 (10.8)	113 (13.0)	
Parental education level				
Primary school	249 (65.0)	63 (16.5)	71 (18.5)	0.000**
High school	406 (78.9)	51 (9.9)	57 (11.0)	
University	86 (83.5)	5 (4.9)	12 (11.7)	
Household income				
<Minimum wage	179 (60.2)	60 (20.2)	58 (19.5)	0.000**
>Minimum wage	562 (79.9)	59 (8.3)	82 (11.6)	
History of breast feeding				
No	19 (63.3)	11 (36.7)		0.000*
Yes	722 (87.0)	108 (13.0)		

* χ^2 test: $p < 0.05$, 95% CI

**Pearson's correlation test: $p < 0.01$

intake. Breast feeding seems to be a positive protective factor for early development. Many studies suggest developmental and intellectual advantages of breast feeding (18,19). An inversely related association between breast-feeding duration and developmental delay was also reported (20). The relationship found in this study is consistent with these findings in literature. Therefore mothers should be encouraged to give breast milk to their children, and such health policies are needed to take into account and improve this relationship, particularly in developing countries.

The two factors, immigration status and delivery mode, were found to not have a significant effect on the DDST results. Data about the effect of immigration or ethnicity on the development of children is controversial (21,22). A longitudinal population-based study found that maternal immigration status is associated with poor developmental attainment in preschool children (12). The immigration status or ethnicity described in this study differs from other studies in some respects. The immigrant mothers were not from other countries, and they only emigrated from other cities, from particular from the eastern regions of the country to the western regions. However, the lifestyles of the eastern and western

regions of our country have distinctions in some ways. Moreover, some of the immigrant mothers were also officials assigned from different regions of the country. In light of these, no statistically significant result was found between immigration status and the DDST results in the present study.

On the other hand, mode of delivery (cesarean section or vaginal delivery) seems to not be associated with the abnormal findings on the DDST results in the present study. Similarly, Khadem et al. (23) demonstrated that there was no significant difference between the IQ scores of children with cesarean delivery and natural vaginal delivery in their cross-sectional study. However, cesarean section was found to provide lower morbidity and better prognosis for the long-term outcome in neurodevelopment in extremely low birth weight infants in a follow-up study (24). However, literature in this area emphasizes the relative significance of risk factors for developmental problems. Biological factors begin to have less importance, and psychosocial factors become more important (12). It should be kept in mind that many risk factors, including biological, social, and environmental, are found to be responsible for the etiology of developmental impairment in young children. Therefore, determining the risk factors that are important for development in young children during the first years of life and early intervention for the development of children at risk and optimal allocation of limited resources are essential.

The present study may have several limitations that should be addressed. The study population may not represent the overall population. In addition, several possible confounding factors, such as biological causes of developmental problems, were not accurately addressed. This study is a cross-sectional study lacking longitudinal outcomes of these psycho-social adversities.

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