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Association of Possible Developmental Delays with Emotional and Behavioral Disorders, and Risk Factors in Children Under Six in Karachi, Pakistan: A Cross-sectional Study

Shumaila Shabbir[1*], Kauser Mahmood[2], Neelum Jamal[3], Gati Ara[4], Bina Fawad[5] and Shabina Salahuddin[3]

[1]Department of Community Health Sciences, Fazaia Ruth Pfau Medical College, Ziauddin Medical College, Karachi, Pakistan
[2]Department of Neurology, Fazaia Ruth Pfau Medical College, Karachi, Pakistan
[3]Department of Community Health Sciences, Fazaia Ruth Pfau Medical College, Karachi, Pakistan
[4]Department of Community Health Sciences, Dow University of Health Sciences, Karachi, Pakistan
[5]Department of Community Health Sciences, Ziauddin Medical College, Karachi, Pakistan

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***Corresponding Author:**
Shumaila Shabbir
Department of Community Health Sciences, Fazaia Ruth Pfau Medical College, Ziauddin Medical College, Karachi, Pakistan
ahmedshumaila12@gmail.com

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ABSTRACT

Developmental delays refer to a child not reaching expected milestones. They are linked to various factors and, if unaddressed in early childhood, can lead to long-term consequences in adulthood. **Objectives:** To determine the association of developmental delays with emotional and behavioural disorders and other risk factors in children less than six years of age. **Methods:** This cross-sectional study was conducted at a primary healthcare center in a Karachi slum from October 2020 to July 2021. Using non-probability consecutive sampling, 425 participants (parents of children aged 1-5½ years) were selected. Data were collected using the validated Survey of Well-being of Young Children tool and analyzed in SPSS version 23.0. Logistic regression assessed associations between outcomes and risk factors. **Results:** Of 425 participants, 161 (37.9%) had possible developmental delays. No association was found with emotional/behavioural disorders (p=0.30). Binary logistic regression linked delays to male gender, uneducated parents, unemployed mothers, low income, domestic violence, and tobacco/drug exposure at home (p<0.05). After adjustment, significant associations remained with the mother's education (aOR=1.785, CI: 1.040-3.065, p=0.036), income (aOR=3.361, CI: 1.197-9.434, p=0.021), and domestic violence (aOR=2.603, CI: 1.055-6.423, p=0.027). **Conclusions:** It was concluded that the prevalence of developmental delays in slum-dwelling children is high. No association was found with emotional/behavioural disorders. Socioeconomic factors, such as the mother's education.

INTRODUCTION

Developmental delays refer to the lag in the progression of speech and language skills, motor abilities, social-emotional growth, and cognitive development [1]. Such delays occur when a child does not achieve developmental milestones at the anticipated age across any areas of functioning [2]. The increased prevalence of such delays is linked to factors such as poverty, health issues, violence, malnutrition, inadequate care and stimulation, and limited growth opportunities [3]. Around 25% of the children are suffering from developmental delays globally. The prevalence of suspected developmental delay varies from 10% in Europe and Central Asia to 42% in West and Central Africa [4]. A study conducted at primary health care in South Africa found that the prevalence of possible developmental delays in children living in slums is around 35% [5]. A multicenter study carried out in Pakistan found that 61.1% of children less than five years' old who are suffering from malnutrition have delayed global

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development [6]. Another study conducted in a developed urban area of Pakistan reported a prevalence of developmental delays in 29.1% of the participants [7]. Unfortunately, despite such high prevalence, Pakistani parents exhibit a significantly limited understanding of developmental milestones [8]. Earlier detection of developmental delay in children through a validated, parent-completed questionnaire and identification of risk factors is critical for primary health care where their growth and development can be monitored regularly [1]. Timely referral to rehabilitation services may help improve children's quality of life and it is essential for promoting children's well-being [9]. There remains a lack of data on the neurodevelopment of children living in slums in Pakistan. Additionally, the factors contributing to developmental delays and their interrelationships have been rarely explored.

This study aims to evaluate the prevalence of possible developmental delays and their predictors in children under six. This study aims to fill the gap in knowledge regarding developmental delays in children in Pakistan.

METHODS

This cross-sectional study was conducted at the Primary Health Care (PHC) Centre in Gulshan e Sikandrabad in Karachi, Pakistan, from October 2020 to July 2021. Before commencing the fieldwork, ethics clearance was obtained from the Ethical Review Committee, Ziauddin University, Karachi (Reference code: 2270620SSCHS). Before the data collection process, informed consent was obtained from each participant through a signature or thumbprint. Participants were provided with a detailed explanation of the study's purpose, procedures, potential risks, and benefits, as well as their rights to confidentiality and voluntary participation. They were also informed that they could withdraw from the study at any point without any consequences. Non-probability consecutive sampling technique was used to recruit participants. Children of one year to less than six years of age with or without any ailment (e.g. infectious diseases like diarrhea, respiratory tract infections, skin diseases, etc.) visiting PHC with their parents were included in the study. Those with any known mental health issues or gross motor disability were excluded from the study. The sample size was calculated through the software open epi (version 3) with a 95% confidence level, 10% margin of error, and an anticipated frequency of 61.6% [6]. A total of 425 participants were enrolled in the study. Direct one-to-one interviews were conducted with the parents of the recruited participants. Before the interview, parents were briefed about the study, and their written consent was obtained before proceeding. Data were collected through a validated questionnaire, freely available online, called the Survey of Wellbeing of Young Children (SWYC) available in the English language. This tool is specifically designed for administration in Primary Health Centers (PHCs). It consists of four components: (1) SWYC milestones for assessing possible developmental delays, (2) the Baby Pediatric Symptoms Checklist (BPSC) and the Preschool Pediatric Symptoms Checklist (PPSC) for evaluating the risk of emotional and behavioural disorders (EBDs), (3) Parent's Observation of Social Interaction (POSI) for screening of autism and (4) family-related questions. Developmental milestones were assessed using a 10-item scale with a 3-point Likert system: "Not Yet" (0), "Somewhat" (1), and "Very Much" (2). The total score was calculated by summing all items and interpreted based on age-specific cutoffs provided in the questionnaire manual. Children were categorized as either "Needs Review," indicating possible developmental delays, or "Appears to Meet Age Expectations." Emotional and behavioural disorders (EBDs) were evaluated through the Baby Pediatric Symptoms Checklist (BPSC) for children aged 12–15 months. This included three subscales with four items each, scored on a 3-point Likert scale: "Not at All" (0), "Somewhat" (1), and "Very Much" (2). A score of 3 or higher on any subscale indicated a risk of EBDs, necessitating expert evaluation. For children aged 16–66 months, the Preschool Pediatric Symptoms Checklist (PPSC) was used, which consisted of 18 items across three subscales. A score of 9 or higher on any subscale suggests a risk of EBDs. Substance use disorder was screened using three questions, with "Yes" scored as 1 and "No" as 0. A score of 1 or higher indicated substance abuse among family members. Food insecurity was assessed by scoring "never" as 0, "sometimes" as 1, and "often" as 2. A score of 1 or 2 indicated food insecurity. Maternal depression was evaluated through two questions on a 4-point Likert scale, with a total score of 3 or higher suggesting depression. Domestic violence was screened using the Woman Abuse Screening Tool (WAST), where a score of 1 or higher indicated its presence. This study included questions related to developmental delays, emotional and behavioural disorders and family questions. The scoring of questions to assess the risk of developmental delays, emotional and behavioural disorders, and other risk factors was conducted according to the guidelines provided by the author on the website [10]. Data were entered and analyzed using SPSS version 23.0. For demographic variables, frequencies and percentages were calculated. Univariable binary logistic regression was computed to assess the association of predictor variables with the risk of developmental delays. Multivariable logistic regression was performed to see the combined effect of the predictor variables on the outcome. A p-value<0.05 was considered significant.

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RESULTS

In total, 425 children were recruited. The same number of children (i.e., 85) were included in each age bracket. Among the participants, 226 (53.2%) were male, and 199 (46.8%) were female. Regarding family structure, 173 (40.7%) children belonged to nuclear families, while the remaining 252 (59.3%) lived in joint or extended families. Among fathers, 116 (27.3%) were uneducated, while the remaining had at least primary education. Compared to fathers, more mothers were uneducated, 189 (44.5%). The majority of the fathers worked as daily wage laborers (201 (47.3%)), while the majority of the mothers were homemakers (323 (76%)). Among all the children, 161 (37.9%) screened positive for possible developmental delay. Other demographic factors are shown in Table 1.

Table 1: Socio-Demographic Characteristics of the Study Group

Variables	Categories	n (%)
Age	1 To 2 Years	85 (20%)
	2 To 3 Years	85 (20%)
	3 To 4 Years	85 (20%)
	4 To 5 Years	85 (20%)
	5 To 5½ Years	85 (20%)
Gender	Male	226 (53.2%)
	Female	199 (46.8%)
Family Structure	Nuclear	173 (40.7%)
	Joint/Extended	252 (59.3%)
Marriage	Cousin	260 (61.2%)
	Non-cousin	165 (38.8%)
Father's Education	Uneducated	116 (27.3%)
	Primary	67 (15.8%%)
	Secondary	72 (16.9%)
	Matric	135 (31.8%)
	Intermediate	13 (3.1%)
	Graduate/Postgraduate	6 (1.4%)
	Madrassa	16 (3.8%)
Mother's Education	Uneducated	189 (44.5%)
	Primary	80 (18.8%)
	Secondary	39 (9.2%)
	Matric	54 (12.7%)
	Intermediate	5 (1.2%)
	Graduate/Postgraduate	3 (0.7%)
	Madrassa	55 (12.9%)
Father's Occupation	Daily Wager	201 (47.3%)
	Private Employment	149 (35.1%)
	Personnel Business	42 (9.9%)
	Government Employment	6 (1.4%)
	Jobless	23 (5.4%)
Mother's Occupation	Home Maker	323 (76.0%)
	House Maids	67 (15.8%)
	Private Employees	27 (6.4%)
	Personnel Business	3 (0.7%)
	Government Employee	1 (0.2%)
Monthly Income (PKR)	5,000-10,000	63 (14.8%)
	11, 000-15,000	188 (44.2%)
	16,000-20,000	135 (31.8)
	21,000-25,000	22 (5.2)
	26,000-30,000	8 (1.9%)
	≥31,000	9 (2.1%)
Tobacco/Smokers at Home	Yes	101 (23.8%)
	No	324 (76.2%)
Food Insecurity	Yes	345 (81.2%)
	No	80 (18.8%)
Drug Abuser at Home	Yes	72 (16.9%)
	No	352 (82.8%)
Domestic Violence at Home	Yes	210 (49.4%)
	No	215 (50.6%)
Parents' Concern for Child's Development	Yes	29 (6.8%)
	No	396 (93.2%)
No. of Siblings	3 or Less	215 (50.5%)
	4 or More	210 (49.5%)
First Child vs Other Order	First Child	69 (16.2%)
	Not First Child	356 (83.7%)
School Going Status	Yes	44 (10.3%)
	No	381 (89.6%)
Depression in Mother	Yes	99 (23.3%)
	No	326 (76.7%)
Developmental Delays	Yes	161 (37.9%)
	No	264 (62.1%)

Binary logistic regression was performed to examine the relationship between developmental delay and various socio-demographic factors. Male gender, an uneducated father, an uneducated mother, an unemployed mother, low family income, domestic violence, and the presence of tobacco smoke and drug abuse at home showed a significant association with developmental delay in children ($p<0.05$). Other risk factors, i.e., possible emotional and behavioural disorders in the child, type of family, father's occupation, cousin marriage, child's birth order, number of siblings, number of people living in the house, child's school-going status, food security, and maternal depression, were not found to be statistically significant ($p\geq0.05$). Results are shown in Table 2.

Table 2: Uni-Variable Binary Logistic Regression Analysis of Factors Associated with Developmental Delays

Variables	Odds Ratio (OR)	95% Confidence Interval of OR	p-Value
Gender			
Female	Ref	-	0.008
Male	1.723	1.156-2.567	
Type of Family			
Nuclear	Ref	-	0.356
Joint	0.828	0.554-1.236	
Father's Education			
Educated	Ref	-	0.045
Uneducated	3.962	1.033-15.188	

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Mother's Education			
Uneducated	Ref	-	0.003
Educated	1.660	0.894-3.082	
Father's Occupation			
Employed	Ref	-	0.948
Unemployed	1.512	0.209-10.957	
Mother's Occupation			
Employed	Ref	-	0.044
Unemployed	1.637	1.013-2.647	
Monthly Income (PKR)			
More than 15000	Ref	-	0.015
Up to 15000	3.065	1.240-7.574	
Cousin Marriage			
No	Ref	-	0.259
Yes	1.263	0.842-1.895	
Number of Siblings			
4 or More	Ref	-	0.084
Up to 3	1.638	1.042-2.349	
Order of Child			
Other than first	Ref	-	0.096
First	1.097	0.984-1.224	
School Going			
Yes	Ref	-	0.565
No	1.161	0.621-2.207	
No. of People in House			
Up to 10	Ref	-	0.059
More Than 10	1.835	1.180-2.931	
Parents' Concern			
Yes	Ref	-	0.062
No	0.291	0.145-0.621	
Tobacco Smokers in the House			
Yes	Ref	-	0.001
No	0.478	0.304-0.752	
Substance Abuse in the House			
Yes	Ref	-	0.039
No	0.514	0.309-0.858	
Food Security			
Yes	Ref	-	0.938
No	1.020	0.617-1.686	
Depression in Mother			
No	Ref	-	0.723
Yes	1.087	0.685-1.724	
Domestic Violence			
Yes	Ref	-	0.024
No	0.645	0.324-0.833	
Emotional and Behavioral Disorder			
No	Ref	-	0.301
Yes	0.811	0.545-1.207	

After adjusting for confounding factors, a significant association was found between possible developmental delays and the mother's education (aOR: 1.785, 95% CI: 1.040-3.065, p=0.036), monthly income (aOR: 3.361, 95% CI: 1.197-9.434, p=0.021), and domestic violence (aOR: 2.603, 95% CI: 1.055-6.423, p=0.027). The risk of developmental delays among children witnessing domestic violence is doubled. Children whose parents' income is less than Rs. 15,000 have a threefold risk of experiencing developmental delays. Only statistically significant values are shown in Table 3.

Table 3: Multivariable Analysis of Risk Factors for Developmental Delays

Variables	Adjusted Odd's Ratio (OR)	95% Confidence Interval of OR	p-Value
Mother Education			
Educated	Ref	-	0.036
Uneducated	1.785	1.040-3.065	
Monthly Income			
More Than 15000	Ref	-	0.021
Joint	3.361	1.197-9.434	
Domestic Violence			
Educated	Ref	-	0.027
Uneducated	2.603	1.055-6.423	

DISCUSSION

This study aimed to screen children living in slums for possible developmental delays and identify the associated factors. Current analysis revealed that around 37.9% of children under six years of age had possible developmental delays and required further assessment to confirm the diagnosis. This aligns with the findings of a meta-analysis, which found that between 38% and 49% of children experience developmental delays globally [11]. Developmental delays are more common among male as compared to female. Many national and international studies have found a statistically significant relationship between male gender and developmental delays. Males are found to have higher odds of developmental delays as compared to female ($p<0.05$) [12, 13]. Current study also found that male were more likely to have developmental delays. (OR: 1.723, 95% CI: 1.156-2.567, p=0.008). Socioeconomic status, measured by parental education, occupation, and family income, strongly predicts children's developmental outcomes [14]. The father's social status and education level also affect the development of children. Research studying the influence of a father's education level on child development found a positive association between the two factors ($\beta=0.93$, $t=3.12$, $p<0.01$)[15]. Present study found the same results showing that fathers of developmentally delayed children were less educated. (OR: 3.962, 95% CI: 1.033-15.188, p=0.045). A mother's education is also important to a child's early development. A study conducted to find the association of mothers' education on a child's development after controlling confounding factors found that children of less educated mothers had higher odds of developmental delays [16]. Another study showed that mothers of higher levels of education had lower levels of developmental delays in their children compared to the lower education

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groups [6]. Analysis of current study is consistent with these results. Even after adjusting for co-factors the association remained significant (OR: 1.660, 95% CI: 0.894-3.082, p=0.003) (aOR: 1.785, 95% CI: 1.040-3.065, p=0.036). A family's socioeconomic status and income directly affect the child's developmental outcome. Low socioeconomic status is associated with a delayed or different developmental pattern [14]. Several studies support the fact that lower household income leads to poor growth and development in children (p<0.05) [10, 13]. Current study found the same association, i.e. the children whose families earned less than Rs.15000 per month had higher odds of developmental delays. These odds remained high even after adjusting for other determinants (OR: 3.065, 95% CI: 1.240-7.574, p=0.015) (aOR: 3.361, 95% CI: 1.197-9.434, p=0.021). Parents in cousin marriages share a higher percentage of genes that carry risks, leading to a significantly higher chance of genetic disorders in their offspring compared to children of unrelated parents. Cousin marriage has been considered one of the biggest risk factors for the developmental delay of children (p<0.05) [17, 18]. However, present study does not support the results. There was no significant association between cousin marriage and children's developmental delay. (OR: 1.263, 95% CI: 0.842-1.895, p=0.259). This lack of association was also observed in a study conducted in Pakistan among children up to 5 years of age (X^2=0.14, p=0.71) [13]. Exposure to tobacco smoke affects mental health and neurodevelopment in children (p<0.001) [19]. Even secondhand smoke exposure increases the likelihood of delayed milestone achievement across various domains [20]. Present study also discovered a positive association between a child's developmental delay and the presence of tobacco smoke in the house. Children living in homes without tobacco smoke had lower odds of developmental delays (OR: 0.478, 95% CI: 0.304-0.752, p=0.001). A study conducted to find the association of depression in mothers during and after pregnancy on the mental development of their children up to five years of age found a positive relation between depression in mothers and lower developmental outcomes in their children (p=0.04) [21]. Another study found that depression in mothers affected the subareas of development in their children (p=0.037) [22]. However, Current analysis contradicts these results, as present study showed no such relationship (p=0.723). A meta-analysis revealed that domestic violence is a distressing event within a family that impacts all its members, including children. Children who are at a critical stage of development are particularly vulnerable to disruptions caused by stress and developmental challenges. Domestic violence can disrupt a child's development, leading to psychological, social, and academic challenges [23]. Maternal trauma due to exposure to violence may play a significant role in the development of disorders in children [24]. Present analyses found higher odds of developmental delay in children who witnessed violence in their homes. This association remained significant even after adjusting for the co-determinants. (aOR: 2.603, 95% CI: 1.055-6.423, p=0.027). Addressing trauma resulting from domestic violence should be a shared responsibility among parents, teachers, and healthcare professionals to implement interventions that prevent more severe consequences [23]. Children with neurodevelopmental delays are more likely to have emotional and behavioural disorders compared to neuro-typical children. A study conducted to find the association between developmental delays and emotional and behavioural disorders found that children having developmental delays exhibited more emotional and behavioural difficulties (p<0.01) [25]. However, current study found no significant association between these two factors. (p=0.301). Current study also found no association between developmental delay and type of family, father's employment status, number of siblings, child's order, school-going status, number of people in the house, parents' concern, and food security. (p≥0.05).

CONCLUSIONS

It was concluded that the prevalence of possible developmental delays in children living in the slums is high. There was no association between developmental delays and emotional and behavioural disorders in children.

Authors Contribution

Conceptualization: SS[1]
Methodology: SS[1], KM, NJ, GA, BF, SS[2]
Formal analysis: SS[1], KM, NJ, GA, BF, SS[2]
Writing review and editing: SS[1], KM, NJ, GA, BF, Ss[2]
All authors have read and agreed to the published version of the manuscript

Conflicts of Interest

All the authors declare no conflict of interest.

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