Cohort Profile: Neonatal Sepsis Cases and their Developmental Outcomes at 6 Months in Nepal

Subtitle : Understanding the impact of neonatal sepsis on neurodevelopment of a child

Presenter: Dr. Swechhya Vaidya
Institute: Amrita Institute of Medical Science and Research Center
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Session : 5

Background :

- **Neonatal Sepsis Definition:**

A systemic condition caused by bacterial ,viral, or fungal infections in newborns, resulting in hemodynamic changes and severe clinical manifestations during the neonatal period.

- **Global Neonatal Deaths:**

In 2022, approximately 2.3 million neonatal deaths occurred globally, predominantly in Sub-Saharan Africa and South Asia, with Southern Asia accounting for 34% of these deaths.

- **WHO Estimates (2020):**

Annual cases of neonatal sepsis are estimated between 1.3 and 3.9 million.This condition leads to approximately 400,000 to 700,000 neonatal deaths each year, highlighting its significant impact on infant health.

Background- Burden

- **Prevalence in Nepal:** Neonatal infection rates in Nepal range from 2% to 4%, with 37.1% of infections occurring in neonatal intensive care units of tertiary referral hospitals, indicating the critical need for improved neonatal care.
- **Impact on Neurodevelopment:** Neonatal sepsis is associated with an increased risk of developmental delays, including deficits in gross motor, language, and cognitive skills by preschool age.Such delays fall under the category of neurodevelopmental delays as defined by DSM-5, underscoring the long-term consequences of early infections.
- **Central Nervous System Development:** CNS development begins in early embryonic life and continues postnatally, making early childhood crucial for the organization and functioning of the CNS.Infections like neonatal sepsis can disrupt this development, leading to lifelong neurodevelopmental impairments.

Study Rationale :

High prevalence of neonatal sepsis

Impact on Developmental outcomes

Need for Longitudinal studies

Informing Healthcare Practices

Global Relevance

Objectives :

- **Primary :** To estimate the prevalence of neurodevelopmental delay in neonates with documented sepsis after 6 months follow up.
- **Secondary :**

1)To identify the predictors of neurodevelopmental delay after 6 months in neonates with documented sepsis

2)To identify the association between neurodevelopmental delay in neonates with documented sepsis and demographic, socioeconomic and clinical variables, during follow up of 6 months

Study Design and Methods :

- Study Designs : Prospective Dual Centric Cohort Study
- Number of patients recruited : **395**
- 6 month follow up completed :**241**
- Sample Size : **185**

Study Sites:

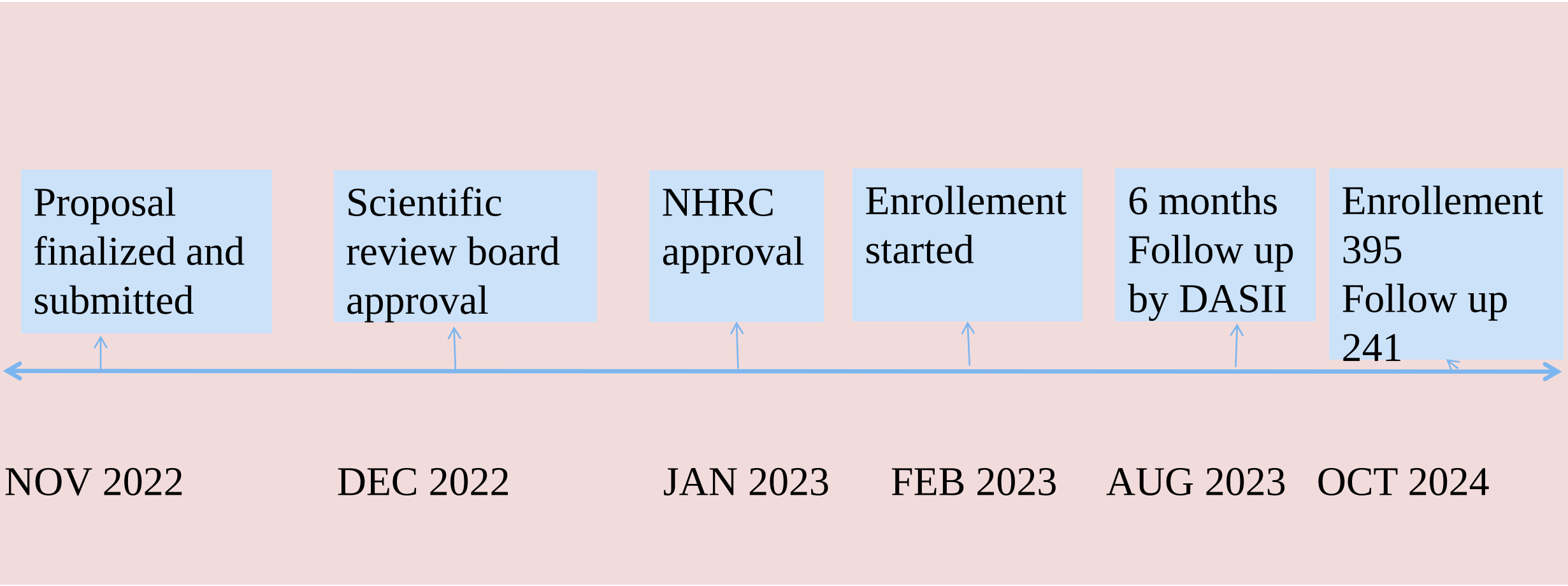
1. Paropkar Maternity and Women's Hospital
2. Siddhi Memorial Hospital

Selection Criteria :

Inclusion : Neonates with documented sepsis attending the 2 hospitals included in the study

- **Severe life threatening conditions**
- **Gross congenital and genetic malformations**
- **Neonatal and post-neonatal deaths**
- **Perinatal Asphyxia HIE grade 2 and grade 3.**
- **Birth weight less than 800 gram.**
- **Extreme preterm less than 28 weeks of gestational age.**

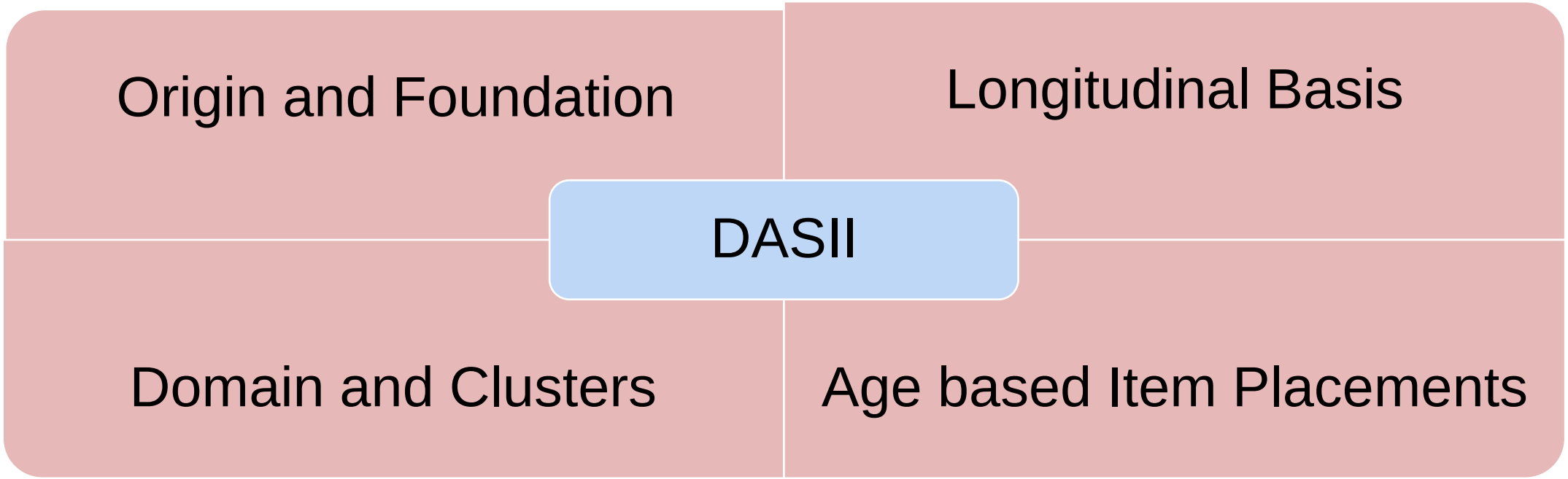
Timeline - Study



Data Collection Tool:

Study Proforma - Baseline Parameters

DASII (DEVELOPEMENTAL ASSESSMENT TOOL FOR INDIAN INFANTS)



Outcome Variable :

Primary Outcome Variable: Neurodevelopmental Outcomes

Two Domains : a) Motor : 5 cluster b) Mental : 10 cluster

Cut off point:

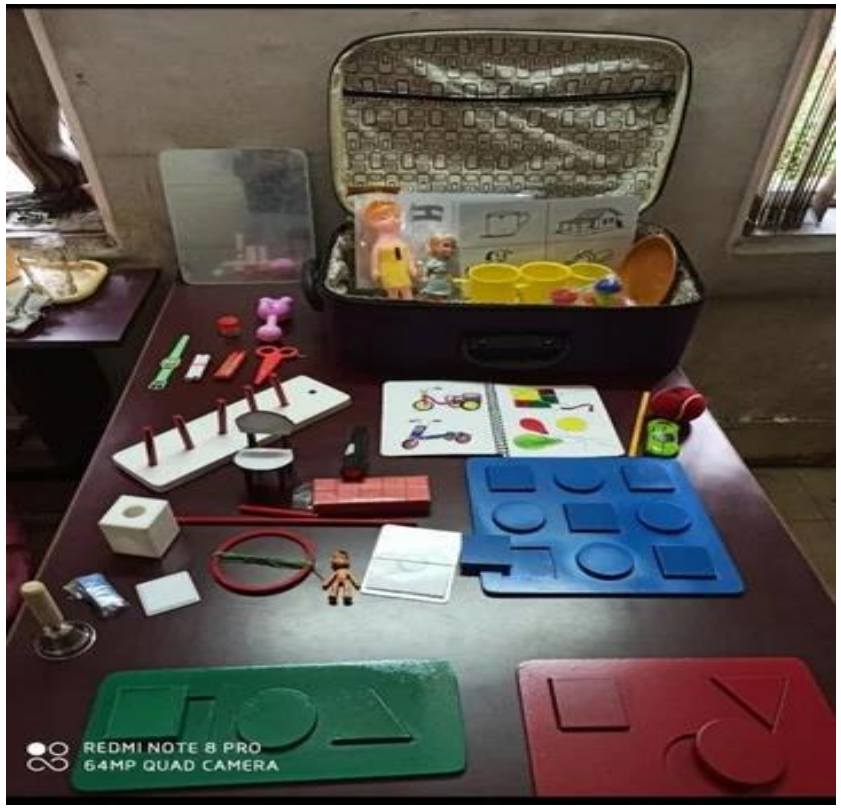
1. Average: 85-115
2. Below Average: 70-85
3. Overall Delay: <70

- Mild Delay: 50-70
- Moderate Delay: 30-50
- Severe Delay: <30

Secondary Outcomes

- Classification of Mental and Motor Developmental Delays:
- Cluster Performance Percentile Ranks using the DASII tool:
- <10th Percentile: Delay
- 10th to 25th Percentile: Below Average
- 25th to 75th Percentile: Average
- >75th Percentile: Above Average
- Mental Developmental Clusters: Evaluates areas such as visual and auditory awareness, memory, language, social interaction, and cognitive differentiation.
- Motor Developmental Clusters: Focuses on neck and body control, coordinated movement, locomotion skills, and manipulation abilities.

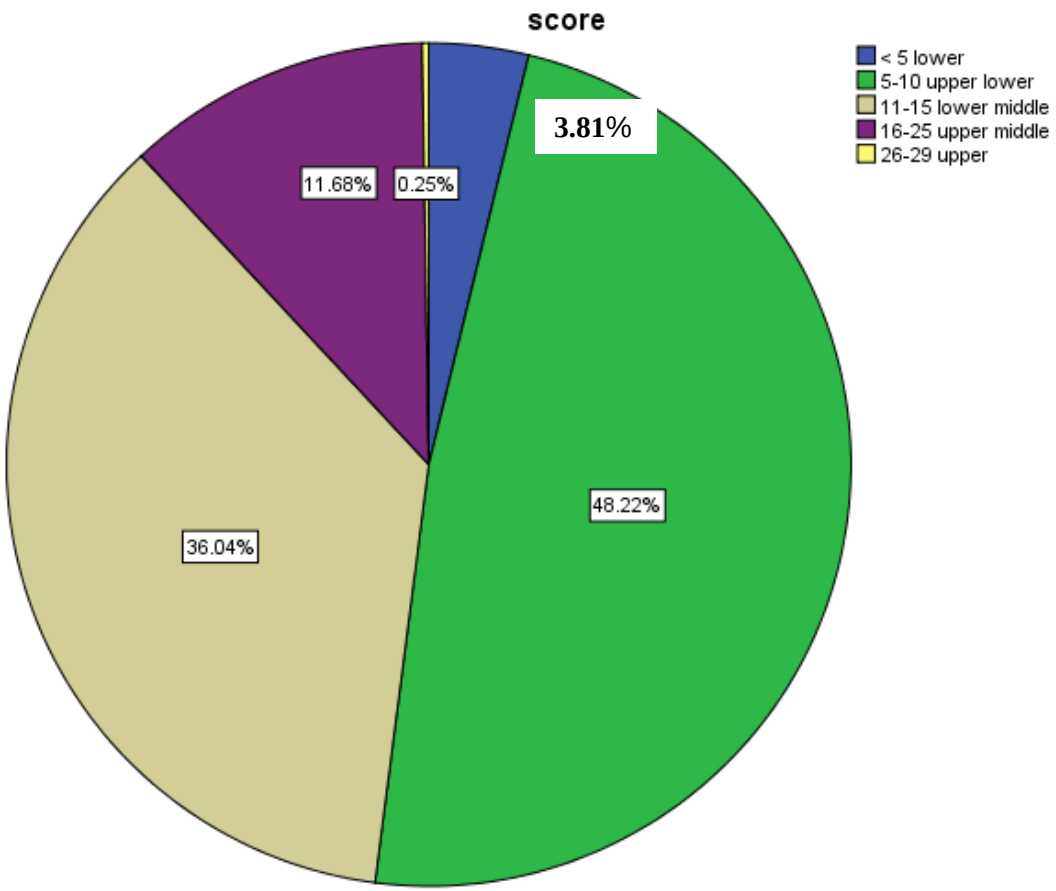
Assessment Kit : DASII

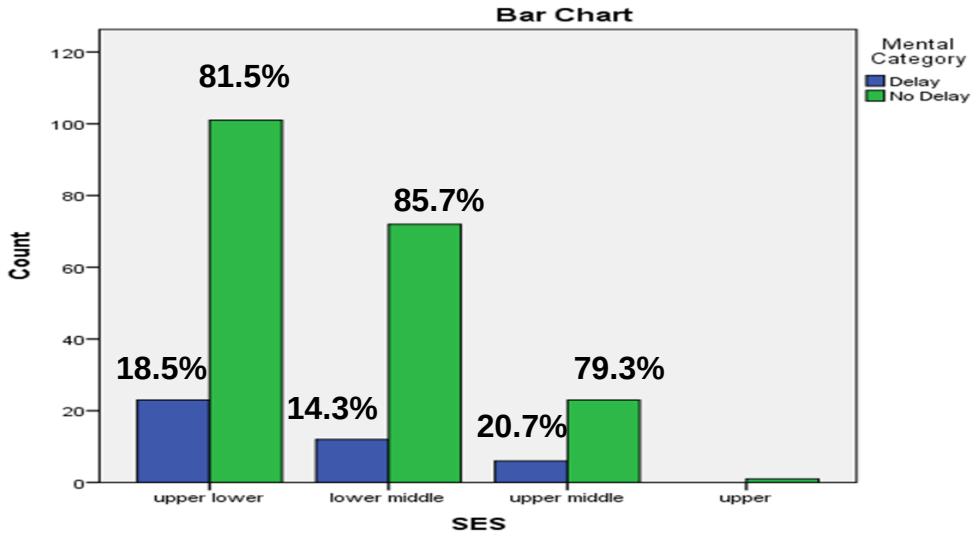


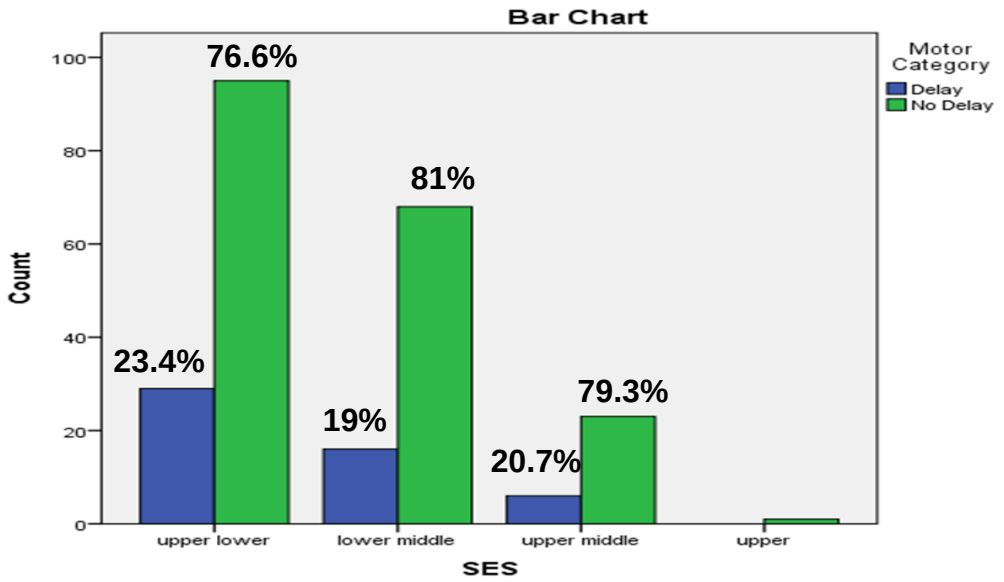
Cohort Profile : Table 1(SocioDemographic)

Sociodemographic Variable	Categories	N	Frequency %
Gender Distribution	Male Female	215 180	54.4 45.6
Family Type	Extended Joint Nuclear	11 217 167	2.8 54.9 42.3
Maternal Education	Graduate or post graduate High school certificate Illiterate Intermediate diploma Middle school certificate Primary School certificate	58 129 36 59 77 36	14.7 32.7 9.1 14.9 19.5 9.1
Maternal Age	<16 16-25yrs 26-35yrs	26 149 219	6.6 37.9 55.5

Figure 1: Socio Economic Class Distribution







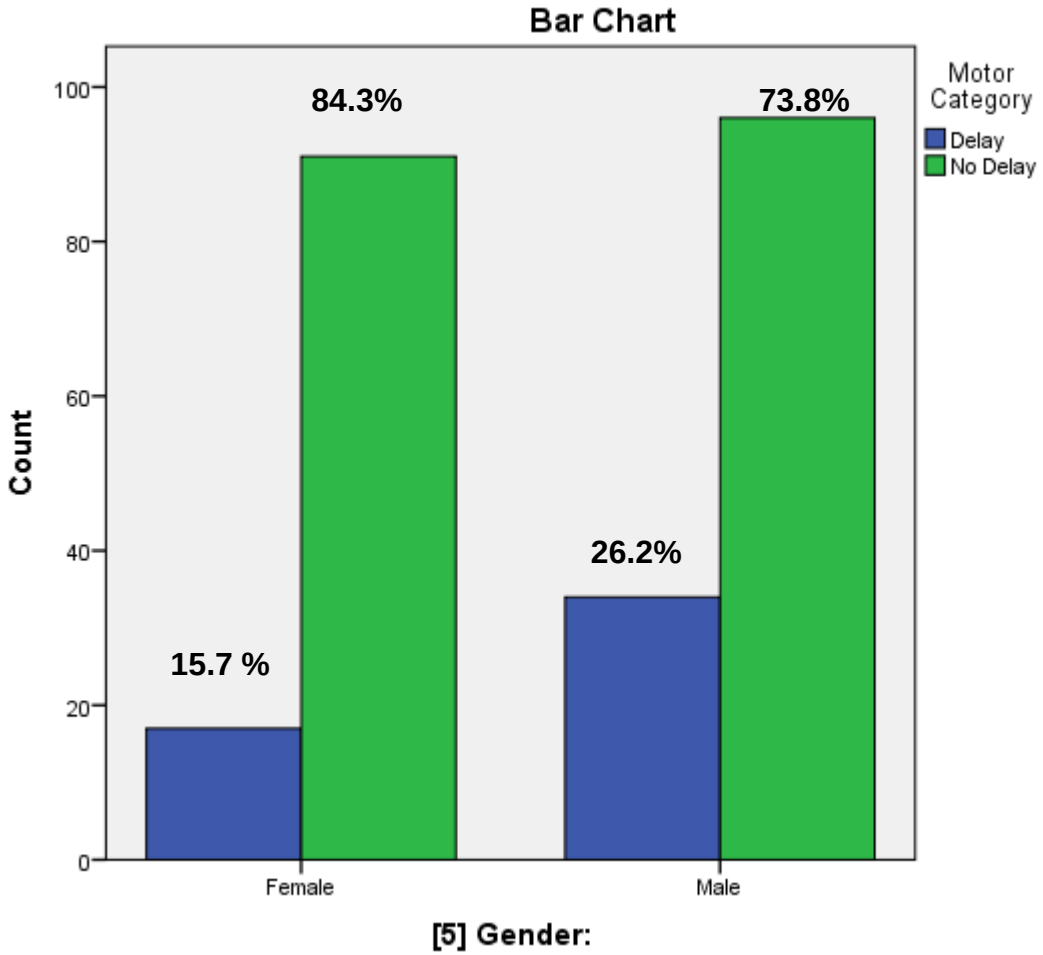
Cohort Profile: Table 2(Clinical)

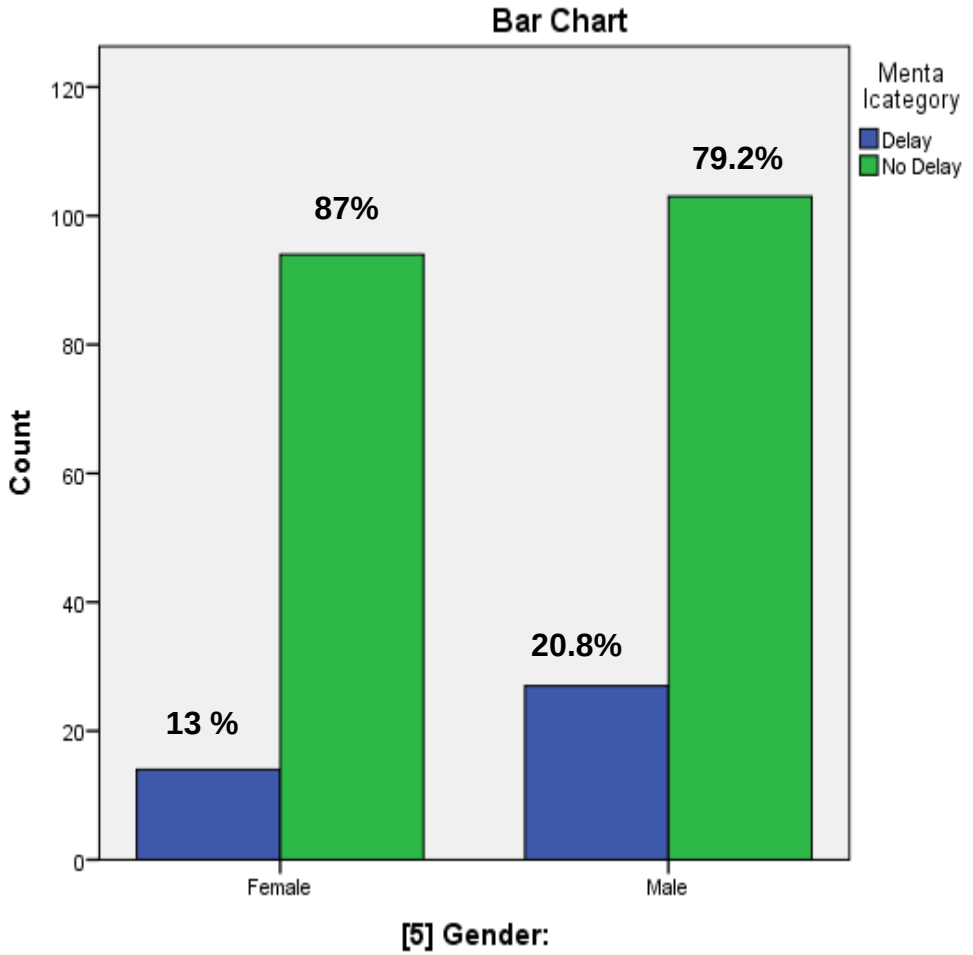
Clinical Variables	Catgeories	N	Frequency %
Gestational Age	Term Preterm	250 145	63.3 36.7
Birth Weight	Normal Birth Weight Low Birth Weight	218 177	55.19 44.81
Assisted Ventilation	Yes No	214 181	54.2 45.8
Neonatal Sepsis Type	Culture Positive Culture Negative	257 138	65.1 34.9
Mode of Delivery	Caeserean Section Instrumental Delivery Vaccum Delivery Vaginal Delivery	218 3 1 168	55.2 0.8 0.3 42.5

Overall Developmental Outcomes : 6 months Follow up (Table 3)

	MOTOR		MENTAL	
Developmental Quotient	**FREQUENCY**	**PERCENTAGE**	**FREQUENCY**	**PERCENTAGE**
<30 Severe delay	7	**2.9**	6	**2.4**
30-50 Moderate delay	7	**2.9**	10	**4.1**
51-69 Mild delay	37	**15.3**	27	**11.2**
70-84 Below average	85	35.1	70	28.8
85-115 Average	105	43.4	128	53.4
TOTAL	241	100	241	100

Figure 2 : Gender Association with Neurodevelopmental Impairment





Predictors	Confidence interval (CI)	Coefficient	Odds Ratio
Gestational Age: a) Motor	95 %	-0.510	1.66
b) Mental	95 %	-0.359	1.43
Meconium stain liquor - Mental	95%	0.833	2.31
Culture positive -Mental	95%	0.777	2.14

Table 4: Significant Predictors of Neurodevelopmental delay in Neonatal sepsis

Implications for Clinical Practice

Pediatric and Neurodevelopmental Monitoring/follow up post sepsis

Awareness and Education

Policy Recommendation

Discussion

Findings

In our study, we found that **17-21%** of both term and preterm infants experienced motor and mental developmental delays, with gestational age and neonatal sepsis being key factors. Culture-positive sepsis (**OR 2.14)** was particularly associated with developmental delay.

Differ from a 2018 study by **Katrina Savioli et al**, which reported delays in 28-50% of cases, likely due to longer follow-up (5 years vs. our shorter duration) and cohort differences.

2020 study from Eastern India

- **18.18%** rate of developmental delay at 1 year

- higher delay of **37.7%** in neonates with culture-positive sepsis

a case-control study on group B streptococcal sepsis and meningitis found an **8.29-fold increased** risk of neurodevelopmental impairment

Conclusion and Future Research :

This study highlights that **neonatal sepsis can lead to lasting neurodevelopmental impairments** in cognitive and motor domains, underscoring the importance of continued monitoring to improve affected children's quality of life. However, the study faces limitations, including potential follow-up loss, resource constraints, and limitation in its **generalizability**. Future research should focus on **longer follow-up periods, a larger sample size, and evaluating interventions for post-sepsis care**. Additionally, findings may not apply to neonatal sepsis cases in lower-level healthcare settings, suggesting **the need for broader research** across different clinical environments. Overall, enhancing clinical care, early intervention, and developmental support post-sepsis could significantly improve long-term outcomes for affected children.

Biography

Dr. Swechhya Vaidya is a medical doctor with over 4 years of experience, holding a medical degree and a postgraduate degree in public health.
Currently a PhD scholar at Amrita Institute of Medical Sciences & Research Center and a Lecturer at Patan Academy of Health Science , she specializes in neonatal care practices, infection control, and long-term neurodevelopmental outcomes. Her study, Cohort Profile: Developmental Outcomes at 6 Months Among Infants with Documented Neonatal Sepsis in Nepal, is critically important for improving healthcare in resource-limited settings. In addition to her clinical and research work, she is an experienced educator, dedicated to mentoring future healthcare professionals.

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