MAGNITUDE AND ASSOCIATED FACTORS OF AUTISM SPECTRUM DISORDER AMONG PATIENTS ATTENDED AT PSYCHIATRY CLINIC IN TIKUR ANBESSA SPECIALIZED HOSPITAL, ADDIS ABABA, ETHIOPIA

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Magnitude and Associated factors of Autism Spectrum Disorder Among Patients Attended at Psychiatry Clinic in Tikur Anbessa Specialized Hospital

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ACRONYMS

ADHD-	Attention deficient hyperactivity disorder
AOR-	Adjusted odds ratio
ASD-	Autism spectrum disorder
ETB-	Ethiopian Birr
GBD-	Global burden of Disease
GA-	Gestational Age
ICSF-	International Classification of Function Disability and Health
ODD-	Oppositional defiant disorder
OCD-	Obsessive-compulsive disorder
GAD-	Generalized anxiety disorder
NDD-	Neurodevelopmental disorder
MDD-	Major depressive disorder
MRN-	Medical record number
WHO-	World health organization
CNS-	Central Nervous System
NCDs-	Non-Communicable Diseases
SPSS-	Statistical Package for Social science
TASH-	Tikur Anbessa Specialized Hospital
UK-	United Kingdom
USA-	United States of America
WHO-	World Health Organization
DSM -	Diagnostic and statistical manual

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Abstract

Background: A complicated developmental condition, autism spectrum disorder is characterized by repetitive behavior, limited interests, and ongoing difficulties with social communication. About 1 in 100 people worldwide has autism. This lifelong condition presents varying challenges that can affect daily life. In Ethiopia, Autism Spectrum Disorder is a growing issue that lacks attention, this is evidenced by the absence of appropriate laws or policies, insufficient facilities, and a scarcity of literature on the topic.

Objective: Assessing the magnitude and associated factors of autism spectrum disorder in patients who visit psychiatry clinic at Tikur Anbessa Specialized Hospital in Addis Ababa, Ethiopia, is the goal of this study.

Method: At Tikur Anbessa Specialized Hospital, a two-year retrospective cross-sectional study was carried out with a randomly chosen sample of 422 patients who visited the psychiatry clinic between September 11, 2022, and September 10, 2024. A Google checklist was used to gather the data, which was then converted to SPSS Windows version 26 for analysis.

We used the percent mean, standard deviation and frequency to characterize our findings. The relationship between each explanatory variable and the outcome variable was evaluated using binary logistic regression. Variables with a p-value of less than or equal to 0.25 in the bivariable analysis were included in the multivariable logistic regression analysis. Adjusted odds ratios and their associated 95% CIs were computed for the multivariable binary logistic regression analysis. A p-value of less than 0.05 was deemed statistically significant, and odds ratios and their 95% CIs were used to show how strong the connections were.

Result: The Magnitude of autism spectrum disorder in the study population was found to be 23% (95% CI: 95% CI: 19.9- 28.3), The study identified several significant factors influencing the odds of having autism spectrum disorder. Males were found to have 2.02 times higher odds of having ASD compared to females. while asphyxia increased the odds by 2.23 times. Preterm infants were 2.4 times more likely to have autism spectrum disorder, and each year of age was associated with a 19% decrease in the odds of having autism spectrum disorder . Later-born children had 2.03 times higher odds of autism spectrum disorder compared to their older

siblings. However, occupational status and Down syndrome did not show significant effects after adjusting for other factors.

Conclusion: In comparison to what has been documented in the literature, the severity of autism spectrum disorder is high. Males made up a larger percentage of the population than females, and most of the participants were older than five. The majority of children had one comorbidity, and a sizable portion had multiple comorbidities. Intellectual disability, attention deficit hyperactivity disorder, and epilepsy were the most prevalent related comorbidities. Autism is linked to maleness, birth asphyxia, preterm birth, and late born. Males are more likely than females to be impacted.

Keywords: Autism, associated factors, Tikur Anbessa Specialized Hospital, magnitude, Ethiopia

1. Introduction

1.1 Background

Autism spectrum disorder (ASD), is a neurodevelopmental disorder that lasts a lifetime, and is characterized by repetitive patterns of behavior, aberrant sensory responses, and ongoing deficiencies in social communication and interaction (1).

It is recognized as a unique neurodevelopmental condition that usually manifests in early childhood. The precise cause of autism is still unknown despite continuous research. It is well accepted that a mix of environmental influences and genetic vulnerability causes the illness.

The genetic component involves several genetic variations, while environmental factors such as prenatal complications, exposure to certain toxins, or maternal health can further influence the manifestation of autism(2). ASD is attributed to early changes in brain development and neural reorganization. As a result, the diagnosis of ASD relies on observing and analysing behavioural patterns, since there are currently no reliable biomarkers available for diagnosis(3, 4).

Autism is characterized by a wide spectrum of abilities and needs. Individuals with autism may display a range of strengths and challenges, including social and communication difficulties, repetitive behaviours, and sensory sensitivities. While some individuals with autism are able to lead independent lives, pursue higher education, and have successful careers, others may experience more severe challenges that require continuous care and support throughout their lives. Recognizing the wide-ranging diversity within the autism spectrum is essential. Providing tailored support to cater to the unique needs of each individual is imperative(5).

ASD is a global public health concern affecting approximately 1 in 100 children worldwide(6). The prevalence of autism spectrum disorder (ASD) in Africa is currently not well-established and varies among different African countries. For instance, Nigeria has reported a prevalence of 2.3%, Uganda 0.68%, Libya 0.33%, and Somalia 2.07%(7-10). A multinational study that included Egypt and Tunisia reported a prevalence of 33.6% and 11.5% respectively(11).

Factors affecting autism spectrum disorder or thought to be the determinants are multifactorial. Autism has a strong genetic component, with studies suggesting that genetics play a significant role in its development. Individuals with a family history of autism, including siblings or other relatives, are at a higher risk of developing the disorder. Certain genetic or chromosomal conditions, like fragile X syndrome and tuberous sclerosis, are linked to an increased risk of

ASD.ASD can be syndromic (associated with specific genetic conditions) or non-syndromic, with the latter having a more complex and less understood genetic etiology.

Perinatal factors and certain medical comorbidities are also mentioned in few studies as a risk factor. lots of research demonstrate that males are more likely to be affected by autism spectrum disorder. (6,53)

Associated comorbidities, which are additional conditions that coexist with autism spectrum disorder, are frequently observed in individuals with this condition. Research has shown that children and teenagers with autism often experience comorbid psychiatric conditions.(12).

Among children with ASD, the Prevalence of Psychiatric comorbidities is striking, with approximately 36.84% affected by at least one additional psychiatric condition. Common comorbidities encompass attention deficit hyperactivity disorder, conduct disorder, disruptive mood dysregulation disorder, anxiety disorder, insomnia, elimination disorder, and depression. Moreover, recent modifications in diagnostic criteria, particularly the inclusion of supplementary diagnoses for individuals with ASD in accordance with the DSM-5, further accentuate the significance of addressing psychiatric comorbidities in ASD populations. A thorough understanding and effective management of these coexisting conditions are imperative to ensure comprehensive care and support for individuals with ASD(13).

1.2 Statement of the problem

Globally, it is estimated that one in every 160 individuals is living with autism spectrum disorder (ASD), resulting in an approximate burden of 7.6 million disability-adjusted life years(14). However, it is crucial to note that this burden might be currently underestimated due to the unclear prevalence of ASD in the African region and other low- or middle-income regions. This lack of clarity underscores the need for further research and understanding of the prevalence and impact of ASD in these areas(15, 16)

The magnitude of autism spectrum disorder and its related comorbidities among individuals seeking psychiatric care have come to light more and more in recent decades. (17). The prevalence of autism spectrum disorder has risen significantly since the 1960s and 1970s, when it was considered a rare condition. Estimates now suggest that the prevalence of autism spectrum disorder is around 1 in 59 children in the United States and up to 1.55% in pre schoolers and 1.00% in school-age children in Spain(18). This increased prevalence is likely due to a combination of factors, including expanded diagnostic criteria, increased awareness

and screening, and potential environmental and genetic influences affecting the developing brain (19).

Around the world the prevalence of autism spectrum disorder varies. The prevalence of autism condition ranges from 0.38 to 1.55% in Europe, while it was 1.85% in the USA (20). According to an Asian study, the percentage of children with ASD in South Korea and Japan is 2.64% and 3.22% of the overall population, respectively (21, 22). In contrast, a study conducted in Nigeria reveals that 2.3% of children in Africa have been diagnosed with autistic disorder (9).

It is imperative to recognize that autism spectrum disorder (ASD) is prevalent in high-income nations, but lags in low- and middle-income areas, particularly in Africa. This information gap poses significant challenges in providing necessary support and interventions for individuals with ASD in these regions. Consequently, urgent attention and research are vital to address the unique needs and obstacles faced by people with ASD across the world.(23, 24)

The almost 1 billion people living in sub-Saharan Africa, 40% of whom are under the age of 14, are not included in the existing data on autism prevalence. Ethiopia is the second most populated country in Africa and one of the developing sub-Saharan African nations. According to our literature analysis, there is little research on the prevalence and related comorbidity, despite the fact that it is a developing country and the second most populated country in Africa, with 70% of the population being young (25).

Autism spectrum disorder is a growing concern in Ethiopia, but it has not received enough attention in the country. This is evident from the lack of appropriate laws or policies, inadequate facilities, and a scarcity of literature on the topic. There have been limited studies on autism, mostly focusing on societal knowledge and attitudes. Although some papers have been published, many are outdated and do not accurately represent the current situation.

Furthermore, a significant number of people with autism spectrum condition also have concomitant mental illnesses. But little is known about the precise prevalence and trends of these comorbidities, particularly in kids undergoing mental health care. Therefore, the purpose of this study is to present crucial data regarding the frequency of autism spectrum

disorder and related comorbidities among patients who visit the Tikur Anbessa psychiatry clinic.

1.3 Significance of the study.

It is crucial to identify the Magnitude of autism spectrum disorder and its associated factors , as well as its impact on patients' lives, to effectively reduce it's impact. This data is vital for informing public policy, raising awareness, and establishing research priorities.

The data will also significantly influence resource allocation to facilitate effective management of autism spectrum disorder. Policymakers will be able to design and carry out initiatives to lessen the effects of autism spectrum disorder with the help of the study's findings. Additionally, the study's findings will establish a crucial baseline for further research in this area, being the first of its kind in our setup.

2. Literature review

The concept of "health" as defined by the World Health Organization in 1948 extends beyond the absence of disease or infirmity. It encompasses a state of overall well-being, including physical, mental, and social aspects. Mental health, a significant facet of this definition, denotes a state of well-being that empowers individuals to effectively manage life's challenges, realize their potential, perform efficiently, and actively contribute to their community. Conversely, mental disorders are characterized by noticeable disturbances in cognition, emotional regulation, or behaviour, indicating dysfunction in the underlying psychological, biological, or developmental processes that govern mental and behavioural functioning(26-28).

Mental health, according to WHO(2019) could be defined as the overall state of wellness of how you think, how you behave, and how you regulate your feelings (29). A mental illness, or mental health disorder, is a pattern or change in thinking, feeling, or behaving that causes distress or disrupts a person's social, occupational, and other important activities(30).

Mental health disorders in children are generally those conditions that cause delays or disruption in developing age-appropriate thinking, behaviours, social skill, or regulation of emotion. These problems usually interfere with the normal development and the youth's effort to cope with peers and attain the normal developmental milestone (31).

The American Psychiatric Association characterizes autism spectrum disorder (ASD) as a multifaceted neurodevelopmental condition that has pervasive and enduring impacts on social interaction, communication, behaviour, and sensory processing. Individuals with ASD often face considerable challenges in social communication and interaction, which can include difficulties in maintaining and initiating conversations, interpreting nonverbal cues, and establishing and maintaining relationships. Furthermore, people with ASD may display repetitive behaviours, have restricted and specific interests, and show either heightened or reduced reactivity to sensory stimuli. It's important to note that the range and severity of these symptoms can vary widely, contributing to the diverse and unique experiences among individuals diagnosed with ASD (1).

2.1 Prevalence

2.1.1 Globally

Autism is estimated to affect about 1 in 100 children worldwide. However, it is important to note that reported prevalence rates vary significantly across different studies. Some well-controlled studies have reported much higher figures, indicating potential variations in the prevalence of autism. Additionally, the prevalence of autism in many low- and middle-income countries is not yet known, indicating a significant gap in our understanding of the global prevalence of autism(32).

The prevalence estimates for autism spectrum disorder (ASD) are frequently underestimated due to various reasons. One primary reason is the intricate nature of the disorder itself, which makes it challenging to accurately capture its full extent. Additionally, the availability of multiple diagnostic tools contributes to the variability in estimates. This diversity in diagnostic approaches can lead to inconsistencies in identifying and quantifying the prevalence of ASD within different populations(33).

The prevalence of autism spectrum disorder (ASD) across different regions of the world varies, falling within the range of 0.38% to 1.85%. A comprehensive study conducted in the United States underscored an ASD prevalence of 1.70% among children aged 4 years and 1.85% among those aged 8 years. Parallel to this, in European countries, the prevalence of ASD spans from 0.38% to 1.55%. Moreover, there is a wealth of mounting evidence suggesting a notable global surge in the prevalence of ASD over the recent years. Notably, specific countries have reported rates such as 1.5% in Spain, 1.4% in the UK, 0.73% in France, and 0.38% in Germany. It is important to note that the USA has the highest recorded prevalence rate in a developed nation, at 1.85% (34–39).

The prevalence of autism disorder ranged from 0.48% in South-East France to 3.13% in Iceland, according to data from three health registries in Denmark, Finland, and Iceland as well as two regional registries in France. The prevalence was 0.73% in South-West France, 0.77% in Finland, and 1.26% in Denmark. The ratio of males to females ranged from 3.3 in Finland to 5.4 in South-West France. Additionally, between 12% (in Denmark) and 39% (in South-West France) of cases were diagnosed with intellectual disability(34).

A comprehensive review conducted on the global prevalence of autism since 2012, which examined a total of 71 studies, revealed that the overall global prevalence of autism is 1%. It

is noteworthy that most studies originated from the United States and Northern Europe. However, there has been a substantial increase in the number of studies from previously underrepresented regions such as Africa and the Middle Eastern region. The amalgamated findings from these studies suggest a global autism prevalence that varies considerably within and across regions, with a median prevalence of 100 per 10,000 (ranging from 1.09 per 10,000 to 436.0 per 10,000). It is interesting to note that the prevalence rates for autism were recorded as 0.82% in America, 0.63% in Europe, 2.03% in the Western Pacific, 0.34% in Southeast Asia, and 0.86% in the Eastern Mediterranean(32).
Another a recent systematic review and meta-analysis covering the years 2008 to July 2021 revealed that the global prevalence of autism spectrum disorder (ASD) was 0.6%, with a 95% confidence interval of 0.4–1%. Further analysis revealed varying prevalence rates across different regions: 0.4% in Asia (95% CI: 0.1–1), 1% in America (95% CI: 0.8–1.1), 0.5% in Europe (95% CI: 0.2–1), 1% in Africa (95% CI: 0.3–3.1), and 1.7% in Australia (95% CI: 0.5–6.1). These findings offer valuable insights into the global distribution of ASD and highlight the importance of region-specific considerations in addressing this condition(40).

A cross-sectional sequential design study was conducted in Hirosaki, Japan from 2013 to 2016, encompassing all 5-year-old children. The study revealed that the adjusted prevalence of autism spectrum disorder (ASD) was 3.22% with a 95% confidence interval (CI) of 2.66–3.76%. Additionally, the male to female ratio of the crude prevalence was found to be 2.2:1. The cumulative incidence of ASD up to 5 years of age for the total study years was determined to be 1.31% with a 95% CI of 1.00–1.62. It was observed that only 11.5% of children had ASD alone, while the remaining 88.5% were found to have at least one co-existing Neurodevelopmental Disorder (NDD)(22).

2.1.2 Africa

Autism spectrum disorder (ASD) prevalence is well-documented in high-income countries. However, there is a substantial lack of understanding and research about ASD in low-income and middle-income regions, such as Africa. This knowledge gap significantly hinders the development of effective support and interventions for individuals with ASD in these regions. It is imperative to ramp up awareness and research efforts to address the unique challenges and needs of individuals with ASD globally(23, 24).

Sub-Saharan Africa, home to around 1 billion people, 40% of whom are under the age of 14 (33), was not included in the data gathered for the global prevalence of autism.
In 2010, a systematic literature review shed light on the prevalence of autism spectrum disorder (ASD) among African children, specifically in Tunisia and Egypt. The review explored various studies and data to reveal that 33.6% of children with developmental issues in Egypt and 11.5% in Tunisia were diagnosed with ASD(15).

In 2012, a small-scale epidemiological study was undertaken in Niger to explore the prevalence of childhood autism. The findings indicated that 11.4% of the children examined met the diagnostic criteria for childhood autism according to the ICD-10 classification. Furthermore, the study uncovered a significant male-to-female ratio of 4:1 among the children meeting the diagnostic criteria for autism(41).

A 2016 systematic review of 47 studies on autism spectrum disorders (ASD) in Sub-Saharan Africa revealed that most of these studies (74%) were carried out in only two countries: South Africa and Nigeria. Furthermore, 83% of these studies were conducted in the last decade. While some studies attempted to estimate the prevalence of ASD in Sub-Saharan Africa, most of them utilized convenience sampling with data mainly from hospitals and specialist units for children with special needs. After systematic screening, the estimated prevalence of ASD was found to be 2.3%. In addition, parents reported noticing a deviation in their child's development at an average age of 22.1 months, with a diagnosis being received at an average age of 44.7 months. Among those with ASD, approximately 75.5% showed associated neurological comorbidities(42).

In Ethiopia, there is a significant potential for conducting comprehensive research to determine the prevalence of autism. However, it is crucial to address the current lack of in-depth studies that specifically examine the knowledge and attitudes surrounding autism within the population. Despite a few recent publications, most of the available literature is outdated and may not accurately represent the current landscape of this condition within the country.

2.2 Associated comorbidities of autism spectrum disorder

Associated comorbidities, which are additional medical, psychiatric, or developmental conditions, are often observed in individuals with autism spectrum disorder. These comorbidities can include epilepsy, gastrointestinal issues, anxiety disorders, and attention-deficit/hyperactivity disorder (ADHD). The presence of comorbidities can have a significant

impact on the overall well-being and management of individuals with autism spectrum disorder(12).

Active surveillance is used in the United States to collect information on the prevalence of autism spectrum disorder (ASD) among 8-year-old children. 31% of children with ASD had intellectual handicap, with an IQ below 70, 25% were in the borderline range, with an IQ between 71 and 85, and 44% had an IQ in the average to above-average range, exceeding 85, according to a study on intellectual capacity (38).

A study conducted in Denmark found that individuals with autism spectrum disorder had a higher risk of being diagnosed with OCD, while individuals diagnosed with OCD had an increased risk of being diagnosed with autism spectrum disorder later in life. Specifically, those diagnosed with autism spectrum disorder had a 2-fold higher risk of later being diagnosed with OCD, while those diagnosed with OCD had a nearly 4-fold higher risk of later being diagnosed with autism spectrum disorder(43).

3. Objective

3.1General objective

- ✓ To determine magnitude of autism spectrum disorder and its associated factors among patients who attended Psychiatry clinic, Tikur Anbessa Specialized Hospital in Addis Ababa, Ethiopia.

3.2 Specific objective

- ✓ To asses the magnitude of autism spectrum disorder among patients attending pediatrics psychiatry clinic
- ✓ To evaluate the magnitude of associated comorbidities of autism spectrum disorder
- ✓ To determine the factors associated with autism spectrum disorder

4. Method and Material

4.1 Study area and Period

The study was conducted at Tikur Anbessa Specialized Hospital in the psychiatric follow-up clinic from October 1 to November 30, 2024. Established in 1974, Tikur Anbessa Specialized Hospital is the largest tertiary hospital in Ethiopia. It is administered by Addis Ababa University and serves as the largest and oldest teaching hospital in the country, providing training for approximately 300 medical students and 350 residents each year. The hospital diagnose and treat around 400,000 patients annually and is equipped with 800 beds, employing 130 specialists and 50 non-teaching doctors.

The psychiatric follow-up clinic has six rooms, one of which is specifically designated for pediatric care. It operates on all working days and hosts more than six residents each year, with the most senior residents taking responsibility for pediatric patient care. On average, the clinic sees five pediatric patients daily, totaling over 1,000 patients per year. Additionally, the clinic is staffed by one child and adolescent psychiatry fellow and three consultants.

4.2 Study design

- ✓ Retrospective cross-sectional research conducted in a hospital.

4.3 Population

4.3.1 Source population

- ✓ All patients under the age of eighteen who came to Tikur Anbessa Specialized Hospital psychiatry clinic.

4.3.2 Study population

- ✓ Every patient under the age of eighteen who came to TASH psychiatry clinic between September 11th, 2022, and September 10th, 2024.

4.4 Eligibility criteria

4.4.1 Inclusion criteria

- ✓ Every patient under the age of eighteen who attended TASH psychiatry clinic during the study period and had a documented diagnosis of autism spectrum disorder

4.4.2 Exclusion criteria

- ✓ Patients' medical records with partial data registries

4.5 Sample size determination and sampling technique

4.5.1 Sample size determination

Since no research has been done in Ethiopia to determine the magnitude of autism disorder, it is assumed to be 50%. The required sample size for this study has been determined using a single population proportion formula.

$$ni = \frac{(Z\alpha/2)2\ p\ (1-p)}{d2}$$

Where: ni= minimum sample size required for the study

Z= standard normal distribution (Z=1.96), CI of 95% = 0.05

P= magnitude of autism disorder; therefore, p=50 % (0.5) is used

d=Absolute precision or tolerable margin of error= 5 % (0.05)

$$ni = \frac{(1.96)2 \times 0.5\ (1-0.5) = 384\ (0.05)}{(0.05)2} = 384$$

By adding 10% non-response rate the final sample size will be 422

4.5.2 Sampling technique

A straightforward random sampling technique was used to choose study participants, guaranteeing a representative sample of the general population. The hospital's computerized records, which offered a thorough database for participant selection, were used to create the sampling frame.

Medical Record Numbers (MRNs) for the two-year period from September 11, 2022, to September 10, 2024, were taken from the Health Management Information System (HMIS) registration book. During this time, thorough eligibility criteria were applied to each medical record to identify suitable candidates for the study. Ultimately, a total of 422 patients from the pediatric psychiatry clinic were selected, reflecting a diverse range of cases from this specialized department within the specified timeframe.

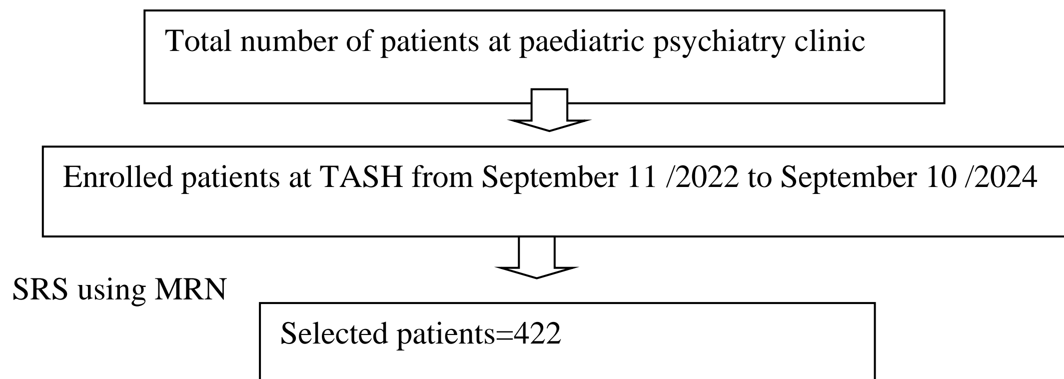

Figure 1. Schematic presentation of sampling procedure in Tikur Anbessa Specialized psychiatry clinic September 11 /2022 to September 10 /2024

4.6 Study variables

4.6.1 Outcome variable

- ✓ Magnitude of Autism spectrum disorder

4.6.2 Explanatory variables

- ✓ Social demographic variables
    - o (age, sex, level of education, place of residence, occupation and monthly income)
- ✓ Presence of Down syndrome
- ✓ Presence of associated comorbidities
- ✓ Type of comorbidities
- ✓ Age at diagnosis
- ✓ number of years on follow up
- ✓ Current Status of the patient

4.7 Definitions of terms and operational definitions

- ❖ **Autism Spectrum disorder (ASD)** – A child diagnosed with autism according to DSM V autism spectrum diagnosing criteria.
- ❖ **Comorbidity-** The co-occurrence of two or more illnesses in one individual

- **Attention deficient hyperactivity disorder (ADHD)** - is a neuropsychiatric condition affecting pre-schoolers, children, adolescents, and adults. It's characterized by a pattern of diminished sustained attention & increased impulsivity or hyperactivity.
- **Generalized anxiety disorder (GAD) -** children with GAD have significant distress in activities of daily life, often focused on the child's fears of incompetence in many areas, including school performance and in a social setting.
- **Obsessive compulsive disorder (OCD)-** Recurrent & persistent thoughts, urges, or impulses that are experienced at some time during the disturbance, as intrusive and unwanted, and that in most individual causes marked anxiety or distress.
- **Birth asphyxia-**defined as failure to initiate crying at birth
- **Term -** babies born alive after completed nine months of amenorrhea
- **Preterm -** babies born alive before completed nine months of amenorrhea.
- **Post term -** babies born alive and labeled as post term by the health professionals.
- **Global developmental delay -** is a general term used to describe a significant lag in two or more developmental domains, such as motor skills, language, cognitive skills, or social and emotional abilities.
- **Fully vaccinated -** children who took all vaccines according to Expanded program of immunization schedule
- **Partially vaccinated -** children who misses one or more dose of vaccine from Expanded program of immunization schedule

4.8 Data collection technique

The information was obtained by looking at the medical records of patients who visited TASH's psychiatry clinic for treatment over a three-year span, from September 11, 2022, to September 10, 2024. Following the careful selection of study cases, the principal investigator undertook the task of data collection by thoroughly reviewing patient charts. This process utilized a structured checklist designed to capture essential socio-demographic information, as well as relevant clinical details. Google Forms was used as the main data gathering tool in order to make it easier to organize and analyze the data.

4.9 Data quality assurance

We spent time and energy developing carefully thought-out data collection materials specifically for our study in order to attain good data quality. As part of our preparation, we conducted a pre-test involving 21 participants from the study population, which represents 5% of the total. This pre-test took place at St. Paul Hospital and was instrumental in identifying any potential issues with the data collection tools.

Following the pre-test, we carefully analyzed the feedback and made necessary adjustments and modifications to enhance the effectiveness of the tools. To ensure the entire data collection process ran smoothly, we implemented daily supervision conducted by both the supervisor and the principal investigator. At the conclusion of each day's data gathering operations, this oversight was essential to preserving the data's integrity and making sure it was comprehensive, consistent, and understandable.

4.10 Data processing and analysis

The data underwent a thorough verification process for completeness following each phase of data collection. Information gathered through Google Forms was subsequently exported to SPSS software for comprehensive analysis.

To begin with, univariate analysis was conducted, which involved creating simple frequency tables, calculating percentages, means, and standard deviations, as well as generating visual representations such as bar charts and pie charts. These tools provided a clear overview of the data distribution and key characteristics.

Binary logistic regression was used in bivariate analysis to investigate how each independent variable affected the desired result. At this stage, variables were chosen for inclusion in a multivariable analysis if their P-value in the bivariate analysis was less than 0.25. In order to account for potential confounding variables that can affect the results, this step was essential.

In the multivariable analysis, variables with a P-value of less than 0.05 were deemed significantly associated with the outcome. The strength of these associations was then measured using the Adjusted Odds Ratio (AOR), accompanied by a 95% Confidence Interval (CI), allowing for a robust interpretation of the relationships between the variables studied.

4.11 Ethical consideration

Ethical clearance for the study was obtained from the Department of Pediatrics and Child Health. Following this approval, an official letter of support, accompanied by a copy of the ethical clearance document, was submitted to both the Psychiatric Unit and the Cardroom to inform them of the study's legitimacy and purpose.

To ensure the privacy of the participants, strict confidentiality measures were implemented at every stage of the research process. Only the Medical Record Number (MRN) assigned to each study participant was utilized for data collection, deliberately omitting any mention of their names to protect their identities. Furthermore, all collected information was securely stored in a designated safe location to safeguard against unauthorized access and maintain the integrity of the study.

4.12 Dissemination of the result

The finding of this research will be submitted to Addis Ababa university health science and medical college,departement of pediatrics and child health and will be presented during the final defense for partial fulfillment of speciality. The finding of the study will also be shared to other concerned bodies. Subsequently an attempt will be made to present the findings on different review meetings, seminars, and workshops Furthermore, the manuscript will be published on peer reviewed journals.

5 Result

5.1 Socio-demographic Characteristics

In the study period, a total of 422 responses were collected from the chart. Of these the majority of the population 350(82.9%) was over five years old, with a higher proportion of males 271(64.2%) compared to females 159(35.8%). In terms of religion, the largest group identifies as Orthodox 169(40%), followed by Protestant 128(30.3%) and Muslim 122(28.9%). Most individuals reside in Addis Ababa 198(46.9%) and Oromia 139(32.9%). The educational status of fathers more than one-third 166 (39.3%) father's holding a bachelor's degree, whereas mothers near half 205 (48.6%) of mother having less than a 10th-grade education. More than one-third of 150 (35.5%) caregivers were government employees and a quarter 107 (25.4%) were private employees, while more than 244 (57.8%) of households earn more than 10,000 Birr per month. Demographic and socioeconomic characteristics of a studied population is shown in table 1

Table 1: Socio-demographic characteristics of attending child at Pediatrics Psychiatry clinic Tikur Anbessa specialized Hospital from September 2022 to September 2024

		Frequency	Percent
Age group	≤ 5 Years	72	17.1
	> 5 Years	350	82.9
	Total	422	100.0
Sex	Male	271	64.2
	Female	159	35.8
	Total	422	100.0
Religion	Orthodox	169	40.0
	Protestant	128	30.3
	Muslim	122	28.9
	Others	3	0.7
	Total	422	100.0
Residency	Addis Ababa	198	46.9
	Oromia	139	32.9
	Amhara	45	10.7
	South,	32	7.6
	Sidamo	1	0.2
	Central	1	0.2
	Other	6	1.4
	Total	422	100.0
	Master's degree	28	6.6

Educational Status Father	Bachelor’s degree	166	39.3
	Diploma	49	11.6
	Certificate	24	5.7
	>10th grade	38	9.0
	< 10th grade	102	24.2
	Illiterate	15	3.6
	Total	422	100.0
Educational Status Mother	Master's degree	1	0.2
	Bachelor’s degree	83	19.7
	Diploma	52	12.3
	Certificate	27	6.4
	>10th grade	29	6.9
	< 10th grade	205	48.6
	Illiterate	25	5.9
	Total	422	100.0
Occupation status Caregiver	Housewife	16	3.8
	Government employee	150	35.5
	Farmer	61	14.5
	Private employee	107	25.4
	Merchant	88	20.9
	Total	422	100.0
Income per month	≤ 5000 Birr	38	9.0
	5001 to 10000 Birr	140	33.2
	> 10000 Birr	244	57.8
	Total	422	100.0

5.2 Magnitude of Autism Spectrum disorder

The Magnitude of autism spectrum disorder (ASD) in the study population was found to be 23% (95% CI: 95% CI: 19.9- 28.3), based on a total of 422 children. With a range of 2 to 17 years, the age at diagnosis for ASD was 6.28 years (± 3.61). Of the youngsters diagnosed, 18 (16%) were female and 83 (82.2.5%) were male. This implies a 5.5:1 male-to-female ratio.

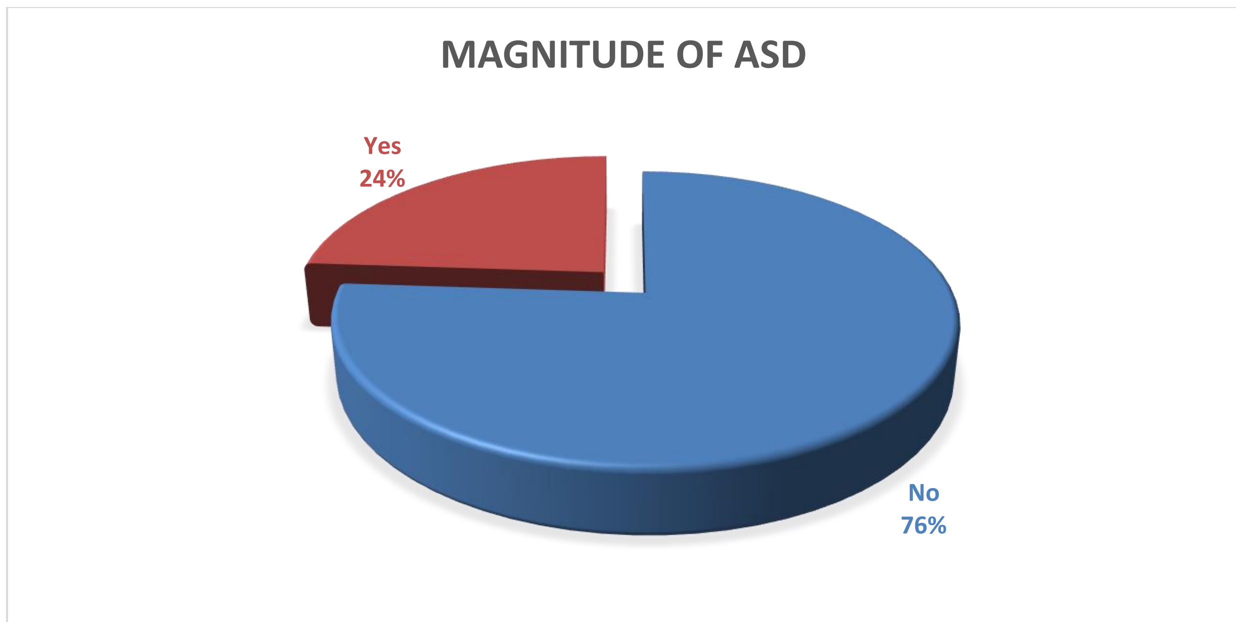

Fig 2 Magnitude of ASD at Pediatrics psychiatric clinics Tikur Anbessa specialized Hospital from September 2022 to September 2024

5.3 Clinical Characteristics and Associated comorbidities

More than half 234 (55.7%) of the children were first-born, 112(26.5%) were second born, and smaller proportions fell into later birth orders. About 73(17.3%) experienced asphyxia at birth. Most children 410 (97.2%) had been vaccinated, with 358(87.3%) being fully vaccinated and52 (12.7%) partially vaccinated. Regarding Gestational age nearly three forth 313(74.2%) were term. Majority 405(96%) of the children had three or fewer siblings. About 29(6.9%) of the children were diagnosed with global developmental delay. A smaller proportion, 44 (10.4%), had Down Syndrome

Nearly half 206(48.8) of the patients had follow-up 1 to 5 years regarding outcome nearly two third 262(62.1%) improved

Table 2 Clinical characteristics of study population

		Frequency	**Percent**
Birth Order	1	234	55.5
	2	112	26.5
	3	51	12.1
	4	21	5.0
	5	4	0.9
	Total	422	100.0
Asphyxia	No	359	82.7
	Yes	73	17.3
	Total	422	100.0
Vaccinated	Yes	410	97.2
	No	12	2.8
	Total	422	100.0
If Vaccinated	Fully Vaccinated	358	84.8
	Partially Vaccinated	52	12.3
	Total	410	97.2
Gestational Age	Preterm	62	14.7
	Term	313	74.2
	Post term	47	11.1
	Total	422	100.0
Number of Siblings	≤ 3	405	96.0
	>3	17	4.0
	Total	422	100.0
Global Developmental Delay	Yes	29	6.9
	No	393	93.1
	Total	422	100.0
Down Syndrome	Yes	44	10.4
	No	378	89.6
	Total	422	100.0
Year of follow-up	Less than 1 year	86	20.4
	1-5 years	206	48.8
	Greater than 5 years	130	30.8
	Total	422	100.0
Outcome	Improved	262	62
	The same	160	37.9
	Total	422	100.0

A significant number of children 352(83.4%) had comorbidities, with 173(49.1%) having one comorbidity, 145(41.2%) having two, and 34(9.7%) having three or more. The most common associated comorbidities included epilepsy 170(29.9%), attention deficit hyperactivity disorder 118(20.7%), intellectual disability 141(24.8%), and others such as cerebral palsy 21(3.7%) and obsessive-compulsive disorder 4(0.7%). Additionally, anxiety disorder and depression were present in smaller proportions (0.9% and 1.1%, respectively), while 18.1% of cases were categorized as "others".

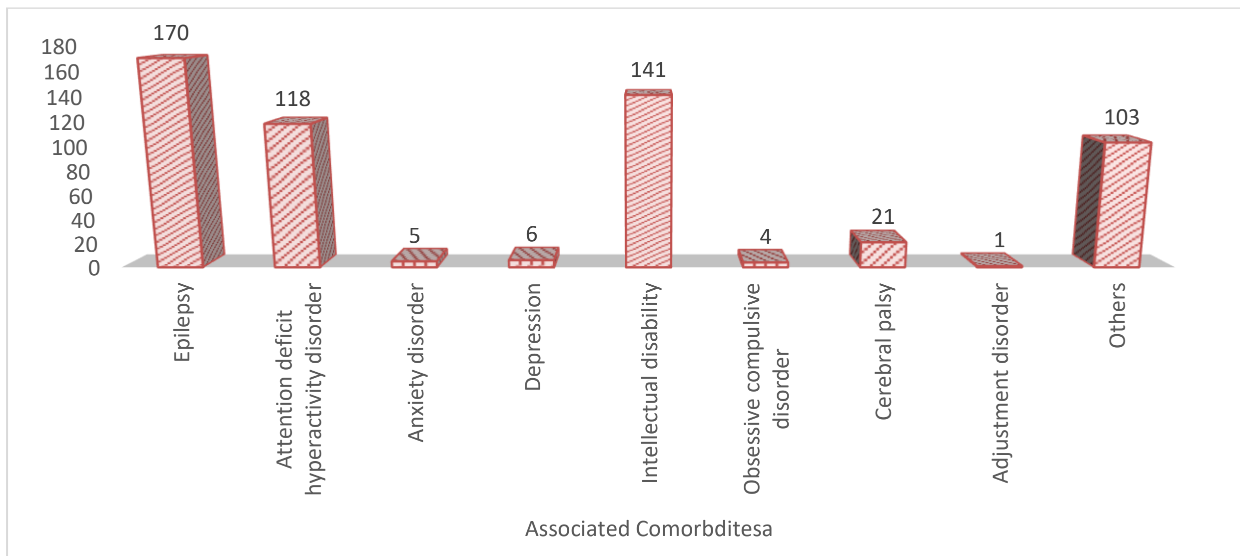

Fig 3: Associated comorbidities of autism spectrum disorder

5.4 Factors Associated with autism spectrum

Explanatory factors included in this study were age, sex, religion, residency, parental education, occupation, caregiver status, and monthly income. First, bivariable analysis was used to examine birth order, asphyxia, gestational age at birth, and Down syndrome. The bivariable analysis's p-value (< 0.25) led to the identification of eight factors as potential variables for the multivariable analysis: age, sex, caregiver occupation, down syndrome, gestational age at birth, asphyxia, and birth order.

The multivariate analysis reveals key insights into factors associated with ASD prevalence. Sex remains a significant predictor, with males having 2.02 times higher odds of having ASD compared to females (AOR = 2.02, 95% CI: [1.08-3.76], p = 0.026). Asphyxia increases the odds of ASD by 2.23 times (AOR = 2.23, 95% CI: [1.1-4.48], p = 0.024). Gestational age shows that preterm infants have 2.4 times higher odds of having ASD (AOR = 2.4, 95% CI: [1.16-5.03], p = 0.018). Age is also a significant factor, with each year of age being

associated with a 19% decrease in the odds of having ASD (AOR = 0.81, 95% CI: [0.76-0.88], $p < 0.0001$). A higher chance of ASD is linked to birth order; infants born later have 2.03 times the odds (AOR = 2.03, 95% CI: [1.08-3.76], p = 0.026). After controlling for other variables, other variables including Down syndrome and occupational status did not exhibit significant effects.

Table 3 factor Associated with Autism spectrum disorder

		ASD		Bivariate analysis (COR)	Multivariate analysis (AOR)	P value
		No	Yes			
Sex	**Male**	188 (69.4%)	83 (30.6%)	3.2[1.87-5.6]	**2.02[1.08-3.76]**	**0.026**
	Female	133 (88.6%)	18 (11.9%)	1	1	
Occupation Status	**Caregiver (Housewife)**	9 (56.3%)	7 (43.8%)	1	1	
	Gov't Employee	115 (76.7%)	35 (23.3%)	1.96[0.65-5.8]	0.50[0.13-1.95]	0.322
	Farmer	49 (80.3%)	12 (19.7%)	0.76[0.42-1.39]	0.41[0.09-1.80]	0.243
	Private Employee	85 (79.4%)	22 (20.6%)	0.61[0.28-1.35]	0.34[0.08-1.38]	0.133
	Merchant	63 (71.6%)	25 (28.4%)	0.65[0.33-1.26]	0.51[0.12-2.07]	0.350
Down Syndrome	**Yes**	20 (54.1%)	17 (45.9%)	4.6[2.46-8.9]	1.97[0.91-4.23]	0.082
	No	301 (78.2%)	84 (21.8%)	1	1	
Asphyxia	**No**	281 (80.5%)	68 (19.5%)	1	1	
	Yes	40 (54.8%)	33 (45.2%)	**3.4[2.0-5.80]**	**2.23[1.1-4.48]**	**0.024**
Gestational Age	**Preterm**	31 (50%)	31 (50%)	**2.22[1.2-4.17]**	**2.4[1.16-5.03]**	**0.018**
	Term	257 (82.1%)	56 (17.9%)	1	1	
	Post term	33 (70.2%)	14 (29.8%)	1.6[0.87-3.28]	1.67[0.75-3.71]	0.20
Age				**0.81[0.76-0.87]**	**0.81[0.76-0.88]**	**0.0001**
Birth order				**0.70[0.53-0.93]**	**2.03[1.08-3.76]**	**0.026**

6.Discussion

This study was a retrospective hospital-based cross-sectional study, conducted at the Psychiatry follow-up clinic, Tikur Anbessa Specialized Hospital, Addis Ababa, Ethiopia, from October 1 to November 30 2024, involving four hundred twenty two patient records from September 11/2022 to September 10/ 2024.

With a range of 2 to 17 years, the age at diagnosis for ASD was 6.28 years (± 3.61). Males were found to be affected at a larger proportion than females, and the age distribution of cases was comparable to that of previous investigations. Developed nations also frequently claim significant male preponderance.

Although there is no study about the prevalence rate of Autism in Ethiopia, statistics from different studies show that it is increasing in alarming rate. The magnitude of autism spectrum disorder (ASD) in the study population was found to be 23% (95% CI: 95% CI: 19.9- 28.3).

A study done by CDC in 11 sites of USA, the overall ASD prevalence per 1,000 children aged 8 years was 27.6 (one in 36) and ranged from 23.1 in Maryland to 44.9 in California. The overall male-to-female prevalence ratio was 3.8.(50)

The size is greater than that of other research conducted in developed and African nations. Most of the studies that was done in Africa have shown a prevalence of 2.3% in Nigeria ,0.6% in Uganda ,2.07% in Somalia ,33.6% in Egypt and 11.5% in Tunisia. Most of the studies are hospital based though there are few community-based studies. This study uses DSM 5 criteria to diagnose Autism and studies done in Egypt and Tunisia also uses the same diagnostic tools. The possible reason for similarities could be usage of the same diagnostic criteria. The other studies use childhood autism rating scales. Different diagnostic and assessment tools used during the study makes comparison difficult across the developed as well as developing countries. Higher rates of comorbidities in individual with ASD also makes it challenging to differentiate. (9,10)

A significant number of children 352(83.4%) had comorbidities, with 173(49.1%) having one comorbidity, 145(41.2%) having two, and 34(9.7%) having three or more. The most common associated comorbidities included epilepsy 170(29.9%), attention deficit hyperactivity disorder 118(20.7%), intellectual disability 141(24.8%), and others such as cerebral palsy 21(3.7%) and

obsessive-compulsive disorder 4(0.7%). Co-occurring comorbidities or psychiatric conditions are common in autism, impairing quality of life. Reported prevalence of associated comorbidities or psychiatric conditions in people with autism range widely. One study sought to describe the frequency and distribution of comorbid conditions in individuals with ASD, found that majority of individuals with ASD had at least one comorbidity, and had a greater average number of comorbidities than their non-ASD siblings. (47) The result of this study is similar with other studies, with majority having one comorbid condition ,epilepsy being the most common one followed by ADHD.(48)

In this study majority of the population 350(82.9%) was over five years old, with a higher proportion of males 271(64.2%) compared to females 159(35.8%).

Sex remains a significant predictor, with males having 2.02 times higher odds of having ASD compared to females (AOR = 2.02, 95% CI: [1.08-3.76], p = 0.026). 83 (82.5) % of the diagnosed children were male, and 18(16) % were female. This implies a male-to-female ratio of 5.5:1. Community-based as well as hospital based studies have consistently shown a sex ratio heavily skewed towards males in autism spectrum disorders. The factors underlying this predominance of males are largely unknown, but the way girls score on standardized categorical diagnostic tools might account for the under recognition of ASD in girls in community based studies .Other animal studies postulate that higher testosterone levels binds to androgen receptors in brainstem neurons responsible for enhancing brain arousal and, therefore, higher amounts of arousal-related inputs to the amygdala sensitize genetically vulnerable male infants to very early stresses.(44)

Asphyxia increases the odds of ASD by 2.23 times (AOR = 2.23, 95% CI: [1.1-4.48], p = 0.024).Asphyxia at birth was associated with an increased risk of having ASD and also contributes to the increased risk of having comorbidities in patient with ASD.(47)This result was comparable with the studies done in Iraq and central China .(45,46)

Gestational age shows that preterm infants have 2.4 times higher odds of having ASD (AOR = 2.4, 95% CI: [1.16-5.03], p = 0.018). A national cohort study was conducted over 4 061 795 singleton infants born in Sweden during 1973-2013 who survived to age 1 year, who were followed-up for ASD identified from nationwide outpatient and inpatient diagnoses through 2015,found that preterm birth were associated with increased risk of ASD in boys and girls. The result of this study is similar with most of the studies .(49)

Birth order is associated with a higher likelihood of ASD, with later-born children having 2.03 times higher odds (AOR = 2.03, 95% CI: [1.08-3.76], p = 0.026). The majority of research on ASD multiplex families has focused on identifying genetic anomalies that may underlie the disorder, the study of symptom severity across ASD birth order may provide evidence for environmental factors in ASD. (51)Although a number of rare mutations and dosage abnormalities are specific to autism, these explain no more than 10% of all cases. The high heritability of autism and low recurrence risk suggests multifactorial inheritance from numerous loci but other factors also intervene to modulate risk. Study done in USA , examine the effect of birth rank on disease risk which is not expected for purely hereditary genetic models. they detect statistically significant, yet varying, patterns of birth order effects across the study population. They found middle births are at high risk; in simplex families, they demonstrate linear effects where risk increases with each additional birth.(52) Compared to this study our study is similar with the later findings.

7. Limitations and strength of the study

Due to incomplete registration of patient information and data management system in the study hospitals, some of the variables were not included under the study (APGAR score, exact gestational age at birth, family history of Autism, early childhood illness and other perinatal complication) and lack of adequate resources that were done in our country on this topic.

One of the strengths of this study is its inclusion of broad age range and first study to be conducted in the study setting.

8. Conclusions

According to the study's findings, the magnitude of ASD is higher than what has been documented in previous research. The majority of the population studied was over five years old, with a higher proportion of males compared to females. Most individuals reside in Addis Ababa and Oromia. A significant number of children had comorbidities, with majority having one comorbidity. The most common associated comorbidities included epilepsy followed by attention deficit hyperactivity disorder and intellectual disability. Being male, birth asphyxia , being preterm and late born are associated with ASD. Males are more likely than females to be affected by autism.

Male are affected in a higher proportion than females. Improved prevalence estimates and identification of associated factors are needed to enhance recognition and care, and to guide future research.

9.Recommendations

Based on the findings of the study, the following recommendations are forwarded

Health professionals

- Based on this result birth asphyxia and preterm delivery was significantly associated with ASD, Much has to be done by the health professional to reduce the preventable causes of preterm delivery as well as birth asphyxia by applying proper prevention strategies set by WHO and ACOG.
- This study revealed most of the children with ASD are over 5 years of age, On this basis provision of professional development program to preschool and primary school teachers for early detection.
- Development of culturally sound and sensitive diagnostic tools for ASD like other African countries.

Government

- Taking the experience of other countries and contextualizing it with our country's reality emphasis and appropriate considerations should be given by the government.
- The existing educational services are scarce and confined to Addis Ababa, emphasis should be given in building special need schools and extending the service to different regions in Ethiopia
- Based on this result the prevalence of autism spectrum disorder is high, government should give emphasis to antenatal care and delivery service ,This may include strengthening the existing ANC service, creating awareness and giving ongoing training programs for health professional .

Researchers

Further large-scale study is needed to assess the prevalence of autism spectrum disorder

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53. CDC.Autism spectrum disorder march 27 ,2025

Annex I: Checklists

MRN No………………

Part I Socio-demographic				
S. No	Question	Answer	Code	Remark
101	Age	______Years (age in completed years)		
102	Sex	Male	1	
		Female	2	
103	Birth order	______		
104	Did the child cried immediately after birth?	Yes	1	
		No	2	
105	Was the child vaccinated?	Yes	1	
		No	2	
106	if yes to the above question	Fully vaccinated	1	
		Partially vaccinated	2	
107	Gestational age	preterm	1	
		term	2	
		post term	3	
108	Religion	Orthodox	1	
		Protestant	2	
		Muslim	3	
		Others	4	
109	Place of residency	Addis Ababa	1	
		Oromia	2	
		Amhara	3	

		South, south west,Sidam, Central,	4	
		Other	5	
		master’s degree	1	
		Bachelor degree	2	
		Diploma	3	
		Certificate	4	
		>10th grade	5	
		< 10th grade	6	
110	Educational status of the father	Illiterate	7	
		master’s degree	1	
		Bachelor degree	2	
		Diploma	3	
		Certificate	4	
		>10th grade	5	
		< 10th grade	6	
111	Educational status of the mother	Illiterate	7	
112	Occupation status of care giver	Housewife	1	
		Government employee	2	
		Farmer	3	
		Private employee	4	
		merchant	5	
		others (specify)	6	
113	Average family monthly income per month	______ETB		
114	Number of siblings:	A, 1 B,2 C, 3 D, >= 4		
Part II Clinical Characteristics				
		Yes	1	
200	Does the child have ASD?	No	0	
201	Does the child have global developmental delay ?	Yes	1	
		No	2	
		Yes	1	
202	Does the child have Down syndrome ?	No	2	
203	Does the child have associated comorbidities ?	Yes	1	
		No	2	
204		A. Epilepsy	1	

	. If yes to the question 203,which associated comorbidities does the child have ?	B. Attention deficit hyperactivity disorder	2	
		C. anxiety disorder	3	
		D. Depression	4	
		E. Intellectual disability	5	
		F. Obsessive compulsive disorder	6	
		G. cerebral palsy	7	
		H. Adjustment disorder	8	
		K. GI problems (specify)	9	
		L. Others	10	
205	How many associated comorbidity the patient has	A. One	1	
		B. Two	2	
		C. Three and above	3	
206	Age at diagnosis…… (In years)	______		
207	The number of years on follow up	A. Less than 1 year	1	
		B. 1-5 years	2	
		C. Greater than 5 years	3	
208	Current Status of the patient	A. Improving	1	
		B. Deteriorating	2	
		C. The same	3	