



The prevalence of suspected Global Developmental Delay and its associated factors among children seen at the Paediatric Neurology Outpatient Clinic of Saint Paul's Hospital, Millennium Medical College, Addis Ababa, Ethiopia, April 2021 to April 2022, an Institution based Cross sectional study.

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ADDIS ABABA, ETHIOPIA

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ACRONYMS AND ABBREVIATIONS

SPHMMC.....	Saint Paul Hospital Millennium Medical College
GDD.....	Global Developmental Delay
ADHD.....	Attention Deficit Hyperactivity Disorder
LMIC.....	Lower and Middle Income Countries
GBD.....	Global Burden Of Diseases
YLD.....	Years Lived with Disability
USA.....	United States Of America
MRI.....	Magnetic Resonance Imaging
ICU.....	Intensive Care Unit
SPSS.....	Statistical Package For Social Sciences
HIV.....	Human Immunodeficiency Virus
PIH.....	Pregnancy Induced Hypertension

ABSTRACT

Background

Global developmental delay (GDD) is defined as a delay in two or more developmental domains (gross motor/fine motor, cognitive, speech/language, personal/social, activities of daily living) in young children less than 5 years of age. About 52.9 million (8.4%) children worldwide have developmental disabilities. Children with global developmental delay are at higher risk of learning difficulties, behavioural problems and functional impairments later in life. This study attempts to describe the prevalence and associated factors of suspected Global developmental delay among children visiting SPHMMC.

Objectives

To determine the prevalence and associated factors of suspected Global Developmental Delay among children visiting the Pediatric Neurology Outpatient clinic from Apr 2021 to Apr 2022 at SPHMMC, Addis Ababa, Ethiopia.

Methods

A descriptive cross-sectional study was conducted on patients visiting the Pediatric Neurology OPD over 1 year (Apr 2021 to Apr 2022). The study population was randomly selected patients visiting the Pediatric Neurology OPD over the study period. Two hundred and fifty patients were evaluated. Data was collected using a structured checklist by health professionals from charts. Once the data was collected, it was entered and analysed by SPSS version 25 software. Logistic regression analysis was utilized. In all analysis, predictor variables with a P-value of <0.05 were considered to be statistically significant. Relationship between independent and dependent variables was assessed and presented using odd's ratio and confidence intervals. Ethical clearance was secured from the ethical review board and the School of Public Health.

Result- Among the 250 study subjects, 54(21.6%) of them had Global Developmental Delay of which 24(44.4%) were males and 30(55.6%) females. Global developmental Delay had significant associations with perinatal asphyxia and abnormal brain MRI finding.

Conclusion- Magnitude of Global Developmental Delay in this study was high. Perinatal asphyxia and abnormal brain MRI finding were found to be independent predictors of Global Developmental Delay.

Key terms- Global Developmental Delay, Prevalence, Perinatal asphyxia

1. Introduction

1.1. Background

Early childhood, defined as the first 5 years of life is a rapid period of growth and the period in which the developing brain is responsive to stimulation and nurturing (1). This period is considered as the basis for future educational and professional attainment at the individual level and human capital and economic development at the population level (2). The concept child development encompasses the progression of the child in all spheres of functioning that is social, cognitive, motor, hearing and speech.

Developmental disabilities are a group of conditions resulting from impairments that affect a child's physical, learning or behavioural functioning (3).

Affected children have sensory defects (hearing and vision loss), epilepsy or seizures, cerebral palsy, attention deficit hyperactivity disorder (ADHD), intellectual disability, or other learning disorders (4). Children with developmental delays are at higher risk of suboptimal health, educational achievement and wellbeing than are children without such disabilities (5). Epidemiological data on developmental disabilities at global, regional and national levels are scarce (6). The most widely reported data suggest that about 250 million children are at risk of suboptimal development in Low- and middle-income countries (LMIC) (7).

About 52.9 million (8.4%) children worldwide had developmental disabilities as documented by the GBD group in 2016, 95% of which reside in low and middle income countries compared with 53 million (8.9%) in 1990. This marginal difference is in sharp contrast with the trend in under-5 mortality which significantly dropped from 11 million in 1990 to 5 million in 2016 (8).

Although the prevalence of developmental disabilities among children younger than 5 years decreased in all countries (except for North America) between 1990 and 2016, the number of children with developmental disabilities increased significantly in Sub-Saharan Africa (71.3%) and in North Africa (71.3%) and in North Africa and the Middle East (7.6%). South Asia had the highest prevalence of children with developmental disabilities in 2016 and North America had the lowest (9).

Global developmental delay (GDD) refers to the delay in two or more developmental domains (gross motor/fine motor, cognitive, speech/language, personal/social, activities of daily living) in young children less than 5 years of age (10).

Global developmental delay (GDD) is a continuous process which starts from conception and continues up to maturity. During this process, biologic, environmental, nutritional factors and chronic diseases could have significant impact on developmental milestones. GDD is not considered as a disease or diagnosis but rather as a symptom or clinical presentation. Children with sustained developmental delay are at higher risk of learning difficulties, behavioural problems and functional impairments later in life (11).

Global increase in survival of children younger than 5 years is an impressive achievement but also a challenge since most surviving children will encounter lifelong developmental disabilities limiting their full participation in society (11).

1.2. Statement of the Problem

Globally around 200 million children under the age of five are not able to achieve their developmental potential. An impressive progress has been registered with regard to reducing under five child mortality in the past three decades. However the same success could not be reproduced in the area of developmental disabilities which have remained high. Majority of children with developmental delay live in LMICs and the burden is more pronounced in families living with high levels of poverty and low educational status(12).

There are significant impacts associated with Global Developmental Delay. Children with Global Developmental Delay are at high risk of intellectual and functional limitations. Also they are at a heightened risk of social and educational discrimination and greater risk of domestic abuse and violence. Additionally caregivers encounter severe impairment in quality of life and mental health issues(13).

The fact that national statistics on young children's cognitive or social emotional development are not available for most developing countries has led to inadequate attention given to the issue of developmental delay. The majority of children with global developmental delays live in low-income and middle-income countries (LMICs) but there is a huge data gap about the prevalence and associated factors in such settings (13).

Therefore the aim of this study is to provide baseline data on the prevalence of global developmental delay and its associated factors at a tertiary care hospital. It also serves as an input for further studies regarding prevention and management of the problem.

1.3. Significance of the study

No adequate data is available on global developmental delay in Ethiopia. This study attempts to describe the prevalence, profile and associated factors of GDD at a tertiary care center. Understanding the local epidemiologic data regarding the magnitude and nature of Global Developmental Delay will help in optimizing prevention strategies, interventions and rehabilitation services for those affected. The result of the research will also provide baseline data for recommending advanced investigations in search of underlying causes.

2. Literature review

2.1. Prevalence of Global developmental delay

Globally, 52.9 million children younger than 5 years (54% males) had developmental disabilities in 2016 compared with 53 million in 1990. About 95 % of these children lived in low-income and middle-income countries. Years- lived with disability (YLD) among these children increased from 3.8 million in 1990 to 3.9 million. These disabilities accounted for 13.3 % of the 29.3 million YLDs for all health conditions among children younger than 5 years in 2016 (9).

Although the prevalence of developmental disabilities among children younger than 5 years decreased in all countries except for North America between 1990 and 2016, the number of children with developmental disabilities increased significantly in Sub-Saharan Africa (71.3%) and in North Africa and the Middle East (7.6%). South Asia had the highest prevalence of children with developmental disabilities in 2016 and North America had the lowest (9).

In a survey done to know the prevalence of developmental disabilities among children in USA over 12 years (1997-2008) , boys had a higher prevalence overall and for a number of select disabilities compared with girls. Hispanic children had the lowest prevalence for a number of disabilities compared with non-Hispanic white and black children. Low income and public health insurance were associated with a higher prevalence of many disabilities. Prevalence of any developmental disability increased from 12.84% to 15.04% over 12 years (14).

In an Ethiopian study done to assess the pattern of neurologic disorders at Pediatric OPD of Tikur Anbessa Hospital, Cerebral palsy (24.6%), Global developmental delay/mental retardation (21.5%), idiopathic epilepsy (13.2%), and CNS infections (12.7%) were the major diagnoses (15).

2.2. Pattern of Global developmental delay

The global burden of diseases study in 2016 showed that visual loss was the most prevalent disability, followed by hearing loss, intellectual disability, and autism spectrum disorder. However intellectual disability was the largest contributor to YLDs in both 1990 and 2016 (8).

In a 12 years survey of US children conducted in 1998-2007, Autism, attention deficit hyperactivity disorder, and other developmental delays increased, whereas hearing loss showed

a significant decline. These trends were found in all of the socio demographic subgroups, except for autism in non-Hispanic black children (12).

A systematic review and meta-analysis on the burden of neurodevelopmental disorders in low and middle income countries revealed that the median pooled prevalence per 1000 for any neurodevelopmental disorder was 7.6, being 11.3 for neurological disorders and 3.2 for mental conditions such as attention-deficit hyperactivity disorder (ADHD) (13).

In a study done in Uganda on children with cerebral palsy, Bilateral spastic CP was the commonest (45%). Moderate impairment in gross motor function was present in 43 % , with comparable numbers (37%) in the mild and severely impaired fine motor function groups. Learning disability(75%) and epilepsy (45 %) were the commonest (45%) comorbidities (16).

A Pakistan research on MRI evaluation of children with GDD showed that normal MRI findings were seen in 45.3 % while 54.7 % had abnormal findings. The ventricles and white matter mainly the corpus callosum were the most commonly affected structures. MRI enabled a direct diagnosis (16%) of patients and in 23.6 % of them, it suggested a diagnosis which was confirmed by further tests (17).

In a Turkish study 247 patients with global developmental delay were evaluated. Etiologic diagnosis was determined in 64 per cent of the patients classified under the following categories: perinatal complications (21 %), cerebral dysgenesis (18 %), chromosomal abnormalities (9%), genetic/dysmorphic syndromes (3%), metabolic disorders (4%).., hypothyroidism (4%), neurocutaneous syndromes (3%) and intrauterine infection (2%). Etiology was undetermined in 36% of the patients (18).

In a study done at a teaching University in Oman, 110 children, 59 males (53.6%) and 51 females (46.4%) were included. The mean age at initial evaluation was 13.29 months. An underlying etiology was determined in 79 (71.8%) children. Perinatal history was associated with significant difference in detection of etiology . Abnormal neurological examination was a significant factor in detection of the underlying etiology. Magnetic resonance imaging (MRI) in 105 children and metabolic screening in 93 children were the most frequently ordered investigations. Abnormal imaging, MRI, CT scan and metabolic screening were significantly associated with detection of etiology (19).

2.3. Factors associated with Global developmental delay

An Indian study showed that, 7.1% of children under the age of 3 years were having global developmental delay. Maximum delay was observed in the 0-12 months age group (7.0%).

Undernutrition and prematurity were the two most prevalent etiological diagnoses (21% each). Stunting and maternal illiteracy were the microenvironmental predictors while prematurity and a history of seizures were identified as biological predictors (20).

A Study in Mongolia reveals that there was a negative association between the risk of developmental delay and higher maternal education. Increasing maternal age, maternal depression, female gender child, being single mother were predictors of developmental delay (21).

A retrospective study done in Southwest Sydney revealed that in children with global developmental delay without Autism spectrum disorder, the prevalence of iron depletion was 1.8% that of iron deficiency 5.5% and that of iron deficiency anaemia 5.5%. In children with ASD with or without global developmental delay, the prevalence of iron depletion was 3.0% that of iron deficiency 7.5% and that of iron deficiency anaemia 3.0% . Three significant risk factors for iron depletion, iron deficiency and iron deficiency anemia identified were problems of sucking, swallowing or chewing, poor eating behaviour, and inadequate amounts of meat, chicken, eggs or fish (22).

The Turkish study revealed that prematurity and IUGR were found to be related to the severity of GDD in cases without definitive etiologic yield. Poor outcome was associated with IUGR, low socioeconomic status and non-compliance to habilitation plan. Prematurity was an additional significant determinant of the outcome (18).

In a study done at King Fahad specialist Hospital in Saudi Arabia, 134 children with GDD were assessed, 22 % of them had low birth weight, 56% had epilepsy, 57% had interfamily marriage. Genetic causes were identified in 40 %, metabolic problem in 25 %. Neuroradiologic and EEG abnormalities were noted in 58% and 45% of participants respectively (10).

2.4. Conceptual Framework



**Sociodemographic
factors**

**Pre/and Perinatal
factors**

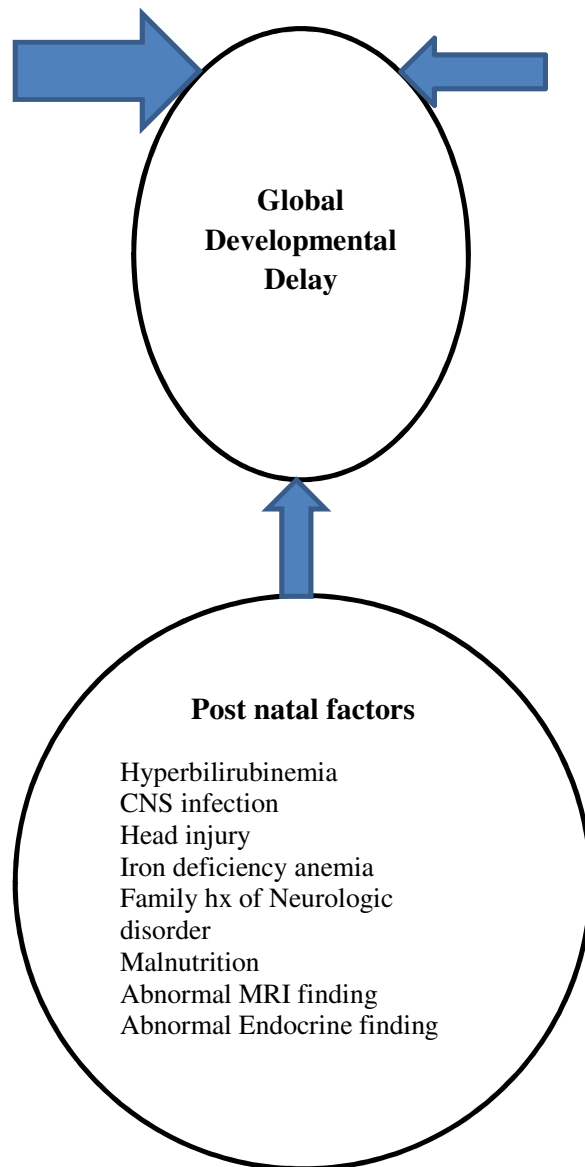


Figure 1: Conceptual framework showing the relationship between Global Developmental delay and its associated factors.(5, 8, 23)

3. Objectives of the Study

3.1. General Objective

The objective of this study is to describe the prevalence of suspected Global Developmental delay and its associated factors.

3.2. Specific Objectives

- To determine the prevalence of suspected Global Developmental Delay
- To describe the profile of suspected Global Developmental Delay
- To identify factors associated with suspected Global Developmental Delay

4. Materials and Methods

4.3. Study area

The study was conducted in St. Paul's hospital, Millennium Medical College found in Gullele subcity, Addis Ababa, Ethiopia. It is a tertiary hospital serving as a referral center from all over the country. The department of Pediatrics and child health has outpatient, Emergency, neonatal, Pediatric ICU and inpatient units. Averages of 30-40 children are evaluated at the Pediatric neurology outpatient unit daily.

4.4. Source Population

All children who have visited the Pediatric Neurology OPD.

4.5. Study Population

All patients who visited the Pediatric Neurology OPD from April 1 2021 to April 01 , 2022 who fulfil the inclusion criteria.

4.6. Study design and period

An institution based cross sectional study was conducted between April 1st to June 30th, 2022

4.3.1. Inclusion Criteria

- All patients who have visited the OPD during the study period

4.3.2. Exclusion Criteria

- Those with Autism Spectrum Disorder.
- Those with muscular dystrophies

4.7. Study Variables

Independent

Socio-demographic variables

- Place of residence
- Marital status
- Religion
- Level of maternal education
- Maternal Occupation

- Family size

Maternal variables

- Age of the mother
- Maternal alcohol use
- Maternal smoking
- Parity
- Type of pregnancy
- Maternal PIH
- Maternal Chorioamnionitis
- Other pregnancy related complication
- Co morbidities
- ANC followup
- Place of delivery
- Mode of delivery

Child related variables

- Age of the child
- Sex of the child
- Gestational age
- Birthweight
- Perinatal asphyxia
- Congenital heart disease
- Pulmonary lesions
- Hyperbilirubinemia
- Congenital infections
- Epilepsy
- CNS infection
- Head injury
- Iron deficiency anemia
- Family history of mental/ neurologic disorders
- Congenital anomalies
- Physical dysmorphic features
- Level of malnutrition
- Neurocutaneous findings

- Abnormal motor findings
- Visual impairment
- EEG finding
- MRI finding
- Endocrine finding

Dependent variable

- Global developmental delay

4.8. Operational definition

Suspected Global developmental delay is defined as a delay in two or more developmental domains (gross motor/fine motor, cognitive, speech/language, personal/social, activities of daily living) in children under the age of 5 years. The diagnosis is made by a physician based on assessment of expected developmental milestones(24) and has been documented on the patient chart.

Premature birth: is defined as babies born alive before 37 weeks of pregnancy is completed.

Low birth weight: describes babies who are born weighing less than 2500 grams.

Very low birth weight: Babies who are born weighing less than 1500 grams.

4.9. Sample size and sampling procedures

Sample size was calculated by using the single population proportion formula. Taking a previous study done in Tikur Anbessa Hospital, the prevalence of global developmental delay is 21.5 % (23)

Level of confidence= 95%, d= margin of error=0.05, p=0.215

$$n = (1.96)^2 * (0.215) * (0.785) / (0.05)^2$$

$$n = 259$$

Using the finite population correction formula, $n_f = 259 / 1 + (258 / 4000) = 243$. Adding 10% to the final sample size, Final sample size (Nf) = 268

The total number of patients who visited the OPD over 1 year were checked from the OPD register. Then using random number generator, the sample population was selected.

4.10. Data Collection Procedures

Data was then retrieved from the selected patient charts. Data was collected using a semi-structured data collection format. There was no mentioning of patient's name in data collection format and the cards were returned to the card room as soon as data was retrieved. A six hours

training was delivered to three data collectors who are medical residents and weekly supervision was given by the PI during the data collection period.

4.11. Data Quality Assurance

In order to assure the quality of data, an appropriately designed data collection instrument was used. A pretest was conducted on 5% of the total sample size in another hospital not part of the current study. Moreover, each data collector checked the data collection checklist for completeness and the principal investigator daily checked for completion and clarity.

4.12. Data Processing and analysis

After data collection, each returned questionnaire was checked for completeness and consistency manually. The questionnaires were classified as unfilled, partially incomplete, and fairly completed. Totally unfilled and partially filled formats were excluded from the analysis. Completed items were coded. The coded questionnaires were entered to Epi Info version 7.2 and analyzed with SPSS version 25.

Analyses like frequency, proportion and mean of variables were used for descriptive results. To see the association between dependent and independent variables, a bivariate and multivariate regression analysis were conducted. Those variables which satisfy the assumption ($p = 0.25$) was taken as candidate for bivariate analysis and statistically significant variables were checked at $p < 0.05$ after multivariate analysis.

4.13. Ethical Consideration

Ethical clearance was obtained from Institutional Review Board of St Paul's Hospital Millennium Medical College. Formal letter of cooperation was secured from the hospital administration and all the information was kept in a way that could not interfere with personal confidentiality.

4.14. Dissemination Plan

This thesis will be presented and submitted to the School of Public health, St Paul's Hospital Millennium Medical College. The study findings will be communicated and submitted to the college's scientific communities and concerned body. The study findings and recommendations will also be communicated by preparing forum for workshops and panel discussion with concerned stakeholders and hard copies and soft copies will be disseminated to all stakeholders. Finally, the publication on scientific journal will be considered.

5. RESULT

Socio-demographic characteristics

Out of the 250 patients reviewed in the study, 155 (62%) were from Urban area .Two hundred seventeen (86.4%) of the mothers were married while thirty four (13.6%) were single. Eighty three mothers (33.2%) are not able to read and write while twenty five (10%) has attended college level and higher. Regarding maternal occupation, two hundred and five (82%) are housewives and the rest 18% have different jobs. Total family size less than or equal to 3 accounted for 116(46.4%) of the study participants, where as sixteen (6.4%) of the patients were living in the family size of seven and above.(Table 1)

Variable	Category	Frequency	Percentage(%)
Place of residence	Urban	155	62
	Rural	95	38
Marital status	Single	34	13.6
	Married	217	86.4
Religion	Orthodox	143	57.2
	Muslim	78	31.2
	Catholic	1	0.4
	Protestant	28	11.2
Level of Maternal Education	Can't read and write	83	33.2
	Can read and write	35	14
	Primary School	65	26
	Secondary School	42	16.8
	College and higher	25	10
Maternal Occupation	Housewife	205	82
	Government employee	15	6
	Merchant	2	0.8
	Private Organization	3	1.2
	Daily labourer	25	10
Family size	<=3	116	46.4

	4-6	118	47.2
	>=7	16	6.4

Table 1: Socio-demographic characteristics of study subjects at Pediatric neurology clinic of SPHMMC between April 1 2021 to April 01 2022.

Maternal Characteristics

Mother's age at delivery of the child showed less than 18 years in 0.4%, 19-24 years in 38.8 %, 25-35 years in 54.8% and greater than 35 years of age in 6% of the total cases. Hundred and twenty children (48%) were a product of primiparous pregnancy, where as hundred and thirty(52%) were delivered by multipara women. Multiple pregnancies accounted for nineteen cases (7.6%). Maternal complications during pregnancy were identified in thirty one patients (12.4%) .While 234 mothers (93.6%) had regular ANC follow up, 16 mothers (6.4%) had no regular ANC follow up. Hundred and thirty nine mothers had delivered at a health center (55.6%) while ninety two mothers (36.8%) delivered at primary hospital and above. Nineteen mothers (17.6%) had delivered at home. One hundred seventy eight mothers delivered by SVD (74.8%). C/S delivery occurred in 49 mothers (19.6%) and 14(5.6%) delivered by instrumental delivery and 187(74.8%) delivered by SVD.(Table 2)

Variable	Category	Frequency	Percentage (%)
Maternal age at delivery	≤18	1	0.4
	19-24	97	38.8
	25-35	137	54.8
	>35	15	6
Parity	Primiparous	120	48
	Multiparous	130	52
Type of Pregnancy	Singleton	231	92.4
	Multiple	19	7.6
Maternal complications during pregnancy	No	219	87.6
	Yes	31	12.4
ANC follow up	No	16	6.4
	Yes	234	93.6
Place of delivery	Home	19	7.6
	Health center	139	55.6

	Primary hospital and above	92	36.8
Mode of delivery	SVD	187	74.8
	C/S	49	19.6
	Instrumental	14	5.6

Table 2: Maternal characteristics of study subjects at Pediatric Neurology clinic of SPHMMC between April 1 2021 to April 01 2022.

Clinical characteristics of Patients

One hundred seventeen(46.8%) of the study participants were in the age group of 12-36 months at diagnosis followed by 77(30.8%) children who are aged less than 12 months. Hundred twenty eight (51.2%) were males where as 122(48.8%) were females. Two hundred and six(82.4%) were born with a normal birthweight, 40(16%) were low birth weight and 4(1.6%) were macrosomic. Perinatal asphyxia was evident in 84(33.6%) of the children studied. Epilepsy was present in 116(46.4%) of children, iron deficiency anemia was found in 36(14.4%) of the study subjects. Regarding the growth parameters, underweight, wasting, stunting and microcephaly were detected in 48.8%, 34.4%, 42.8% and 28% of the cases. Dysmorphic features and congenital anomalies were present in 26(10.4%) and 23(9.2%) of the cases. The presence of motor findings, visual impairment, abnormal EEG and abnormal brain MRI findings accounted for 115(46%), 34(13.6%), 81 (20.4%), 87(34.8%) of the cases while endocrine findings were found in only 8 cases (3.2%).(Table 3)

Variable		Frequency	Percent (%)
Age at initial Dx	<12 months	77	30.8
	12-36 months	117	46.8
	37-60 months	56	22.4
Sex	Male	128	51.2
	Female	122	48.8
	Rural	95	38
Birth weight	VLBW	10	4
	LBW	30	12
	NBW	206	82.4
	Macrosomic	4	1.6
Gestational age	Very Preterm	23	9.2
	Moderate preterm	8	3.2
	Term	212	84.8
	Postterm	7	2.8
Perinatal asphyxia	No	166	66.4
	Yes	84	33.6
Birth injury	No	245	98
	Yes	5	2

Congenital heart disease	No	234	93.6
	Yes	16	3.4
Pulmonary lesions during neonatal period	No	223	89.2
	Yes	27	10.8
Hyperbilirubinemia	No	231	92.4
	Yes	719	7.6
Congenital infections	No	247	98.8
	Yes	3	1.2
Epilepsy	No	134	53.6
	Yes	116	46.4
CNS infection	No	231	92.4
	Yes	19	7.6
Head injury	No	242	96.8
	Yes	8	3.2
Iron deficiency anemia	No	214	85.6
	Yes	36	14.4
Family hx of mental and developmental disorder	No	246	98.4
	Yes	4	1.6
Variable		Frequency	Percent (%)
Underweight	No	128	51.2
	Yes	122	48.8
Wasting	No	164	65.6
	Yes	86	34.4
Stunting	No	143	57.2
	Yes	107	42.8
Microcephaly	No	180	72
	Yes	70	28
Dysmorphic features	No	224	89.6
	Yes	26	10.4
Congenital anomalies	No	227	90.8
	Yes	23	9.2
Neurocutaneous findings	No	246	98.4
	Yes	4	1.6
Motor findings	No	135	54
	Yes	115	46
Visual impairment	No	216	86.4
	Yes	34	13.6
EEG finding	No	199	79.6
	Yes	81	20.4
MRI finding	No	163	65.2
	Yes	87	34.8
Endocrine finding	No	242	96.8
	Yes	8	3.2

Table 3: Clinical characteristics of study subjects at pediatric neurology clinic of SPHMMC between April 1 2021 to April 01 2022

Prevalence of Global Developmental Delay in the study

Among the 250 children reviewed in this study, 54(21.6%) had Global Developmental Delay. Twenty four of the children (44.4%) with global developmental delay were males and 30(55.6%) were females. Sixteen (29.6%) were diagnosed before the age of 12 months, 28(51.9%) were diagnosed between the age of 12-36 months, 8(18.5%) were diagnosed between the age of 36-60 months. (Figure 2)

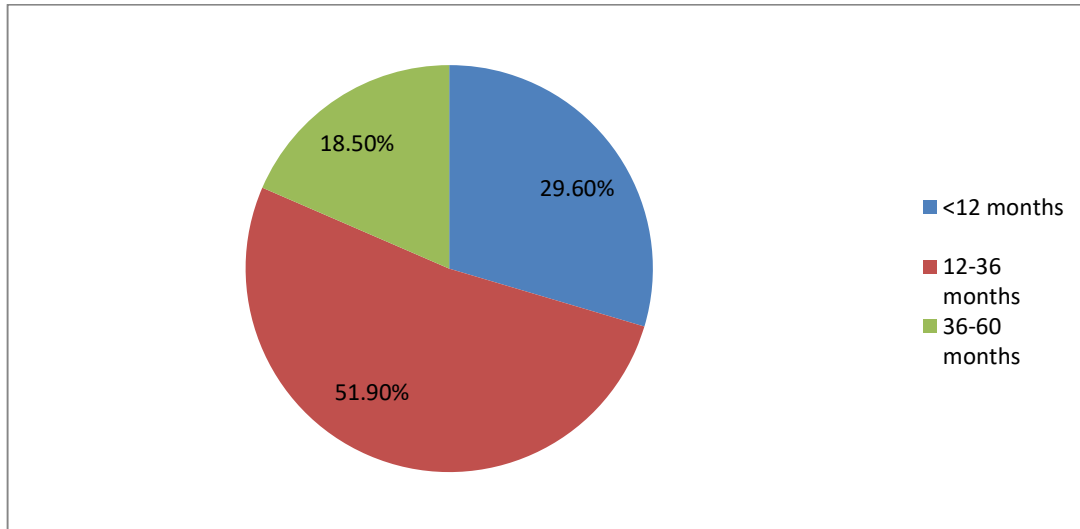


Figure 2: Age distribution of subjects with Global Developmental Delay at Pediatric Neurologic clinic of SPHMMC between April 01 2021 to April 01 2022

Socio demographic, Maternal Characteristics and Clinical Profile of Global Developmental Delay in the study

Out of the fifty four children with Global Developmental Delay, 38(70.4%) of them were from Urban area while the rest were from rural area. With regard to gestational age, 47(87%) of them were born term, prematurity accounted for five of them (9.3%) and 2 (3.7%) of them were born post term. Normal birth weight was present in 44 (81.5%) of the GDD cases while 10 (18.5%) of them were low birth weight.

Regarding maternal age of the children with Global Developmental Delay, 22(40.7%) of them were in the age group 18-24 years, while 29(53.7%) were in the age range of 25-35 years. The rest 3(5.6%) of them were above the age of 35 years.

Regarding the maternal educational status, Nineteen (35.1%) can not read and write, 6(11.1%) can read and write, 15(27.8%) are at Primary school level, 12(22.2%) were at secondary school level and 2(3.7%) are at college level and higher.

Twenty five mothers (46.3%) have a family size of three, 25(46.3%) were having family size of 4-6 and 4(7.4%) had a family size of seven and above. Twenty six of the children (48.1%) with GDD were born from primiparous mothers while 28(51.9%) of the mothers were multiparous.

Concerning the place of delivery, 4(7.4%), were delivered at home, 33(61.1%) were born at a health center and 17(31.5%) were delivered at Primary hospital and above. Forty-three (79.6%) mothers gave birth by Spontaneous vaginal delivery, 7(13%) required C/S delivery and 4(7.4%) had instrumental delivery.

Epilepsy was observed in 28 (51.9%) of the patients, 7(13%) of patients had a history of CNS infection. Eight patients (14.8%) had associated Iron deficiency anemia and congenital anomalies were identified in 5(9.3%) of them.

With regard to the level of malnutrition, 32(59.3%) were underweight, 19(35.2%) were wasted, 28(51.9%) were stunted and 32(59.3%) were microcephalic. Motor findings were abnormal in 42(77.8%) of patients. Visual abnormalities were isolated in 14(25.9%) of patients with GDD while only 2 (1.9%) patients had endocrine abnormalities.

Among the 54 children with global developmental delay, 45 (83.3%) of the children had perinatal asphyxia where as 9(16.7%) had no perinatal asphyxia. (Figure 3)

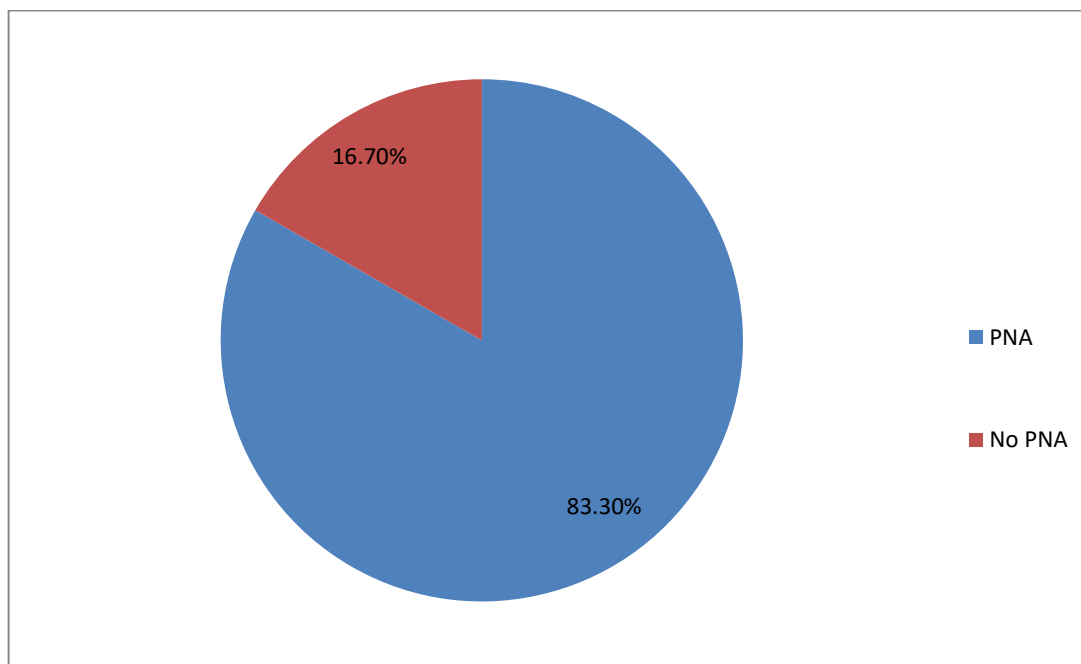


Figure 3: The prevalence of Perinatal asphyxia among subjects with Global Developmental Delay at Pediatric Neurologic clinic of SPHMMC between April 1 2021 to April 01 2022

Abnormal EEG and brain MRI findings were observed in 10(18.5%) and 50(92.6%) of the cases with global developmental delay. (Figure 4)

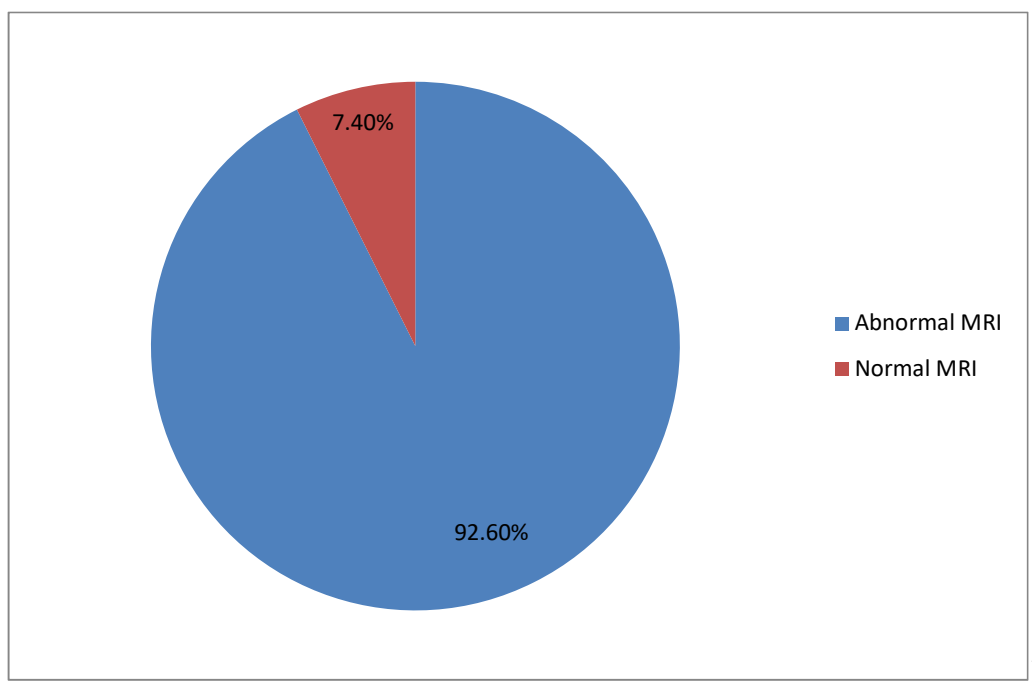


Figure 4: The pattern of MRI findings among subjects with Global Developmental Delay at Pediatric Neurology clinic of SPHMMC between April 1 2021 to April 01 202

Factors associated with Global Developmental Delay

In binary logistic regression analysis, the covariates Perinatal asphyxia, microcephaly, Motor findings, visual impairment, and brain MRI finding were candidates for multivariable binary logistic regression with a P-value <0.25.

Perinatal asphyxia and Brain MRI findings had a significant association with Global Developmental Delay at P-value <0.05 in multivariate logistic regression analysis.

The study showed that the presence of perinatal asphyxia was an important determinant factor for Global Developmental Delay. The odds of global developmental delay was 10 times more likely in patients with perinatal asphyxia than patients with out having perinatal asphyxia (AOR=10.022, 95%CI (3.774-26.61), p-value=0.0001). The odds of global developmental delay were 30 times more in patients with abnormal brain MRI findings than those with out abnormal MRI findings (AOR= 30.227,95%CI(9.161-99.737), p-value= 0.0001)

Variable	Category	Global developmental delay		COR	AOR	P-value
		Yes	No			
Perinatal asphyxia	No	9	157	20.128(9.072-44.661)	10.022 (3.774-26.610)	0.0001
	Yes	45	39			
Microcephaly	No	22	158	6.048(3.163-11.563)	2.58 (0.993-6.699)	0.052
	Yes	32	38			
Motor finding	No	12	123	5.897(2.917-11.922)	2.199(0.800-6.048)	0.127
	Yes	42	73			
Visual impairment	No	40	176	3.080(1.434-6.615)	0.960(0.304-3.034)	0.945
	Yes	14	20			
Brain MRI finding	No	4	159	53.716(18.252-158.087)	30.227(9.161-99.737)	0.001
	Yes	50	37			

Table 4: Multivariable binary logistic regression result of significant variables

6. Discussion

The result of this study showed that the prevalence of Global Developmental Delay is 21.6%. This is consistent with a study done in Tikur Anbessa Hospital which showed a prevalence of 21.5% (15) but this figure was much higher than studies done in India which showed prevalence of 7.1%, a study from Mongolia with prevalence of 11% (21) and studies from Nigeria with prevalence of 14.6% (25) and UAE study with prevalence of 8.4%.(26). The higher result could be explained because the diagnosis is made on clinical grounds and not on advanced screening and diagnostic tools which are used in the other studies used for comparison.

The study showed that the presence of perinatal asphyxia and abnormal MRI finding were the determinants of Global Developmental Delay among children attending the Pediatric neurology clinic. This finding was consistent with a study from Nigeria and UAE where perinatal asphyxia was identified to be a strong predictor (25, 26). This finding was contrary to the finding from Greece which rather showed prematurity and IUGR to be independent predictors of Global Developmental Delay (27). An Indian study also revealed prematurity and history of seizures as significant predictors which was not the case in our study (20). The Mongolian study showed female gender and single motherhood to be significant predictors of Global Developmental delay in contrast to our study (21). The difference in the result might be attributed to a difference in study settings and a lower contribution of perinatal asphyxia to the occurrence of Global Developmental delay because of possibly better levels of obstetric and neonatal care.

In this study, prematurity accounted for 9.3% of the patients with GDD. This is similarly observed in the study done in India with rate of prematurity being 10.1% (9). But higher rate of prematurity which is 33% is reported in the study done in Greek and 62.9 % reported in Rwanda (27, 28). This difference could be explained by the fact that premature babies have better survival in the other settings where care for premature babies might be higher.

This study has shown that epilepsy was present in 51.9% of the cases with suspected GDD. This result is almost consistent with a study done in Saudi Arabia which reported an epilepsy rate of 56 % (29)

With regard to visual abnormalities, 25.9 % of the patients with suspected GDD had visual problems in this study. This result is much lower when compared to other studies done in India

showing a rate of 85.9%, 84.8% and 83.6% respectively(30-32). The much higher prevalence might be explained by the availability of better ophthalmologic diagnostic facility and tools.

In this study most cases with Global Developmental Delay had an abnormal MRI finding (92.6%). And the study showed that cases with abnormal MRI finding has 30 times the odds of having Global developmental Delay than those with normal MRI finding. This finding is much higher than a study from Saudi Arabia by Habibullah et al i.e 54.7% (10), and a study by Ali Ekbar et al from Iran with rate of 59% (33). Similar studies from Tikur Anbessa Hospital and India showed figures of 73.4% and 80% respectively. (34, 35).

This study gives baseline data as the topic is rarely studied and there is paucity of data in Ethiopia. Therefore, it highlights the need to conduct a nation wide study on Global Developmental Delay. Data was collected from a large teaching hospital and thus it should be generalized with caution. A multi center study including more hospitals is needed to improve generalizability of current findings

7. Conclusion

The prevalence of suspected Global Developmental Delay was found to be high. Perinatal asphyxia and Abnormal MRI findings are significantly associated with Suspected Global Developmental Delay.

8. Recommendation

For the health system stakeholders and partners

Implementation of Preventive strategies for Perinatal asphyxia could decrease the burden of Suspected Global Developmental Delay. The ministry of Health should strongly work on the cascading of the high impact preventive interventions to reduce the incidence of birth asphyxia. This has to be coupled with the escalation of access to rehabilitation services which the great burden of the problem demands.

The expansion of MRI services in tertiary care hospitals could significantly assist in the evaluation and diagnosis of Global Developmental Delay.

For researchers

A larger community based study has to be undertaken to have a more accurate prevalence of the problem and a more comprehensive assessment of associated risk factors

Application of advanced and locally validated screening and diagnostic tools in future studies would give a better data on the extent of the problem.

9. Limitation of study

A limitation of this study is the use of secondary data and being a single center study. Additionally this study did not adequately assess psychosocial factors associated with Global developmental delay as the data was difficult to find from chart review.

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11. ANNEXES

Annex I- Data Collection Format

Patient's medical record number: -----

Part I- Socio-demographic characteristics

No		
1	Place of residence	1. Urban
		2. Rural
2	Marital status	1. Single
		2. Married
		3. Widowed
		4. Divorced
		5. Separated
3	Religion	1. Orthodox
		2. Muslim
		3. Catholic
		4. Protestant
		5. Other
4	Level of Maternal education	1. Can't read and write
		2. Can read and write
		3. Primary school
		4. Secondary school

		5. College and higher
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5	Maternal Occupation	1. Housewife
		2. Government employee
		3. Merchant
		4. Private organization
		5. Daily labourer
6	Family size	1. < or=3
		2. 4-6
		3. > or =7

Part II- Maternal characteristics

No		
1	Age of the mother	1. <18
		2. 18-25
		3. 25-35
		4. >35
2	Parity	1. Para 1
		2. Para 2
		3. Para 3
		4. Para 4
		5. Para 5
		6. Above 5
3	Type of pregnancy	1. Singleton

		2. Multiple
4	Place of delivery	1. Home
		2. Health center
		3. Primary hospital and above
5	Mode of delivery	1. SVD
		2. Assisted vaginal delivery
		3. C/S
		4. Instrumental
6	Regular ANC followup	1. No
		2. Yes
7	Maternal PIH	1. No
		2. Yes
8	Maternal chorioamnionitis	1. No
		2. Yes
9	Other pregnancy related complication	1. No
		2. Yes
10	Hx of Comorbid illness	1. No
		2. Yes
11	Maternal alcohol use	1. No
		2. Yes
12	Maternal hx of smoking	1. No
		2. Yes

Part III- Child related characteristics

No		
1	Age of the child at diagnosis	1. <12 months
		2. 12-36 months
		3. 37-60 months
		4. >60 months
2	Sex	1. Male
		2. Female
3	Gestational age	1. <28 wks
		2. 28-32 wks
		3. 32-37 wks
		4. 37-42 wks
		5. >42 wks
4	Birth weight	1. >4000 gm
		2. 2500-3999 gm
		3. 1500-2499 gm
		4. 1000-1499 gm
		5. <1000 gm
5	Wasting	1. No
		2. Yes
6	Stunting	1. No
		2. Yes
7	Underweight	1. No
		2. Yes
8	Microcephaly	1. No
		2. Yes

9	Perinatal asphyxia	1. No
		2. Yes
10	Congenital heart disease	1. No
		2. Yes
11	Pulmonary lesions	1. No
		2. Yes
12	Hyperbilirubinemia	1. No
		2. Yes
13	Congenital infection	1. No
		2. Yes
14	Epilepsy	1. No
		2. Yes
15	CNS infection	1. No
		2. Yes
16	Head injury	1. No
		2. Yes
17	Iron deficiency anemia	1. No
		2. Yes
18	Family hx of mental/neurologic disorder	1. No
		2. Yes
19	Congenital anomalies	1. No
		2. Yes
20	Physical dysmorphic features	1. No
		2. Yes
21	Neurocutaneous finding	1. No
		2. Yes

22	Abnormal motor finding	1. No
		2. Yes
23	Visual impairment	1. No
		2. Yes
24	Abnormal EEG finding	1. No
		2. Yes
25	Abnormal MRI finding	1. No
		2. Yes
26	Endocrine finding	1. No
		2. Yes
27	Global Developmental Delay	1. No
		2. Yes

ANNEX-II

ASSURANCE OF PRINCIPAL INVESTIGATOR

I, the undersigned agree to accept responsibility for the scientific, ethical and technical conduct of the research project entitled *Pattern of suspected global developmental delay and its associated factors among children seen at the Pediatric Neurology outpatient unit of St Paul's Hospital, SPHMMC* and for provision of required progress report as per terms and condition of the School of Public Health.

Name of Principal Investigator	Signature	Date
Misikir Ambaye		

Approval of the advisors

This thesis proposal has been submitted with our approval as advisors.

Name of the advisors	Signature	Date
Mr. Getachew		
Mr. Kinfu		