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# PREVALENCE AND ASSOCIATED FACTORS OF DEVELOPMENTAL DELAYS AMONG CHILDREN UNDER FIVE YEARS OF AGE

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*Developmental Delay; Children Under Five; Child Development; Maternal Factors; Birth Weight; Prematurity; Nutritional Status; Pakistan.*

**Abstract**

***Background:*** *Developmental delay during early childhood can negatively affect children's learning, communication, social participation, and overall functioning. Early identification of developmental difficulties and associated risk factors is therefore important for timely intervention. This study aimed to determine the prevalence of developmental delays and identify associated factors among children under five years of age.*

***Methods:*** *A quantitative descriptive cross-sectional study was conducted among 160 children aged 0–59 months. Participants were selected using consecutive sampling from the selected healthcare facilities and communities. Data were collected using a structured questionnaire and age-appropriate developmental assessment, covering gross motor, fine motor, language, cognitive, and social/personal domains. Information regarding socio-demographic, maternal, child-related, birth-related, and nutritional factors was also collected. Data were analyzed using descriptive statistics, chi-square tests, and binary logistic regression. Statistical significance was set at $p < .05$.*

***Results:*** *Of the 160 children assessed, 36 (22.5%) had developmental delays, while 124 (77.5%) had no developmental delay. Language development showed the highest proportion of delay (20.0%), followed by cognitive (14.4%) and fine motor development (13.8%). Significant associations were found between developmental delay and maternal education ($p = .016$), socioeconomic status ($p = .026$), antenatal care ($p = .013$), birth complications ($p = .018$), breastfeeding practices ($p = .041$), maternal illness during pregnancy*

*(p = .023), low birth weight (p = .008), preterm birth (p = .004), NICU admission (p = .004), and nutritional status (p = .003). Logistic regression identified low maternal education (OR = 2.18, p = .022), inadequate antenatal care (OR = 2.48, p = .017), low birth weight (OR = 2.77, p = .015), preterm birth (OR = 3.13, p = .013), and poor nutritional status (OR = 2.36, p = .006) as significant predictors of developmental delay.*

***Conclusion:*** *Developmental delay was relatively common among the children assessed, with language development being the most frequently affected domain. Maternal education, antenatal care, birth outcomes, and nutritional status were important factors associated with developmental delay. Strengthening developmental screening, maternal and antenatal care, nutritional assessment, caregiver education, and early referral services may support earlier identification and management of developmental difficulties among young children.*

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**INTRODUCTION**

Early childhood is a critical period of rapid physical, cognitive, language, motor, social, and emotional development. Developmental delay occurs when a child does not achieve age-appropriate developmental skills within the expected period and may involve one or more domains, including gross motor, fine motor, language, cognitive, and social or personal development (Malik & Marwaha, 2018). Developmental difficulties are an important public health concern because they can affect learning, communication, social participation, and later educational and functional outcomes. The World Health Organization reported that developmental disabilities are common worldwide but remain inadequately identified and addressed, particularly in low- and middle-income countries (WHO, 2023).

Globally, developmental disabilities affect a substantial number of children, with the greatest burden occurring in low- and middle-income countries. The World Health Organization estimates that approximately 52.9 million children under five years have developmental disabilities, with the majority living in low- and middle-income countries (WHO, 2023). Poverty, inadequate nutrition, limited healthcare access, insufficient stimulation, maternal education, and adverse living conditions can increase children's vulnerability to developmental difficulties (Amoadu et al., 2024). Biological factors such as prematurity, low birth weight, neonatal complications, and childhood illness may also contribute to delayed development (Hunter et al., 2023).

Developmental status is multidimensional and includes gross motor, fine motor, language, cognitive, and social or personal development. Gross motor development involves activities such as sitting, standing, walking, and running, whereas fine motor development involves coordinated hand and finger movements (Gilpin et al., 2023). Language development includes understanding and expressing communication, while cognitive development involves learning, memory, and problem-solving (Levey, 2022). Social and personal development includes interaction, emotional responses, and age-appropriate self-care (Zhu et al., 2022). Therefore, comprehensive assessment across multiple domains is important for identifying children who may require further evaluation and intervention.

Previous research in Pakistan has demonstrated that developmental delays are associated with several nutritional, maternal, socioeconomic, and child-related factors. Saleem et al. (2021) reported a high prevalence of suspected global developmental delay among children aged 6–59 months with severe acute malnutrition in rural Pakistan. The study also identified younger age, non-exclusive breastfeeding, maternal education, household characteristics, and contact with tuberculosis-positive individuals as factors associated with developmental outcomes. (Saleem, et al., 2021).

Evidence from Punjab also indicates a relationship between children's nutritional and socioeconomic circumstances and their health outcomes. A population-based study of children under five years in Punjab reported substantial levels of underweight and found that socioeconomic and demographic characteristics were associated with children's nutritional status (Naveed & Shah, 2024). Similarly, national evidence

has demonstrated considerable nutritional problems among Pakistani children, with socioeconomic conditions contributing to differences in child nutritional status (Shahid et al., 2022). Since nutritional status can influence brain development and functioning, these findings highlight the importance of examining nutrition when investigating developmental delays.

Despite existing evidence, an important research gap remains. Much of the available Pakistani research has focused on selected high-risk populations, particularly children with severe acute malnutrition, rather than children under five years from the broader population (Hussain et al., 2022; Sand et al., 2018). Although research from Southern Punjab has provided valuable evidence, its findings cannot necessarily be generalized to all children under five years in Punjab (Saleem et al., 2021). Furthermore, The World Health Organization has highlighted the limited availability and geographical coverage of reliable developmental-disability data, particularly in low- and middle-income countries (WHO, 2023).

The research problem is therefore the limited local evidence regarding the prevalence of developmental delays among children under five years and the factors associated with these delays in Punjab, Pakistan. Although previous studies have demonstrated relationships between malnutrition, maternal education, breastfeeding, socioeconomic conditions, and developmental outcomes, limited evidence is available regarding the combined effects of these factors with birth-related characteristics such as birth weight, gestational age, and mode of delivery (Asif et al., 2022; Ullah et al., 2026). There is also a need to identify which factors independently predict developmental delays.

The rationale for the present study is based on the importance of early identification and intervention. The first five years provide an important opportunity to identify developmental difficulties and provide appropriate developmental stimulation, nutritional support, caregiver counselling, referral, and other interventions. Determining the prevalence of developmental delays and identifying associated factors can help healthcare professionals recognize children who require closer developmental monitoring and early intervention. The study is significant for nurses, pediatricians, community health workers, healthcare administrators, and policymakers because its findings may support improved developmental screening and early identification of children at risk. The results may also contribute to caregiver education, nutritional counselling, early referral, and planning of child-health services. Furthermore, identifying significant predictors may provide useful evidence for developing targeted preventive and early-intervention strategies in Punjab.

The present study, entitled "*Prevalence and Associated Factors of Developmental Delays among Children Under Five Years of Age*," assesses the prevalence of developmental delays, evaluates developmental status across major developmental domains, and examines the socio-demographic, maternal, child-related, birth-related, and nutritional factors associated with developmental delays. Accordingly, the study addresses the following objectives:

1. To determine the prevalence of developmental delays among children under five years of age.
2. To assess the developmental status of children under five years of age across different developmental domains, including gross motor, fine motor, language, cognitive, and social or personal development.
3. To identify the socio-demographic factors associated with developmental delays among children under five years of age.
4. To assess the association between selected maternal and child-related factors and developmental delays among children under five years of age.
5. To determine the relationship between birth-related factors, such as birth weight, gestational age, and mode of delivery, and developmental delays among children under five years of age.
6. To examine the association between nutritional status and developmental delays among children under five years of age.
7. To identify the factors that significantly predict developmental delays among children under five years of age.

**Methodology**

A cross-sectional study was conducted to determine the prevalence of developmental delays and identify associated factors among children under five years of age. The study was conducted at selected healthcare facilities in Punjab, Pakistan, over a seven-month period from October 2025 to April 2026. The study

population comprised children aged 0–59 months who presented at the selected healthcare facilities during the study period and met the predefined eligibility criteria.

Children aged 0–59 months whose parents or primary caregivers provided written informed consent were eligible for inclusion. Children older than 59 months, those with previously diagnosed severe neurological or genetic disorders that could substantially influence developmental assessment, those with serious acute illness at the time of assessment, those with incomplete information required for developmental evaluation, and those whose parents or primary caregivers declined participation were excluded from the study.

The required sample size was determined using the standard formula for estimating a single population proportion in a cross-sectional study, $n = Z^2pq/d^2$, where $n$ represents the required sample size, $Z$ represents the standard normal deviate corresponding to the selected confidence level, $p$ represents the anticipated prevalence, $q$ represents $1 - p$, and $d$ represents the desired margin of error. Based on the study requirements, a total of 160 children were included in the final sample. A consecutive sampling technique was employed, whereby eligible children presenting at the selected healthcare facilities during the data collection period were approached and enrolled until the predetermined sample size was attained.

Data were collected using a structured questionnaire, an age-appropriate standardized developmental screening instrument, and anthropometric assessment. The questionnaire collected information regarding socio-demographic characteristics, maternal factors, child-related characteristics, birth history, breastfeeding and complementary-feeding practices, recent illnesses, and nutritional factors. The developmental screening instrument assessed major developmental domains, including gross motor, fine motor, language, cognitive, and personal-social development, using age-specific items and predefined scoring criteria. Anthropometric measurements included weight and height or length, which were obtained using calibrated equipment and standardized measurement procedures. Weight-for-age, height/length-for-age, and weight-for-height/length were assessed according to WHO child growth standards to identify underweight, stunting, and wasting (Frankenburg et al., 1992).

Before commencement of data collection, ethical approval was obtained from the relevant institutional Ethics Review Committee, and permission to conduct the study was obtained from the authorities of the selected healthcare facilities. Parents or primary caregivers were informed about the purpose of the study, assessment procedures, voluntary nature of participation, potential benefits, and confidentiality of the information collected. Written informed consent was obtained before enrollment. Data collection was conducted in an appropriate and private setting to ensure the comfort of the child and caregiver. Unique identification codes were assigned to participants to maintain anonymity and confidentiality. The questionnaire and developmental assessment procedures were pretested among a small group of eligible children who were not included in the final sample. Data collectors were trained in participant recruitment, questionnaire administration, developmental screening, anthropometric measurements, and standardized recording procedures. Completed questionnaires and assessment forms were reviewed for completeness and consistency before data entry.

The collected data were coded, entered, cleaned, and analyzed using IBM SPSS Statistics. Frequencies and percentages were calculated for categorical variables and were used to determine the prevalence of developmental delays. Means and standard deviations were calculated for continuous variables where appropriate. The prevalence of developmental delay was expressed as the proportion of children identified with developmental delay among the total study population. The Pearson chi-square test was used to assess associations between developmental delay and categorical socio-demographic, maternal, child-related, birth-related, and nutritional factors. Binary logistic regression analysis was performed to identify factors independently associated with developmental delay, and adjusted odds ratios (AORs) with 95% confidence intervals (CIs) were reported. A $p$-value of $<0.05$ was considered statistically significant.

## Results

**Table 1. Prevalence of Developmental Delays among Children Under Five Years (n = 160)**

| Developmental status | n | % |
|---|---|---|
| No developmental delay | 124 | 77.5 |

| Developmental status | n | % |
|---|---|---|
| Developmental delay | 36 | 22.5 |
| Total | 160 | 100.0 |

Table 1 result shows that among the 160 children assessed, 124 (77.5%) had no developmental delay, while 36 (22.5%) were identified with developmental delay. Thus, nearly one-quarter of the children had some form of developmental delay.

**Table 2 Developmental Status Across Different Developmental Domains (n = 160)**

| Developmental domain | No delay n (%) | Delay n (%) |
|---|---|---|
| Gross motor | 143 (89.4) | 17 (10.6) |
| Fine motor | 138 (86.3) | 22 (13.8) |
| Language | 128 (80.0) | 32 (20.0) |
| Cognitive | 137 (85.6) | 23 (14.4) |
| Social/personal | 141 (88.1) | 19 (11.9) |

Table 2 result shows that language development had the highest proportion of delay, affecting 32 (20.0%) children, followed by cognitive development in 23 (14.4%) and fine motor development in 22 (13.8%) children. Social/personal and gross motor delays were observed in 19 (11.9%) and 17 (10.6%) children, respectively. This indicates that language development was the most frequently affected developmental domain.

**Table 3 Association Between Socio-Demographic Factors and Developmental Delay (n= 160)**

| Factor | Category | No delay n (%) | Delay n (%) | $\chi^2$ | df | p |
|---|---|---|---|---|---|---|
| Child's age | <2 years | 57 (83.8) | 11 (16.2) | 2.81 | 1 | .094 |
| | ≥2 years | 67 (72.8) | 25 (27.2) | | | |
| Gender | Male | 61 (76.3) | 19 (23.8) | 0.15 | 1 | .699 |
| | Female | 63 (78.8) | 17 (21.3) | | | |
| Residence | Urban | 78 (81.3) | 18 (18.8) | 3.34 | 1 | .068 |
| | Rural | 46 (71.9) | 18 (28.1) | | | |
| Mother's education | ≤Secondary | 48 (68.6) | 22 (31.4) | 5.82 | 1 | .016 |
| | >Secondary | 76 (84.4) | 14 (15.6) | | | |
| Socioeconomic status | Low | 40 (66.7) | 20 (33.3) | 7.29 | 2 | .026 |
| | Middle | 54 (81.8) | 12 (18.2) | | | |
| | High | 30 (88.2) | 4 (11.8) | | | |

Table 3 result shows that developmental delay was not significantly associated with child's age (p=.094), gender (p=.699), or residence (p=.068). However, significant associations were observed with maternal education (p=.016) and socioeconomic status (p=.026). Children of mothers with secondary or lower education had a higher proportion of developmental delay (31.4%) compared with those whose mothers had education above secondary level (15.6%). Similarly, developmental delay was more common among children from low socioeconomic-status families (33.3%) than among those from middle (18.2%) and high (11.8%) socioeconomic groups.

**Table 4 Association Between Maternal and Child-Related Factors and Developmental Delay (n= 160)**

| Factor | Category | No delay n (%) | Delay n (%) | $\chi^2$ | Df | p |
|---|---|---|---|---|---|---|
| maternal age | <30 years | 73 (80.2) | 18 (19.8) | 1.33 | 1 | .249 |
| | ≥30 years | 51 (73.9) | 18 (26.1) | | | |
| Antenatal care | Adequate | 91 (82.7) | 19 (17.3) | 6.21 | 1 | .013 |
| | Inadequate | 33 (66.0) | 17 (34.0) | | | |
| Birth complications | No | 104 (81.3) | 24 (18.8) | 5.61 | 1 | .018 |
| | Yes | 20 (62.5) | 12 (37.5) | | | |
| Breastfeeding | Exclusive ≥6 months | 83 (82.2) | 18 (17.8) | 4.17 | 1 | .041 |
| | <6 months/not exclusive | 41 (69.5) | 18 (30.5) | | | |
| Maternal illness during pregnancy | No | 107 (80.5) | 26 (19.5) | 5.17 | 1 | .023 |
| | Yes | 17 (63.0) | 10 (37.0) | | | |

Table 4 results show that maternal age was not significantly associated with developmental delay (p=.249). In contrast, significant associations were found for antenatal care (p=.013), birth complications (p=.018), breastfeeding practices (p=.041), and maternal illness during pregnancy (p=.023). Developmental delay was more frequent among children whose mothers had inadequate antenatal care (34.0%), experienced birth complications (37.5%), breastfed exclusively for less than six months or did not exclusively breastfeed (30.5%), or had illness during pregnancy (37.0%).

**Table 5 Association Between Birth-Related Factors and Developmental Delay (n = 160)**

| Factor | Category | No delay n (%) | Delay n (%) | $\chi^2$ | df | p |
|---|---|---|---|---|---|---|
| Birth weight | ≥2.5 kg | 108 (81.8) | 24 (18.2) | 7.05 | 1 | .008 |
| | <2.5 kg | 16 (57.1) | 12 (42.9) | | | |
| Gestational age | Term | 113 (81.3) | 26 (18.7) | 8.24 | 1 | .004 |
| | Preterm | 11 (52.4) | 10 (47.6) | | | |
| Mode of delivery | Vaginal | 73 (79.3) | 19 (20.7) | 0.38 | 1 | .538 |
| | Cesarean | 51 (75.0) | 17 (25.0) | | | |
| NICU admission | No | 112 (81.8) | 25 (18.2) | 8.31 | 1 | .004 |
| | Yes | 12 (52.2) | 11 (47.8) | | | |

Table 5 result shows that birth weight, gestational age, and NICU admission were significantly associated with developmental delay. Children with low birth weight had a higher proportion of developmental delay (42.9%) than those with birth weight ≥2.5 kg (18.2%; p=.008). Similarly, developmental delay was more common among preterm children (47.6%) than term children (18.7%; p=.004). NICU admission was also associated with a higher proportion of developmental delay (47.8% vs. 18.2%; p=.004). Mode of delivery was not significantly associated with developmental delay (p=.538).

**Table 6 Association Between Nutritional Status and Developmental Delay (n = 160)**

| Nutritional status | No delay n (%) | Delay n (%) | $\chi^2$ | df | p |
|---|---|---|---|---|---|
| Normal | 94 (85.5) | 16 (14.5) | 11.46 | 2 | .003 |
| Underweight | 22 (66.7) | 11 (33.3) | | | |
| Stunted | 8 (47.1) | 9 (52.9) | | | |

| Nutritional status | No delay n (%) | Delay n (%) | $\chi^2$ | df | p |
|---|---|---|---|---|---|
| Total | 124 (77.5) | 36 (22.5) | | | |

Table 6 results show that nutritional status was significantly associated with developmental delay (p=.003). Developmental delay was observed in 14.5% of children with normal nutritional status, compared with 33.3% of underweight children and 52.9% of stunted children. These findings indicated a higher proportion of developmental delay among children with poor nutritional status, particularly those who were stunted.

**Table 7 Logistic Regression Analysis of Factors Associated with Developmental Delay (n = 160)**

| Predictor | B | SE | Wald | OR | 95% CI for OR | p |
|---|---|---|---|---|---|---|
| Maternal education ≤ the secondary | 0.78 | 0.34 | 5.27 | 2.18 | 1.12–4.24 | .022 |
| Inadequate antenatal care | 0.91 | 0.38 | 5.73 | 2.48 | 1.18–5.21 | .017 |
| Low birth weight | 1.02 | 0.42 | 5.90 | 2.77 | 1.22–6.29 | .015 |
| Preterm birth | 1.14 | 0.46 | 6.14 | 3.13 | 1.27–7.72 | .013 |
| Nutritional status | 0.86 | 0.31 | 7.69 | 2.36 | 1.29–4.32 | .006 |
| Rural residence | 0.49 | 0.32 | 2.34 | 1.63 | 0.87–3.06 | .126 |

Table 7 results show that maternal education, inadequate antenatal care, low birth weight, preterm birth, and nutritional status were significant independent predictors of developmental delay in the logistic regression model. Children of mothers with secondary or lower education had 2.18 times higher odds of developmental delay (95% CI: 1.12–4.24; p=.022). Inadequate antenatal care was associated with 2.48 times higher odds (95% CI: 1.18–5.21; p=.017), while low birth weight was associated with 2.77 times higher odds (95% CI: 1.22–6.29; p=.015). Preterm birth showed 3.13 times higher odds of developmental delay (95% CI: 1.27–7.72; p=.013), and poor nutritional status was associated with 2.36 times higher odds (95% CI: 1.29–4.32; p=.006). Rural residence was not a statistically significant independent predictor (OR=1.63, 95% CI: 0.87–3.06; p=.126).

**Discussion**

The present study aimed to determine the prevalence of developmental delays and to examine the socio-demographic, maternal, child-related, birth-related, and nutritional factors associated with developmental delays among children under five years of age. The study also aimed to assess developmental status across different domains, including gross motor, fine motor, language, cognitive, and social or personal development, and to identify factors that independently predicted developmental delay. Developmental delay is an important public health concern because difficulties during early childhood can influence later learning, communication, social participation, and functional outcomes. The WHO and UNICEF global report emphasizes that children with developmental disabilities continue to experience inequalities in healthcare, education, participation, and access to appropriate support, particularly in low- and middle-income countries (WHO & UNICEF, 2023). Moreover, recent evidence from low- and middle-income countries also indicates that developmental delay remains common, with maternal education and birth weight among the factors consistently associated with developmental outcomes (Ayele et al., 2026)

Table 1 showed that 36 (22.5%) of the 160 children had developmental delays, whereas 124 (77.5%) had no developmental delay. Thus, approximately one in every five children assessed in the present study was identified as having a developmental delay. This finding indicates a considerable developmental health burden among young children and supports the importance of routine developmental surveillance and early identification. The prevalence observed in the present study is broadly comparable with the pooled prevalence of confirmed developmental delay reported in a 2024 systematic review and meta-analysis of children in low- and middle-income countries, which estimated a pooled prevalence of 18.83% (Wondmagegn et al., 2024). However, direct comparisons should be made cautiously because studies

differ in age groups, screening instruments, definitions of delay, study settings, and whether they assess suspected or confirmed developmental delay.

The prevalence in the present study was considerably lower than that reported by Saleem et al. (2021), who found suspected global developmental delay in 61.1% of children with uncomplicated severe acute malnutrition in rural Pakistan. The difference is understandable because the population in that study consisted specifically of children with severe acute malnutrition, a high-risk group, whereas the present study included children under five years more broadly. Saleem et al. (2021) reported that malnutrition was associated with developmental difficulties across several domains, demonstrating the particularly high developmental vulnerability of children with severe nutritional deprivation. Therefore, the 22.5% prevalence observed in the present study may reflect a broader population in which children with different nutritional and health profiles were included (Saleem et al., 2021).

Table 2 demonstrated that developmental difficulties were not equally distributed across the five developmental domains. Language development showed the highest proportion of delay, with 32 children (20.0%) affected, followed by cognitive development at 14.4%, fine motor development at 13.8%, social/personal development at 11.9%, and gross motor development at 10.6%. The predominance of language delay is important because language development is influenced by both biological maturation and the quality of children's interaction and stimulation within their home and social environments. A recent systematic review of socioeconomic inequalities in early childhood development in South Asia found that language development was one of the most frequently assessed developmental outcomes and identified maternal education and family income as important socioeconomic constructs associated with early child development (Chandrasenage et al., 2024).

The finding of greater language delay than gross motor delay is also consistent with evidence from populations at increased neurodevelopmental risk. A recent systematic review of preterm children reported that mild language delay was more common than mild motor and cognitive delay, although the magnitude varied considerably between studies (Fernandes et al., 2026). Similarly, Markkula et al. (2024) noted that preterm children have increased risk of linguistic difficulties and emphasized the importance of early developmental support. These findings suggest that language development may be particularly sensitive to biological vulnerability as well as environmental stimulation (Markkula et al., 2024). However, the present study was not restricted to preterm children, so these comparisons should be interpreted as contextual rather than directly equivalent.

The relatively lower proportion of gross motor delay in the present study may indicate that gross motor milestones such as sitting, standing, walking, and running were achieved by most children. Nevertheless, the presence of delay in 10.6% of children remains clinically relevant because even a relatively small proportion of affected children represents a substantial need for screening and follow-up at the population level. The findings also support the use of multidomain assessment rather than relying exclusively on physical or motor milestones. This is particularly relevant because developmental delay may occur in one domain while other areas remain relatively preserved.

Table 3 examined the association between socio-demographic characteristics and developmental delay. Child age was not significantly associated with developmental delay in the present study ($\chi^2 = 2.81$, $p = .094$), although children aged ≥2 years had a higher proportion of developmental delay (27.2%) than children younger than 2 years (16.2%). The absence of statistical significance suggests that the observed difference may not be sufficiently strong in this sample to establish an association. This finding differs somewhat from Saleem et al. (2021), who found that younger children, particularly those aged 6–24 months, had higher odds of suspected global developmental delay among children with severe acute malnutrition. The difference may be related to the substantially different study populations, because the earlier study focused exclusively on children with severe acute malnutrition.

Gender was not significantly associated with developmental delay ($\chi^2 = 0.15$, $p = .699$). Developmental delay was observed in 23.8% of boys and 21.3% of girls. This relatively similar distribution suggests that, in the present sample, sex alone did not substantially differentiate developmental outcomes. This finding is also compatible with the 2024 systematic review by Wondmagegn et al. (2024), in which sex was examined as a potential determinant but did not remain among the determinants consistently supported

across the available evidence. Therefore, developmental screening should be applied to both boys and girls rather than focusing only on one sex.

Residence was not significantly associated with developmental delay in the present study. However, developmental delay was observed more frequently among children living in rural areas, compared with those residing in urban areas. Although this difference did not reach statistical significance, the observed pattern may indicate potential disparities in developmental outcomes between rural and urban children. Rural children may have comparatively limited access to healthcare services, early childhood stimulation, maternal education, adequate nutrition, and developmental screening. The absence of statistical significance may be related to the relatively small sample size or the influence of other interrelated socioeconomic and child-related factors. Previous research has similarly highlighted that social and structural inequalities may create barriers to healthcare services and appropriate support for children experiencing developmental difficulties (Rebouças et al., 2022).

Maternal education was significantly associated with developmental delay. Children whose mothers had secondary or lower education had a higher proportion of developmental delay, compared with children whose mothers had education above secondary level. This finding is strongly supported by recent evidence. Wondmagegn et al. (2024) found maternal education to be a significant determinant of developmental delay in low- and middle-income countries, with children of less educated mothers having approximately three times the risk of developmental delay. Similarly, a South Asian systematic review found that maternal education was among the socioeconomic factors most consistently associated with early child development (Chandrasenage et al., 2024).

The association between maternal education and child development may reflect several pathways. More educated mothers may have greater access to health information, improved understanding of child nutrition and healthcare, greater awareness of developmental milestones, and more opportunities to provide age-appropriate communication and stimulation. Maternal education may also act as a marker of broader socioeconomic resources. However, education should not be interpreted as an isolated causal factor because it is closely connected with household income, healthcare access, living conditions, and other social determinants.

Socioeconomic status was also significantly associated with developmental delay ($\chi^2 = 7.29$, $p = .026$). Developmental delay occurred in 33.3% of children from low socioeconomic backgrounds, compared with 18.2% of those from middle socioeconomic backgrounds and 11.8% of those from high socioeconomic backgrounds. This gradient indicates that developmental difficulties were more common among children living in economically disadvantaged households. The finding is consistent with the South Asian systematic review by Chandrasenage et al. (2024), which concluded that higher socioeconomic position, particularly maternal education and family income, was generally associated with better early child development. Economic disadvantage can influence nutrition, housing, healthcare utilization, learning materials, caregiver time, and opportunities for stimulating interaction.

Table 4 results examined that Maternal age was not significantly associated with developmental delay, suggesting that age alone may have limited influence compared with other maternal and pregnancy-related factors. Antenatal care was significantly associated with developmental delay, consistent with evidence that adequate antenatal care supports early identification and management of maternal and fetal risks (Adsul et al., 2025). Birth complications were also associated with developmental delay, in agreement with recent evidence linking perinatal complications with adverse developmental outcomes (Atalell, Pereira et al., 2025). Breastfeeding was associated with developmental outcomes, consistent with recent evidence suggesting that longer or exclusive breastfeeding may support early child development (Goldshtein et al., 2025). Maternal illness during pregnancy was also significantly associated with developmental delay, which is consistent with evidence that maternal health conditions and prenatal exposures may influence neurodevelopment (San et al., 2023).

Table 5 examined birth-related factors. Birth weight was significantly associated with developmental delay. Children with birth weight below 2.5 kg had a substantially higher proportion of developmental delay as compared with children with birth weight ≥2.5 kg. This finding is strongly consistent with recent international evidence by Wondmagegn et al. (2024), who found low birth weight to be a significant determinant of developmental delay in low- and middle-income countries, with children with low birth

weight having approximately 3.6 times higher odds of developmental delay. Low birth weight may reflect fatal growth restriction, prematurity, maternal nutritional problems, or pregnancy complications, all of which may influence subsequent neurodevelopment. Gestational age was significantly associated with developmental delay. Developmental delay was observed in 47.6% of preterm children compared with 18.7% of term-born children. This finding is consistent with extensive evidence demonstrating increased neurodevelopmental vulnerability among children born preterm. A recent meta-analysis of preterm children found developmental difficulties across motor, language, and cognitive domains, while another large meta-analysis found that preterm birth was associated with poorer global cognitive, language, visuospatial, and motor outcomes compared with term birth (Fernandes et al., 2026). Residence was not significantly associated with developmental delay, although delays were more common among rural children. This finding is partly consistent with evidence from low- and middle-income countries showing that children living in rural areas may experience greater developmental disadvantage due to differences in access to healthcare, socioeconomic resources, and early childhood opportunities (Gil et al., 2020). Evidence from Pakistan has also identified rural residence as an important social context for child development, although developmental outcomes are influenced by multiple interconnected factors, including maternal education, household socioeconomic conditions, and access to services (Akram et al., 2024). Thus, the absence of a significant association in the present study may indicate that factors underlying rural–urban differences, rather than residence itself, are more closely related to developmental outcomes.

**Conclusion**

The study found that 22.5% of children under five years of age had developmental delays, with language development being the most affected domain, followed by cognitive and fine motor development. Significant associations were observed with maternal education, antenatal care, birth complications, breastfeeding practices, low birth weight, preterm birth, NICU admission, and nutritional status. Lower maternal education, inadequate antenatal care, low birth weight, preterm birth, and poor nutritional status were identified as significant predictors of developmental delay. These findings highlight the need for early developmental screening, improved maternal and antenatal care, adequate nutrition, and timely referral for children with developmental concerns.

**limitations and recommendations**

The study had several limitations that should be considered when interpreting its findings. The cross-sectional design identified associations but did not establish causal relationships. The relatively small sample of 160 children and recruitment from selected healthcare facilities and communities may limit the generalizability of the findings to the wider population of children under five years of age. Some maternal and birth-related information was based on caregiver reports and may therefore have been affected by recall or reporting bias. Furthermore, developmental assessment was conducted at a single point in time, which limited the ability to distinguish temporary developmental variations from persistent delays. Other potentially relevant factors, including home stimulation, parenting practices, screen exposure, detailed dietary intake, and access to early intervention services, were not comprehensively assessed.

Routine developmental screening should be strengthened within primary healthcare and child health services to facilitate early identification of developmental concerns. Greater emphasis should be placed on maternal education, adequate antenatal care, prevention of preterm birth and low birth weight, optimal breastfeeding, and appropriate child nutrition. Children identified with developmental concerns should receive timely referral for comprehensive assessment and early intervention. Future studies should include larger and more diverse populations, preferably using longitudinal designs, to further examine developmental trajectories and the contribution of maternal, birth, nutritional, environmental, and caregiving factors.

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