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Clinical presentations and patterns of neuro-developmental disorders in a health facility in Ghana: implications for the health and educational sectors

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Abstract

Background: Neurodevelopmental disorders (NDD) are a heterogeneous group of disorders with life-long implications for cognition, behaviour, emotions, academic performance, social well-being, and future career. Early identification and interventions yield a better outcome. Yet, there is a gap in knowledge about the range of NDD that exists in Ghana among laypersons, health, and education professionals.

Objective: This study examined the clinical presentations and patterns of NDD in a clinical psychological clinic of a quasi-governmental hospital in Ghana.

Methods: Using a retrospective chart review design, secondary data were extracted from eligible psychological reports of children managed at the clinic from January 2012 to December 2018.

Results: Most children (62.96%, n = 85/135) were aged 6 - 13 yr. at the time of establishing a diagnosis. They had been referred from private schools (49.62%, n = 67/135) because they were doing poorly academically (38.51%, n = 52/135) or exhibited some behavioural problems (22.22%, n = 30/135). Most of them had been born at term by spontaneous delivery (58.51%, n= 79/135) but went through traumatic delivery and suffered perinatal complications (32.6%). There was a significant association between birth asphyxia and labour complications ($p < 0.0001$), gestational age ($p < 0.008$), mode of delivery ($p < 0.016$), and cerebral palsy ($p < 0.018$). Almost forty per cent had comorbid neurodevelopmental disorders.

Conclusion: Findings from this study have implications in the prevention and early identification of NDDs. Parental education must be intensified during antenatal care and childhood educators must be trained to identify NDDs to enable early referral for diagnosis and intervention.

Keywords: *Neurodevelopmental disorders, paediatric, emotions, academic performance, Ghana*

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INTRODUCTION

Neurodevelopmental Disorders (NDDs) are a heterogeneous group of conditions that share a commonality of abnormal development and functioning of the brain [1]. The Diagnostic and Statistical Manual (DSM-5) defines NDD to include Intellectual Disability, Communication Disorder, Autism Spectrum Disorders, Attention Deficit Hyperactive Disorder, Motor Disorders and Specific Learning Disability [2]. The NDDs manifest in the early developmental phase of life often before the child reaches school-going age [1,3]. There are lifelong implications for those who live with the condition – affecting cognition, behaviour, emotions, academic performance, social well-being, and future career [4]. Diagnosis is usually by clinical interview reports from significant others, observations and use of standardized tests [5]. The NDD may manifest singly but often co-occur with other developmental disorders [1,5]. Early identification and intensive interventions have the potential to maximize the developmental outcome for the child and prevent secondary comorbidities [6,7]. The risks for NDD are multifactorial with developing countries carrying a greater burden [4]. This high burden is attributed to the high

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prevalence of causative factors for the disorders such as infections, malnutrition, poor antenatal, obstetric, and neonatal management causing birth asphyxia and other forms of birth injury [8, 9,10]. The presence of the disorder may not be readily detected because such children may seem healthy at first glance [11]. Child morbidity has not gained as much focus as mortality even though NDDs have been recognised as a public health threat contributing to the heavy burden of children living with disability in low- to-middle-income countries [9]. However, identification of NDDs is low due to problems with the assessment [9, 4]. In Ghana, the prevalence of NDDs is uncertain. It is estimated that 1.8% of children below 15 yr. in a study conducted in the Central Region of Ghana have some form of disability [12]. Approximately 45% of children aged less than 5 yr. in this Ghanaian cohort had some form of developmental delays including deficits in the NDD domains such as cognition and communication problems [13]. Child welfare clinics in Ghana are accessible to most children until the age of 5 yr. The services which should include monitoring of the development of children is accessed only until the completion of the expanded immunization program and has gained the nickname "Weighing" [13]. Thus, the services have been limited to weight monitoring and vaccinations. The child developmental surveillance component has become almost non-existent compared to practices in high-income countries where policies and laws mandate health professionals to proactively identify and institute interventions for children with NDDs [14]. There is therefore a gap in knowledge about the range of NDDs as exists in Ghana among both health and educational professionals [15, 4]. However, knowledge of the patterns of presentation in clinics could inform policy formulation especially in the context of appropriate practices in prevention, early identification, and surveillance to reduce the prevalence, impact, over-medicalization and generally improve outcomes of NDDs. This study sought to examine the clinical presentations and patterns of NDD among children attending a clinical psychological unit of a quasi-governmental hospital in Ghana.

MATERIALS AND METHODS

Study design

A retrospective chart review (RCR) design was adopted to access data from a clinic that offers clinical psychological services. Psychological reports written for all children receiving the service from the clinic served as the pool from which eligible samples were extracted. The NDD was defined using DSM-5 to include: Autism Spectrum Disorder, Intellectual disability, Communication Disorders, Specific Learning Disorders, Motor Disorders, and other NDDs.

Data collection tool

Data were extracted from eligible medical reports guided by the following characteristics: age of children when first diagnosed with an NDD; demographic information of relevance; sources of referral of NDD cases for diagnostic assessment; common presenting problems leading to the referral; risks of NDD; and common NDD diagnosed alone or in combinations. The data obtained were captured in an excel sheet (Supplementary Table 1).

Reports

The reports that were reviewed contained information gathered from interviewing parents/caregivers who brought the children to the clinic. Other sources of information in the reports were obtained from observational reports of at least two different sessions, ancillary sources of information such as reports from teachers, referral letters, medical information where they existed and standard psychological tests and ratings. Interviews with significant persons focused on the reason for referral, presenting complaints, the history of presenting complaints, the obstetric history of pregnancy with the child which includes any antenatal illnesses that the mother may have suffered during pregnancy, the gestational age at birth, the form of delivery and any complications or conditions in the perinatal or neonatal phase of life. The developmental milestones, significant medical, educational, and social history and the adaptive behaviours of the child were also reported.

Psychological tests used included the Childhood Autism Rating Scale (CARS) which consisted of 14 domains assessing behaviours associated with autism, with a 15th domain rating general impression of autism. Each domain was scored on a scale ranging from 1 - 4; higher scores were associated with a higher level of impairment [16]. The Early Childhood Attention Deficit Disorder Evaluation Scale (ECADDES) consisted of 56 items (24 items on the Inattentive subscale, and 32 items on the Hyperactive-Impulsive subscale). Ratings ranged from 0 (does not engage in the behaviour) to 4 (one to several times per hour) [17]. The Attention Deficit Hyperactive Disorder Test (ADHDT) included a brief rating scale consisting of 33 Likert-type scale statements that describe the child. The scale ranges from 0 - 3. A score of "0" means never observed, a score of "1" means occasionally observed, a score of "2" means often observed, and a score of "3" means very often observed [18]. The Vanderbilt ADHD Diagnostic Teacher and Parent Rating Scales (VADTPRS) included both teacher and parent assessment scales. The scale had two components: symptom assessment and impairment in performance. The symptom assessment component screened for symptoms relevant to inattentive and hyperactive ADHD subtypes. To meet criteria for ADHD diagnoses, a respondent must have 6 positive responses to either the core 9 inattentive symptoms or core 9 hyperactive symptoms or both. Both the parent and the teacher versions asked the respondent to rate the frequency of a child's behaviours on a scale of 0 - 3 [19]. The Comprehensive Test of Non-Verbal Intelligence (CTONI) used nonverbal formats to measure general intelligence of children and adults whose performance on traditional tests might be adversely affected by subtle or overt impairments

involving language or motor abilities. Results were reported as standard scores, percentile ranks, and age equivalents [20]. The Bender-Gestalt Test-II (BGT-II) consisted of nine index cards picturing different geometric designs. The cards were presented individually, and test subjects were asked to copy the design before the next card was shown. Test results were scored based on the accuracy and organization of the reproductions [21]. The Wide Range Achievement Test-3 (WRAT-3) measures the basic academic skills of word reading, sentence comprehension, spelling, and maths computation [22]. Tests were selected depending on the information gathered and served as adjunct or confirmation of diagnosis made during the assessment. Relevant tests were conducted, and their outcome reported. Conclusive diagnosis with evidence of how it was arrived at and recommendations concluded the reports.

Table 1. Demographic characteristics of children with NDDs

Characteristics		Frequency	Percentage
Sex	Male	82	60.70
	Female	53	39.30
Age at diagnosis			
	2 -5	30	22.22
	6 - 9	43	31.85
	10 -13	42	31.11
	14 - 17	20	14.81
Type of school			
	Private	104	77
	Public	6	4.44
	Special School	24	17.80
	None	1	0.80
Grade level at intake			
	Preschool	2	1.48
	Lower Primary	68	50.37
	Upper Primary	27	20
	Junior High	9	6.66
	Special School	29	21.48
Informant			
	Mother only	63	46.66
	Father only	18	13.33
	Both Parents	21	15.55
	Guardian/ Foster	29	21.48
	Other	4	2.96

*NDD, Neurodevelopmental disorders

Table 2. Referral source, and the reasons for referral

Characteristics	Frequency	Percentage
Referral source		
School	31	22.96
Special School	36	26.66
Healthcare worker	41	30.40
Family/ Guardian	12	8.88
Orphanage	13	9.62
Other	2	1.48
Reason for Referral		
Poor academic performance	52	38.51
Behavioural problems	30	22.22
Communication problems	12	8.88
School placement	36	26.66
Developmental delay	5	3.70

Sampling
Guided by a pre-determined eligibility criterion (any case that is categorised as an NDD), reports of children aged 2 - 17 yr. diagnosed with an NDD (DSM-5) from January 2012 to December 2018 were screened for inclusion. A total of 163 out of 225 reports were independently extracted by the researchers who discussed each report for harmonisation.

Statistical analysis
Relevant data were recorded and entered in MS Excel. Subsequently, data were coded and exported into STATA Version 13 (StataCorp, USA). Univariate analysis was computed to assess the frequency, ranges of variables, and trends. Bivariate analysis using The Fisher Exact test was used to compute possible relationships between the gestational age, mode of delivery, complications of delivery, perinatal and neonatal and, types of NDD diagnosis.

RESULTS

In all, 135 out of the 163 reports were found eligible. There were more males (60.70%, n = 82/135) than females (39.30%, n = 53/135) with their ages ranging from 2 - 17 yr. Most of the children were aged 6 – 13 yr. (63%, n = 85/135) at the time they were referred and therefore at the time a diagnosis was established. The mean age ± standard deviation (SD) at diagnosis was 8.97 ± 3.94 yr. Most of the children attended private schools (77%, n = 104/135) and only (4.44%, n= 6) attended public schools. There were 17.80% (n = 24/135) who attended private special schools. Only one child was not in school (0.80%, n = 1/135). The majority (50.40%, n = 68/135) were at the lower primary level and a few (6.70%, n = 9) were at Junior High School level at the time of first assessment. Table 1 details the demographic characteristics of children participants.

Source and reason for referral
Among the 135 children, the sources of referral were mostly from schools (mainstream or special schools) (49.62%, n = 67/135) and healthcare workers (paediatricians and general practitioners) (30.40%, n = 41). Parents and guardians constituted the least referral source (18.51%, n = 25). The reasons for referral were mainly attributed to poor academic performance (38.51%, n = 52/135), but also because of behavioural problems (22.22, n = 30), communication challenges (8.90%, n = 12), or developmental delay (3.70%, n = 5). A significant number were referred for the reason of special school placement (26.66%, n = 36) (Table 2).

Antenatal, delivery, neonatal characteristics, and complications
The obstetric and perinatal information of children in foster care in orphanages or with guardians were deficient as most were not privy to the information. Of those whose mothers'

Table 3. Obstetric characteristics of Mothers' of children with neuro-developmental disease

Characteristics	Frequency	Percentage
Gestational age		
Preterm (< 38 wk)	12	8.90
Term (38 – 40 wk	85	63
Post-term (< 40 wk)	13	9.60
Unknown	25	18.50
Mode of delivery		
Vaginal delivery	79	58.50
Surgical delivery	29	21.50
Unknown	27	20
Antenatal problems		
Yes	5	3.70
No	104	77.03
Unknown	26	19.25

Table 4. Delivery, perinatal, and neonatal complications

Characteristics	Frequency	Percentage
Labour complications		
Yes	44	32.59
No	65	48.14
Unknown	26	19.25
Type of Complication		
Induction of labour	14	10.37
Prolonged labour	23	17.33
Unknown	7	5.18
Perinatal and neonatal complications		
Birth asphyxia	27	20
Sepsis	4	2.96
Neonatal jaundice	5	3.70

Table 5. Types of Neurodevelopmental Disorder Diagnosis among the cohort

Neurodevelopmental Disorder Diagnosis	Frequency	Percentage
Diagnosis		
Intellectual disability	75	55.55
Attention Deficit/ Hyperactive Disorder	41	30.37
Autism Spectrum Disorder	17	12.59
Communication difficulty	7	5.18
Cerebral palsy	17	12.59
Recurrent seizures	20	14.81
Learning disability	9	6.66
Enuresis	1	0.74
Comorbidities		
Single diagnosis	81	60
Two Comorbidities	48	35.55
Triple Comorbidities	6	4.44

obstetric history was known, only 5 (3.70%, n = 5/135) of mothers had some significant medical condition during the pregnancy; one had Rubella infection, and two each had pregnancy-induced diabetes or pregnancy-induced hypertension. Most of them were delivered at term (63%, n = 85/135), while an almost equal number were delivered either pre-term (8.90%, n = 12) or post-term (9.63%, n= 13). Most of them were delivered vaginal (58.50%, n = 79) with 44% describing what can be considered a traumatic delivery or complicated delivery. Surgical deliveries (21.50%, n = 29) were indicated under emergency (62.22%, n = 84/135) rather than under planned intervention. Table 3 shows detailed obstetric characteristics of the mothers of the children.

Delivery, perinatal, and neonatal complications

In Table 4, there were some challenges during delivery and as a result, some children experienced some trauma. For instance, prolonged labour (inability of the woman to proceed with childbirth for about 18 to 24 h after regular contractions begin) accounted for 17.33% (n = 23/135) while 10.37%, n = 14) had labour induced or augmented. Of those induced 48.14% (n = 65/135) failed to deliver vaginal leading to emergency surgical intervention. Even though there was some reported lack of knowledge about labour complications experienced, most of the mothers reported absence of complications during delivery.

Neurodevelopmental disorders diagnosis and observed associations with Asphyxia

The reports revealed varied NDDs were diagnosed. Whereas some children had single diagnosis (60%, n = 81/135), others had comorbid NDDs (40%, n = 54) of either two (35.55%, n = 48) or three (4.44%, n = 6) disorders. Intellectual disability (55.56%, n = 75) accounted for more than half of all the referrals either alone or comorbid with either one or two other NDDs. The ADHD (30.37%, n = 41/135) accounted for the next commonest diagnosis. There were as many children diagnosed with Cerebral Palsy (12.59%, n = 17/135) as were those with Autism Spectrum disorder (12.59%, n = 17). The least diagnosed NDDs were Learning Disability (6.66%, n = 9) and Communication difficulties (5.18%, n = 7). Seizure disorder (14.81%, n = 20/135) was a common comorbid condition with NDDs (Table 5). Findings also showed that there existed some associations between birth asphyxia, gestational age, and type of delivery, labour complications, and the diagnosis of cerebral palsy (Table 6).

Table 6: Significant associations with asphyxia

Factor	Asphyxia		
	Chi square	Significance	Fisher exact
Labour complications	14.11	0.000	0.001
Delivery type	8.28	0.016	0.006
Gestational Age	11.72	0.008	0.002
Cerebral palsy	5.58	0.018	0.071

DISCUSSION

The NDD constitutes the most occurring group of disorders with high rates of both homotypic and heterotypic comorbidity among children and adolescents accessing mental health services [16]. This provides some explanation to the high number of children (82.96%, n = 112/135) who were provided services at the study site between January 2012 and December 2018 that suggests that there may be a high incidence of NDDs in the general population. The realisation that more males than females are diagnosed with a type of NDD is consistent with findings in both high and low-income countries [23,24,25]. This high prevalence of NDDs among males has led to the concept of a "female protective model. This model suggests that females would be predicted to require greater exposure than males to genetic and environmental factors associated with NDD to display sufficient behaviours to warrant a diagnosis. Consequently, fewer females than males would be expected to be diagnosed with NDD. In recent times, children in Ghana are enrolled in school early, some before attaining 2 yr. The expectation, therefore, is for children with any NDDs to be noticed early and referred for identification and establishment of a diagnosis. In this study, approximately 9 yr. was the average age at which referrals were done, consistent with findings in other African countries like Nigeria [15,26,27]. However, this far exceeds those of the UK, USA, and Canada [28,29].

The case of late identification in Ghana manifests in a large number of the first diagnosis at the primary and Junior High School levels. The observation that majority of the children who had been referred attended privately-operated schools either in mainstream or special with only 4.4% who attended public schools could be attributed to expectations of value for money that parents require of these schools and hence the close monitoring done by both parents and school authorities. In Ghana, these schools maintain high-performance standards by closely monitoring student performance thus, easily identifying those who may have challenges. Besides, the relatively larger class sizes in public schools make monitoring and identification of children with challenges difficult [30]. Although Ghana's National Education Strategic Plan advocates for inclusive education, the number of special needs children receiving inclusive education is low [31]. Public special schools are limited to cater for those with visual, hearing, and intellectual disabilities. More so, programmes for other special needs have not been instituted [31]. For these reasons, many children with special needs are unlikely to attend public schools, hence the negligible referral rate from that source. The reasons for referral were mainly related to the children's' poor academic performance and behavioural problems. Therefore, even when some children have NDDs, they may not be identified if they do not exhibit any of the known problems. In high-income countries, some policies require children to be proactively screened between 9 - 30 mos before pre-school level [29]. The involvement of paediatricians and general physicians who coordinate specialist referral for expert diagnosis is also proactive [7]. In some cases, parents can initiate the use of services when they report observed challenges to health professionals. In Ghana, there is no policy on the identification, diagnosis, or management of NDD. The limited number of health professionals who are over-worked and lack the requisite skills for identifying challenges in child development may account for this problem [4,32]. Medical professionals may also not be actively looking to identify developmental challenges because there are no standardized protocols to screen children for NDDs. Perhaps, the child welfare clinics would have been the ideal places for child development surveillance, but these places are limited to physical growth and immunization [13].

The general populace usually does not have adequate information about NDDs resulting in non-reporting of cases for the requisite intervention [33]. The situation where there are limited resources for the assessment and management of NDDs make some parents/guardians uninspired to report to appropriate medical facilities. They are motivated in this position by the notion that there are no/little interventions to be instituted [4,33]. A compelling issue is cultural beliefs that are associated with children with NDDs in Ghana. There is the belief that the occurrence of NDDs could be the result of witchcraft, sorcery, or punishment from the "gods" for acts committed by the family. Some of these children with NDDs may therefore be kept away from the public eye, including health and educational facilities [34]. The widely held view that mothers are the custodians of childcare unlike fathers was amply demonstrated by the higher number of mothers who accompanied their children to the clinic. This culture of childcare being the prerogative of mothers more than fathers in the West African sub-region has been supported [35]. It also shows that mothers are probably more involved in child health-seeking and management. Mothers may therefore be targeted for education on child development and indicators for developmental problems. In this study, we found that intellectual disability constituted more than half of the diagnosis of NDDs. The ADHD constituted more than a third of the diagnosis. There were many children with Autism Spectrum Disorder as were cerebral palsy, and about 40% of the children had comorbidities with either one or two other diagnoses. The NDDs have been shown to co-occur more than manifest as a single diagnosis. The high comorbidity rate is consistent with findings in developing countries. However, a single diagnosis in this cohort was higher than is reported [36]. This may be due to clinicians focusing on the main diagnosis without assessing other comorbidities. A Nigerian study that screened for Autism Spectrum Disorder among children aged 2 - 18 yr. found comorbidities with ADHD, intellectual disability, seizures, and Cerebral palsy. Similarly demonstrated high comorbidity of autism with intellectual disability and seizures in the Democratic Republic of Congo in a clinical setting [25]. The significant association found between

birth asphyxia and delivery complications, the type of delivery, gestational age and cerebral palsy is consistent with many studies that indicate that 25 - 60% of babies that suffer asphyxia at birth may suffer cerebral palsy and other neurological problems including intellectual disability and seizures [37,38]. It is, therefore, possible that the traumatic deliveries which carry the potential risk of brain hypoxia to the child may have resulted in some asphyxia with resultant NDD among the cohort children in this study. Limitations of this study include the retrospective approach that was adopted. Recall bias cannot be excluded since some parents had to recall information about their pregnancy, birth and developmental milestones of their children dating back to as long as 17 yr. Besides, the secondary hospital-based data that was used may not be reflective of the general patterns in the general population.

Conclusion

This study confirms the knowledge that NDDs are first diagnosed at a later age in Ghana than in the developed world. Early identification through paediatric follow-up of at-risk cases and surveillance at child welfare clinics could improve the outcomes. It is therefore recommended that antenatal care should include education of mothers about normal pregnancy, labour, delivery, and child development. This would increase their vigilance and early seeking of professional assistance where this has been missed by the health professionals. Midwives and obstetricians must monitor keenly through all the stages of labour and give timely intervention to avert potentially traumatic deliveries. Additionally, they must communicate with parents following traumatic and other at-risk deliveries, informing them of the potential damage. Similarly, early childhood educators must be trained to identify NDD indicators to enable early referral for diagnosis.

DECLARATIONS

Ethical considerations

Ethical clearance was obtained from the Institutional Review Board of the 37 Military Hospital (Reference Number 37MH-IRB IPN/280/2019).

Consent to publish

All authors consented to the publication of the manuscript.

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None

Competing Interests

No conflict of interest was reported by the authors.

Author contributions

The study was conceived and designed by EDD, JO, EA, and IK. EDD and JO performed the statistical analysis. EDD, JO, EA, and IK interpreted the results. EDD drafted the manuscript. EDD, JO, EA, and IK critically revised the manuscript for intellectual content. EDD, JO, EA, and IK approved the final version.

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Availability of data

The data is available from the corresponding author on a reasonable request.

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