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Verbal Communication Impairments of Children with Autism Spectrum Disorders in Northern Bangladesh: An Exploration of Maternal, Environmental and Socio-demographic Determinants

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ABSTRACT

Autism spectrum disorder (ASD). One major sign is difficulty with verbal communication, which makes it far harder for kids to learn and interact with others. Today, more individuals in low- and middle-income countries are developing ASD. Information and data on the correlates of the verbal deficit in Bangladesh are scarce. The aim of this study was to identify maternal, environmental, and sociodemographic factors associated with verbal communication impairment among autistic children in northern Bangladesh. A mixed-methods approach was applied. Quantitative data were obtained from 246 parents/caregivers of autistic children aged 3 to 18, enrolled with the Ministry of Social Welfare in two divisions (Rajshahi and Rangpur) in Bangladesh. To measure how well people communicated, we used an ordinal scale with the following options: “never,” “rarely,” “occasionally,” and “frequently.” Predictors included sociodemographic characteristics, environmental exposures, and maternal health and pregnancy-related conditions. Bivariate relationships were assessed using the chi-square test, and adjusted odds ratios (AORs) were estimated using multivariate ordinal logistic regression. Qualitative results were derived from 16 case studies and 16 key informant interviews. There was a low correlation between communication outcomes and delivery modality, as indicated by bivariate analysis ($\chi^2 = 7.80$, $p = .050$). There were no significant independent factors from the multivariate analysis. The model classification was effective, with a Nagelkerke R2 of 0.170. Qualitative findings described stigma, caregiver burden, and limited access to speech treatment as common barriers to verbal development. Traditional maternal, environmental, and sociodemographic factors explain few differences in the verbal results. These findings underscore the impact of postnatal factors, including access to early intervention, caregiver responsiveness, and speech therapy. Those who want to enhance the language capabilities of autistic children must focus on educating caregivers and securing strong cooperation from every child in school.

1. Introduction

Autism spectrum disorder (ASD) is a neurodevelopmental disorder during the early stage of childhood (Shimomura et al., 2022). Autism spectrum disorder (ASD) is a complex neurodevelopmental disorder that manifests with restricted, repetitive

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patterns of behavior, interests, or activities as well as deficits in social communication and interaction.

(American Psychiatric Association [APA], 2013). Other areas may be important issues, but verbal communication issues are the most impactful on life. A person who struggles with verbal communication faces many challenges, including difficulty communicating and engaging with others. Verbal impairments can take many forms, including an inability to speak the language at all, as well as limited or idiosyncratic verbal communication modes such as echolalia and pragmatic language problems.

sion (Tager-Flusberg and Kasari, 2013). Among others, it is an alarming concern for low- and middle-income countries (LMICs) like Bangladesh, where facilitation of specialized education, access to therapeutic treatments, and early diagnosis in the traditional rehabilitation approach are very difficult to avail.

The prevalence of ASD is estimated to be 1 in 100 children worldwide, though it varies greatly by region as a result of differences in diagnosis, awareness, and services. (World Health Organization [WHO], 2022). Recent studies have found that the prevalence is increasing globally. Instead, the increase in incidence is not due to increased incidence per se, but rather to better diagnostic classifications and/or higher recognition rates (Lyall et al., 2017). Despite the scarcity of valid prevalence estimates from South Asia, mainly Bangladesh, low-risk research implies that ASD is one of the major and growing public health problems. (Didar et al., 2017). However, the number of studies remains limited, and most are not focused on predictors of specific ASD outcomes, including poor verbal communication ability.

Verbal communication is one of the major areas that can significantly affect a child with ASD's long-term quality of life, socialization, and educational success. Language impairments, combined with broader deficits in social mutuality and interaction, make things harder for children and their families. In First World countries, some studies suggest that linguistic deficits are influenced by a range of sociodemographic, maternal, environmental, and genetic factors. (Sandin et al., 2016). Prenatal and perinatal problems, such as a depressed mother before birth, preterm births, low birthweights, or complications with delivery, are linked to higher odds of autistic children developing a communication disorder. (Gardner et al., 2011). Certain studies were about LMICs-related surroundings, and the environmental exposures, including building-specific tobacco smoke, proximity to industrial compounds, and indoor air pollution, associated with neurodevelopment disorders. (Modabbernia et al., 2017).

Special challenges arise regarding the likelihood of voice communication impairments caused by environmental factors and maternal and child health needs in Bangladesh. Maternal depres related to pregnancy is the other common factor often induced by lack of social support, family disharmony, stress, or poverty. (Islam et al., 2021). Having low birthweight, preterm, and cesarean delivery are also seen frequently as perinatal problems in rural and peri-urban engagements. (Bizuayehu et al., 2023). In some areas, preterm birth, low birth weight, and their combination are a public health concern, particularly amongst young nulliparous women without adequate access to prenatal care. (Pusdekar et al., 2020). In rural areas, environmental risks such as pesticide exposure, poor water quality, and indoor air pollution from solid fuel use remain a concern. (Suryadhi et al., 2019). These disorders may aggravate any general developmental issues, as well as specifically communication difficulties, which are associated with ASD in children. However, no experimental data exist linking these risk factors to the communicative manifestations of ASD in Bangladesh. Sociodemographic and family contexts also shape the developmental trajectories of children with autism. The researchers also found that parental education and employment status influence language settings at home and access to medical services. (Spencer et al., 2012). Moreover, parent-child relationships and family structures of both nuclear and joint families can affect the early activation, emotional support, and stability in care. Age at marriage and the age difference between parents are among the risk factors for developmental outcomes in the South Asian family context. (Khan et al., 2024). Nevertheless, these socio-demographic variables have rarely been examined in autism-related studies in Bangladesh due to their potential significance.

1.2 Theoretical framework of the study

The theoretical frameworks applied in this study include several models, such as the Knowledge, Attitude, and Practice (KAP) model, which posits that parental knowledge and attitudes regarding child care and maternal health can influence outcomes. In addition, the Andersen Behavioral Model of Health Services emphasizes need, enabling, and predisposing factors associated with the use of medical care and treatment. It guided research on the social-ecological model, which holds that a child's development is influenced by factors in the family, society, and the broader system. Finally, theories underlying

environmental risk emphasize the potential contribution of prenatal and postnatal exposures to neurodevelopmental engagements. This study interleaves these frameworks to investigate deficits in verbal communication as a multicausal outcome associated with sociodemographic, environmental, and maternal factors. Based on these theoretical and contextual factors, this study examines the factors influencing the verbal communication outcomes of children with autism in northern Bangladesh. It is part of a larger study that seeks to understand how the environment and mothers influence ASD. (I.e., this article is about why children are not scoring in the category of verbal communication), which scores children on an ordinal scale from "never," to "rarely," "occasionally," and "frequently." By focusing solely on verbal communication, the study sought to provide a comprehensive understanding of how prenatal, environmental, and sociodemographic factors interact to contribute to one of the most crucial domains of ASD.

1. Objectives of the study

The purpose of the objectives is to focus on assessing maternal health and pregnancy-related conditions (type of delivery, prematurity, birthweight depression), by their possible relationships in conjunction with verbal communication implications for autistic children. That study also aimed to explore the role of environmental risk factors (e.g., water quality, paternal smoking, household air pollution, and proximity to industries) and socio-demographic and family characteristics (i.e., parental education/occupation/dominant type of family/parental bond) in the construction of verbal communication outcome as pertaining to the phenomenon of discovery.

2. Methodology

2.1 Study Design and Approach

By adapting these theories, the study added little to the broad spectrum of evidence on autism in low- and middle-income countries. Importantly, this study demonstrates how family factors interact with environmental and maternal systemic risks to impact child outcomes. The findings, which underscore the importance of early identification and maternal mental health care, as well as improvements in environmental health in northern Bangladesh, are expected to impact clinical results long after the region. Using a mixed-methods design that combined quantitative and qualitative data, this study investigated the determinants of verbal communication outcomes in children with autism spectrum disorder (ASD) in northern Bangladesh. A mixed-methods approach was performed to triangulate contextual qualitative perceptions with numerical survey data on acceptance of the results. Qualitative data were collected through Key Informant Interviews (KIIs) and case studies, whereas quantitative data were collected via a structured questionnaire administered to parents and caregivers. The combination of these data generated a broad understanding of the sociodemographic, environmental, and maternal variables that affect verbal communication difficulties for children with ASD.

2.2 Study Area

The study was conducted in Rajshahi and Rangpur divisions of Bangladesh. These two divisions were selected because they include a relatively high number of autistic children officially registered with the Ministry of Social Welfare, as well as to investigate sociodemographic and environmental relationships. To achieve statistical significance and viability at the district level, the data collection process primarily focused on districts that have a relatively higher population of registered autistic children. We explored differences in maternal and child health care access by the urban–rural divide, environmental regions and household factors within the geography.

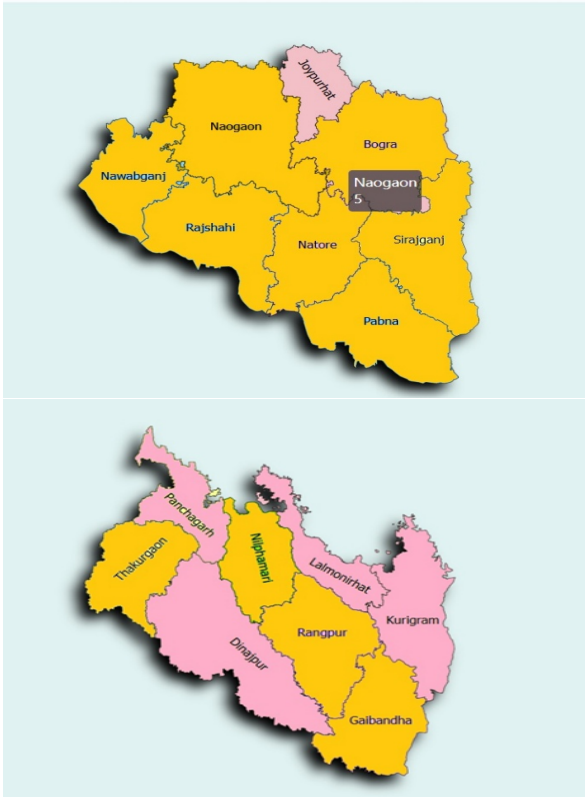


Figure:1 Study area of Rajshahi & Rangpur division (marked with yellow color)

2.3 Study Population

Children with ASD who were officially registered under the Ministry of Social Welfare's Protibondhi Seba O Sahajjyo Kendro (PSOSK) of Bangladesh and those who were enrolled in other special schools in the Rajshahi and Rangpur divisions included in the study population. The study selected children with ASD who were between the ages of 3 and 18 since this age range was suitable to evaluate verbal communication skills from early infancy to adolescence in a relevant way. Those whose parents unwilling to participate or those without a formal diagnosis of ASD were not included. Health professionals and teachers of those special schools were enlisted as key informants in addition to the parents.

2.4 Sample Size Determination

The sample size was determined using formula of the Krejcie and Morgan ensuring representativeness with a 95% confidence level and a 5% margin of error (Krejcie, 1970). The total population of registered autistic children in the study area was approximately 900. According to Krejcie and Morgan's sample size table, the minimum required sample size for this population was 269. After maintaining all the process of selection, a total of 246 completed responses were obtained, representing a strong sample size of 91% of the recommended selection. This process ensured an adequate power for bivariate and multivariate statistical analyses.

2.5 Sampling Technique

A straightforward random sampling procedure was applied to ensure the equal chance of being selection. The PSOSK centers and special schools provided lists of registered autistic children, and the participants proportionately from each district was selected randomly. This method helped to reduce selection bias. Purposive sampling was utilized to find case study families and key informants (consultants, principals, and service providers) who provided relevant important contextual views for the qualitative component.

2.6 Data Collection Methods

2.6.1 Questionnaire Survey

A semi-structured questionnaire was given to Parents and caregivers of ASD children to answer in order to gather primary data. Environmental exposures (water quality, household air pollution, paternal smoking, industrial proximity), maternal health and pregnancy-related conditions (e.g., delivery mode, prematurity, birthweight, micronutrient intake, maternal depression), and sociodemographic traits (e.g., parental education, family type, age at marriage, spousal bond) were all included in the questionnaire. Questions, which classified children's verbal communication skills as "never," "frequently," "occasionally," or "rarely," was used to find out verbal communication outcomes. Interviews over phone and digital communication methods were also used in addition. Before initiating interview, an informed consent was taken from everyone.

2.6.2 Key Informant Interviews

As a qualitative data collection tools, KII were used where key informants interviewed. 6 principals from special schools for children with autism and 10 consultants from PSOSK centers. To gather best possible opinions, a structured interview guide was followed. In order to evaluate quantitative findings, these data provided a useful direction.

2.6.3 Case Studies

One family was chosen from each study area to participate in in-depth case studies with 16 families. Case studies provide qualitative information which revealed how communication deficits were influenced by maternal health, environmental exposures, and family dynamics. Multiple communications were oriented to gather detailed narratives that documented the real experiences of children and families, including familial support and obstacles to verbal communication.

2.7 Data Processing and Analysis

The Statistical Package for Social Sciences (SPSS, version 25) was used for this study. Data was coded in best possible way to ensure the measurements into meaningful categories, Frequencies, averages, and percentages of the respondents' sociodemographic attributes were compiled using descriptive analysis.

Cross-tabulations and Pearson's chi-square tests were used to evaluate bivariate relationships between predictors and verbal communication effect for inferential analysis and those predictors were divided into three categories: sociodemographic factors, environmental exposures, and maternal/pregnancy-related variables. In multivariate analysis, variables that revealed statistical significance ($p<0.05$) in bivariate analysis were selected for further investigation.

Ordinal logistic regression (OLR) was used with verbal communication as the dependent variable, given its ordinal scale ("never," "rarely," "occasionally,"

"frequently"). The regression included predictors such as maternity leave duration, ultrasonography, delivery type, birth outcomes, micronutrient supplementation, maternal depression, and socio-demographic covariates. Adjusted odds ratios (AORs) with 95% confidence intervals were reported. Model fit was assessed using −2 Log Likelihood, Cox and Snell R^2, Nagelkerke R^2, and McFadden R^2. The Hosmer–Lemeshow test was used to evaluate calibration.

2.8 Ethical Considerations

This study is non-experimental observational research, and the study involves no risk to participants, is not associated with any interventions or manipulations, and data was collected through observation without identifying individuals. We ensure that the ethical standards are fulfilled, including protecting participant privacy and confidentiality. Prior to interviews, all parents or caregivers gave their informed consent, and participation was completely voluntarily. IRB approval is not taken, as this is non-experimental observational research, and the study involves no risk to participants.

2.9 Rationale for Focusing on Verbal Communication

Verbal communication issue is one of the most important factors of ASD functioning, are the particular significance of this article. Children with verbal impairments have a notable impact on their social integration, learning, and interaction skills, which affects their long-term quality of life. Although there are other forms of deficiencies associated with ASD, verbal communication was selected as the dependent variable for this study because it is correlated with maternal, environmental, and sociodemographic factors as well as its quantitative character.

3. Results

3.1 Descriptive Characteristics: Sociodemographic characteristics of respondents

The study included 246 mother–child pairs. Nearly half of fathers (48.8%) had graduate-level education or higher, while 19.1% were illiterate. Among mothers, 22.4% were illiterate and about one-fourth (24.4%) had graduate or higher education. Regarding occupation, most fathers were engaged in autonomous employment (29.3%) or business (24.8%), whereas the majority of mothers (88.2%) were housewives. Most families lived in joint households (85.0%). Marriage patterns indicated that two-thirds of fathers married between ages 20–29 years (67.1%), while 46.3% of mothers married before the age of 18. Age gaps of ≥7 years between spouses were most common (49.6%). More than two-thirds of the autistic children were male (71.1%), and nearly half were aged 6–11 years (47.2%). Family relationships were generally supportive, with 95.5% of respondents reporting positive spousal bonds during pregnancy.

Figure:2 Distribution of parental educational attainment by gender (Source: Fieldwork, 2024)

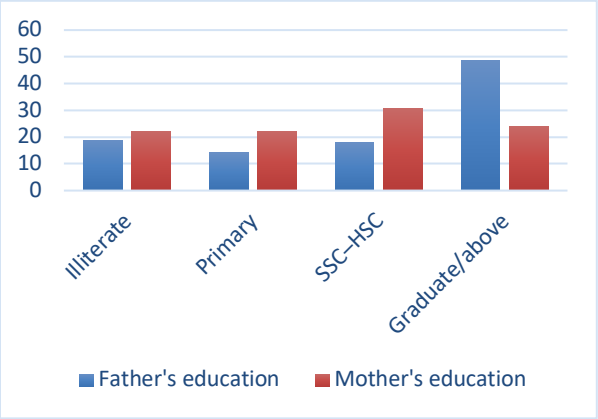


Figure:3 Distribution of paternal occupational status (Source: Fieldwork, 2024)

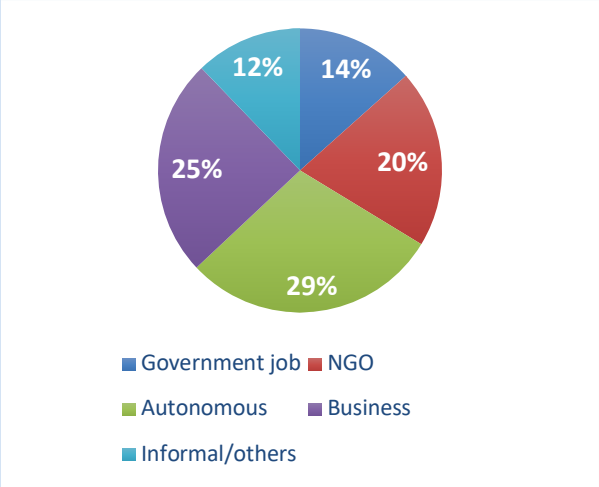
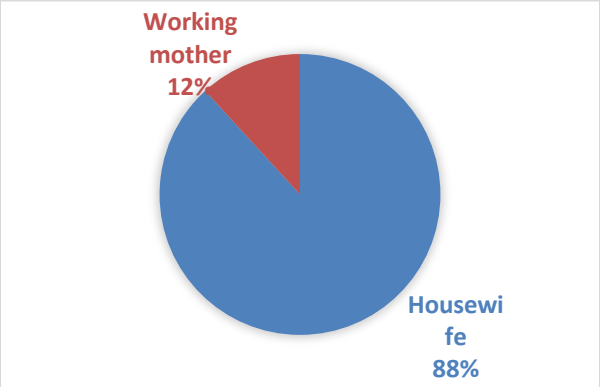


Figure:4 Distribution of maternal occupational status (Source: Fieldwork, 2024)



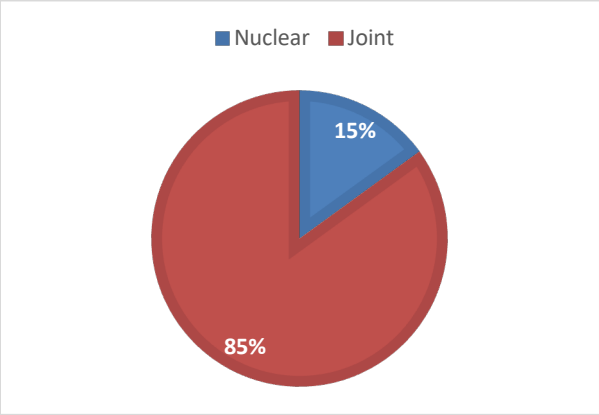


Figure:5 Distribution of parent's age at marriage (Source: Fieldwork, 2024)

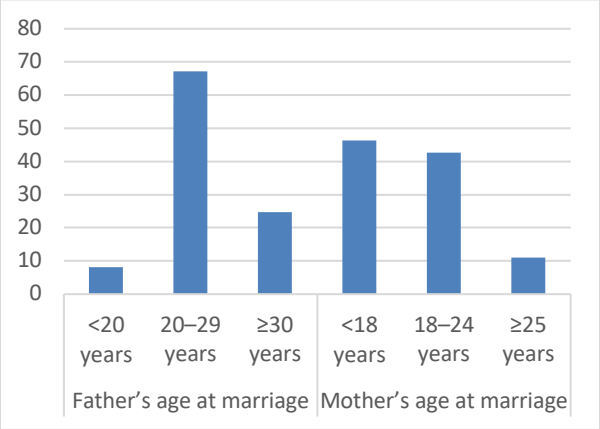


Figure:6 Distribution of family types within the study population (Source: Fieldwork, 2024)

Table 1: Sociodemographic and household characteristics of the study participants (N = 246)

Variable	Category	n	%
Parental age gap	≤2 years	15	6.1
	3–6 years	109	44.3
	≥7 years	122	49.6
Child age group	3–5 years	17	6.9
	6–11 years	116	47.2
	12–17 years	78	31.7
	≥18 years	35	14.2
Gender of the child	Male	175	71.1
	Female	71	28.9
Parental bond (pregnancy)	Poor bond	11	4.5
	Supportive bond	235	95.5
Father detached for job	No	204	82.9

	Yes	42	17.1
Father late return from job	No	134	54.5
	Yes	112	45.5
Good relation with neighbors	No	11	4.5
	Yes	235	95.5

3.2 Bivariate Analysis

Bivariate associations between maternal, environmental, and socio-demographic predictors and verbal communication outcomes are summarized in Table 2. Most of the maternal and environmental predictors, including maternity leave (χ^2=3.01, p=.391), ultrasonography use (χ^2=0.62, p=.893), number of scans (χ^2=5.05, p=.538), micronutrient intake (χ^2=2.84, p=.416), tetanus vaccination (χ^2=1.26, p=.738), and maternal depression (χ^2=0.98, p=.806) were not significantly associated with verbal communication effects.

The types of delivery showed a borderline significant association (χ^2=7.80, p=.050), with children delivered by cesarean section more frequently categorized in the "rarely" response group. Other birth effects, including prematurity (χ^2=3.64, p=.726) and birthweight categories (χ^2=5.69, p=.458), were not significant. Causes of maternal depression (Q62) also showed no statistical association (χ^2=3.64, p=.725). These findings reveal that while several maternal and environmental exposures influence the risk of ASD, their specific association with verbal communication outcomes was limited at the bivariate level.

Table 2. Bivariate analysis of maternal health and delivery related predictor variables in relation to frequency

Predictor Variable	Never n (%)	Frequently n (%)	Occasionally n (%)	Rarely n (%)	χ^2 (df)	p-value
Duration of maternity leave					3.01 (3)	.391
<6 months	1 (6.3)	1 (6.3)	8 (50.0)	6 (37.5)		
≥6 months	14 (6.1)	14 (6.1)	69 (30.0)	133 (57.8)		
Number of Ultrasonography during pregnancy					0.62 (3)	.893
No	3 (6.3)	2 (4.2)	14 (29.2)	29 (60.4)		
Yes	12 (6.1)	13 (6.6)	63 (31.8)	110 (55.6)		
No. of USG scans					5.05 (6)	.538
1 scan	4 (7.1)	1 (1.8)	18 (32.1)	33 (58.9)		
2–3 scans	8 (6.3)	11 (8.7)	41 (32.5)	66 (52.4)		
≥4 scans	0 (0.0)	1 (6.3)	4 (25.0)	11 (68.8)		
Drug intake during pregnancy					1.97 (3)	.578
No	14 (6.4)	12 (5.5)	68 (30.9)	126 (57.3)		
Yes	1 (3.8)	3 (11.5)	9 (34.6)	13 (50.0)		
Iron/Folic/Calcium intake during pregnancy					2.84 (3)	.416
No	1 (2.7)	1 (2.7)	10 (27.0)	25 (67.6)		
Yes	14 (6.7)	14 (6.7)	67 (32.1)	114 (54.5)		
Tetanus vaccine received					1.26 (3)	.738
No	1 (8.3)	0 (0.0)	3 (25.0)	8 (66.7)		
Yes	14 (6.0)	15 (6.4)	74 (31.6)	131 (56.0)		
Type of delivery					7.80	.050

Predictor Variable	Never n (%)	Frequently n (%)	Occasionally n (%)	Rarely n (%)	χ^2 (df)	p-value
					(3)	
Normal vaginal	8 (4.9)	6 (3.7)	57 (35.2)	91 (56.2)		
Cesarean	7 (8.3)	9 (10.7)	20 (23.8)	48 (57.1)		
Status of newborn					3.64 (6)	.726
Premature	3 (5.7)	5 (9.4)	17 (32.1)	28 (52.8)		
Mature	10 (5.8)	10 (5.8)	55 (32.0)	97 (56.4)		
Postmature	2 (9.5)	0 (0.0)	5 (23.8)	14 (66.7)		
Birthweight					5.69 (6)	.458
Low (<2.5 kg)	1 (5.3)	1 (5.3)	6 (31.6)	11 (57.9)		
Normal (2.5–3.9 kg)	4 (7.5)	2 (3.8)	15 (28.3)	32 (60.4)		
High (≥4.0 kg)	2 (1.7)	11 (9.2)	40 (33.6)	66 (55.5)		
Maternal depression					0.98 (3)	.806
No	7 (8.1)	5 (5.8)	26 (30.2)	48 (55.8)		
Yes	8 (5.0)	10 (6.3)	51 (31.9)	91 (56.9)		
Reasons depression					3.64 (6)	.725
Poverty/Stress	2 (7.7)	0 (0.0)	8 (30.8)	16 (61.5)		
Familial disharmony	5 (5.4)	6 (6.5)	29 (31.2)	53 (57.0)		
Conjugal disharmony	1 (2.4)	4 (9.8)	14 (34.1)	22 (53.7)		

3.3 Multivariate Analysis

Model Fit: −2LL = 176.7; Cox & Snell R^2 = .146; Nagelkerke R^2 = .170; McFadden R^2 = .080; HL test ns. Results of the ordinal logistic regression (Table 3) revealed that after regulate the confounders, none of the maternal, environmental, or socio-demographic predictors appeared as statistically significant determinants of verbal communication outcomes. Shorter maternity leave (<6 months) was associated with lower odds of frequent verbal communication compared to ≥6 months leave (AOR=0.24, 95% CI: 0.04–1.40, p=.113), though not significant. Similarly, limited ultrasonography use (1 scan) showed a trend toward lower odds of better communication outcomes (AOR=0.18, 95% CI: 0.02–1.42, p=.103). Drug intake during pregnancy showed a positive but nonsignificant association (AOR=3.45, 95% CI: 0.80–14.82, p=.096). Model diagnostics indicated acceptable performance: −2 Log Likelihood = 176.7, Nagelkerke R^2 = .170, and McFadden R^2 = .080, suggesting that the model explained a modest proportion of variation in verbal communication outcomes.

Table 3. Multivariate Ordinal Logistic Regression Predicting Verbal Communication Outcomes

Predictor Variable	Category	AOR	95% CI (Lower–Upper)	p-value
Maternity leave	<6 mo vs ≥6 mo	0.24	0.04–1.40	0.113
No. of USG scans	1 vs ≥4	0.18	0.02–1.42	0.103
	2–3 vs ≥4	0.2	0.03–1.41	0.106
Drug intake during pregnancy	No vs Yes	3.45	0.80–14.82	0.096
Type of delivery	Normal vs C-section	0.82	0.30–2.29	0.706
Status of newborn	Premature vs Postmature	0.26	0.06–1.59	0.144
	Mature vs Postmature	0.35	0.07–1.81	0.209
Birthweight	Low vs High	1.91	0.28–13.47	0.506

Predictor Variable	Category	AOR	95% CI (Lower–Upper)	p-value
	Normal vs High	1.29	0.50–3.34	0.596
Depression reason	Poverty vs Conjugal	1.13	0.19–6.58	0.891
	Familial vs Conjugal	0.67	0.22–2.01	0.471

4. Discussion

The major maternal, environmental, and sociodemographic features of the study population did not show any statistically significant association with children's verbal communication outcomes in autism in northern Bangladesh, after adjustment in a multivariate ordinal logistic regression model. While bivariate results indicated that communication deficits were potentially associated with delivery type, these associations were non-significant after covariates were included. The model (Nagelkerke R2 = .170) accounted for only a small proportion of the variation, suggesting that language-related problems in this group are likely to be influenced by other (unassessed) factors.

These findings are in line with other work suggesting that social interaction in autistic individuals is nuanced and not definitively shaped by prenatal environment. In order to bolster commonly negative results of early screening strategies for core ASD features, Christensen et al. (2024) found no association between prenatal ultrasonography and the risk of an ASD diagnosis. This study aligns with our own conclusion; the frequency of ultrasound tests during pregnancy had no associated relationship with verbal communication in children with ASD.

Although maternal prenatal depression (Avalos et al., 2023), a known risk factor identified as related to autism, was not statistically significant in our study with respect to verbal communication specifically, it had been identified previously (Avalos et al., 2023). Increased autism-related traits, such as social and communication deficits, have been associated with prenatal depression in previous large-scale studies (though these associations are typically observed in very large cohort studies aimed to capture general ASD risk rather than specific language outcomes). The inconsistent relationship in the present study could be attributed to measuring verbal communication difficulties rather than general autistic features.

Even though prenatal environmental risk factors such as toxicants, air pollution, water pollution, proximity to industrial plants, and pesticide exposure are known to affect neurodevelopment (social and language functions), these exposures did not significantly correlate with our sample's verbal communication level (Love et al., 2024). This absence may reflect the measurement limitations of this study, the lack of exposure variability in our location, or the existence of associations with these exposures that are more relevant to overall ASD risk than to specific communication problems.

Sociodemographic characteristics, including marital patterns, family structure, and parental education, similarly had no identifiable associations with verbal communication impairments in the adjusted models. Higher socioeconomic position and educational engagement are often considered likely predictors of children's language development (Spencer et al., 2012).

Our findings point to the heterogeneous and multidetermined nature of verbal deficits in ASD, with no association between classical prenatal, perinatal, and sociodemographic variables. Temporal 2: Gene–environment interactions, epigenetic changes, and postnatal variables, including early intervention, the home verbal communication environment, and caregiver responsiveness, are other prospective alternative processes to be explored (Beversdorf et al., 2021).

4.1 KII discussion

A total of 20 key informant interviews (KII) were also conducted among health professionals, educators in special education sectors for children with ASD, and therapists, who provided robust insights into the barriers to verbal communication from their perspectives in Northern Bangladesh. The results addressed the relevance of environmental engagement, sociodemographic variables, and maternal knowledge on communication outcomes in children with ASD.

4.1.1 Maternal Awareness and Knowledge

Informants (n=9) noted the importance of maternal awareness and cognizance about child developmental milestones in identifying early signs of communication difficulty in children with ASD. Due to these barriers, many mothers from the rural and semi-urban regions of Northern Bangladesh do not know about the symptoms of autism, nor its developmental milestones, nor difficulties with spoken communication during early life. As the special education teachers say, educated mothers showed more concern for obtaining

professional help and intervention services for their children. Autistic children, due to the interruption of their diagnosis and treatment, mothers with less education do not bother to seek special education services.

4.1.2 Parenting Techniques and Maternal Stress

The findings also emphasized that the success of communication development for children with ASD is closely linked to the distress and challenges parents face as caregivers. Most of the mothers had faced emotional and psychological difficulty raising an autistic child, in particular due to a lack of social support networks where this informant lived. Women facing significant mental and familial stress may have fewer opportunities to bond with their child, medical experts say. Mothers who receive “family support, assistance, and counseling,” conversely, are more likely to engage in verbal communication, which supports language development.

4.2 Case Study discussion

4.2.1 Communication Issues with Children

It was reported that children with autism tend to have delayed expressive language development. At this point, the kids in the reported case did not speak much and instead vocalized demands and feelings primarily through gestures, sounds, and nonverbal signals. Mother states that the child pronounced two words around age 2 and developed a speech delay, which was initially assumed to be normal by the family and nothing but growing age. Education is lacking on developmental delays, and this kind of late diagnosis is common in many communities. The findings reported that early signs of communication impairment are often overlooked, resulting in delayed diagnosis and treatment for autistic children.

4.2.2 Maternal Aspects

The mother's knowledge and consciousness itself has a very memorable influence on their autopoietic development. As the mother in the case study had almost no knowledge at all about developmental problems and autism, as a result, she initially thought the child’s challenges in communicating were a normal variation in speech development. After the child was diagnosed with autism, the mother became more involved in their communication development through treatment sessions and interactive activities. The mother also stated that she was emotionally burdened and wanted to help, but had no idea what actions could fulfill the communication needs of the child. This explanation shows how care-giving services given to children with communication problems and early diagnosis procedures are influenced by parents' knowledge and education.

4.2.3 Environmental Factors

A rich home environment is one of the most important predictors of child communicative development. Early possibilities for organized verbal contact were minimal. Family members were often busy with work and home tasks, leading to less direct talk and interactive play with the child. Following the diagnosis, as a result of engaging help towards implementing more interactive resources such as; visual learning activities, storytelling and also guided play with other children, the child's ability to respond and engage in verbal expression continued to steadily improve. This points to the indication that language and communication development in children with autism can be significantly helped by integrated communication factors.

4.2.4 Sociodemographic Background

Sociodemographic factors also significantly influence the family’s access to resources and services for an autistic child. As per the case study, at that time, the family had difficult access to specific therapy and special educational programs due to their financial condition. Most autism related services were found in urban areas, which makes them time-consuming and cost money. Limited access to services for early intervention leads to treatment delay and loss of opportunity in improving other aspects of communication (Lusty et al., 2018).

4.2.5 Community and Social Factors

Emphasizing community perceptions and social interventions. The autism, the family said in its lawsuit, resulted in stigma, social barriers, and misunderstandings. Such social pressures left families neither able to seek help nor to have open discussions about developmental concerns. Good counselling, increasing public knowledge of autism and communication difficulties can help reduce stigma and encourage families to seek care as soon as possible.

5. Implications of the study

5.1 Theoretical implications

The results do lend some support to the Social Ecological Model, which posits that child development is shaped by multiple, interrelated structures. Postnatal and interindividual variables not controlled for, such as caregiver sensitivity and infant intervention, would seem more germane than maternal and

sociodemographic predictors, which were not particularly illustrative. This finding aligns with a recent study that found significant correlations between outcomes in verbal communication and enriched social and linguistic environments (Tager-Flusberg and Kasari, 2013).

5.2 Practical and policy implications

The absence of accurate environmental or maternal predictors underscores the importance of funding treatments grounded in language learning and early childhood programmes. Policies must prioritize access to all aspects of inclusive education, caregiver training, and speech therapy. Community health programs may indirectly support language development by strengthening parents' knowledge, habits, and awareness.

Conclusion

This study investigated the sociodemographic, environmental, and maternal determinants of verbal communication outcomes among autistic children in northern Bangladesh. Analysis: A bivariate approach suggested possible relationships between delivery types and communication problems, yet in multivariate regression, no independent factors were found. The studied factors accounted for only a small percentage of the variance in outcomes related to verbal communication. These findings highlighted the complexity of verbal communication deficiencies in ASD and indicated that when assessed individually, prenatal, environmental, and socio-demographic factors do not appear to exert a direct influence.

Limitations of the study. This study relied on caregiver-reported metrics and may have introduced bias. The capacity to detect small associations was limited because environmental exposures were self-reported rather than ascertained objectively. Future studies aimed specifically at verbal outcomes in ASD should use genetic/epigenetic data, as well as longitudinal designs with other postnatal factors. »

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