FOLLOW-UP OF HIGH RISK INFANT

D r M E E N A K S H I J
First some basics.........
## Definition of Prematurity

<table>
<thead>
<tr>
<th></th>
<th>Weeks</th>
<th>Preterm Births (%)</th>
<th>Birth Weight (gm)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Preterm</td>
<td>&lt; 37</td>
<td>100</td>
<td>&lt; 2500 (LBW)*</td>
</tr>
<tr>
<td>Late preterm</td>
<td>34 0/7-36 6/7</td>
<td>75</td>
<td>&lt;2500-3500</td>
</tr>
<tr>
<td>Very preterm</td>
<td>&lt; 32-33</td>
<td>20</td>
<td>&lt; 1500 (VLBW)</td>
</tr>
<tr>
<td>Extremely preterm</td>
<td>&lt; 28</td>
<td>10</td>
<td>&lt; 1000 (ELBW)</td>
</tr>
<tr>
<td>Micropremie or fetal infant</td>
<td>&lt; 26</td>
<td>1-2</td>
<td>&lt; 750</td>
</tr>
</tbody>
</table>

*LBW: low birth weight-manry preterm infants weigh more than 2500g
VLBW: very low birth weight
ELBW: extremely low birth weight

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University of Minnesota Amplatz Children’s Hospital
## Who constitute the high risk infants - Biological risk

<table>
<thead>
<tr>
<th>Preterms</th>
<th>Terms</th>
</tr>
</thead>
<tbody>
<tr>
<td>VLBW infants 1500 g birth weight</td>
<td>Encephalopathy persisting at discharge</td>
</tr>
<tr>
<td>ELBW infants 1000 g birth weight</td>
<td>Other neurologic problems/meningitis</td>
</tr>
<tr>
<td>Infants with cranial ultrasound abnormalities</td>
<td>Small for gestation</td>
</tr>
<tr>
<td>including PVL-intraventricular hemorrhage, linear hyperechogenicity</td>
<td>Twin-twin transfusion</td>
</tr>
<tr>
<td>Complex medical problems</td>
<td>Complex congenital anomalies</td>
</tr>
<tr>
<td>Other neurologic problems (seizures, hydrocephalus)</td>
<td>Birth defects</td>
</tr>
<tr>
<td>NEC</td>
<td>Metabolic disorders</td>
</tr>
<tr>
<td>Chronic lung disease</td>
<td>Sepsis, meningitis, nosocomial infections</td>
</tr>
<tr>
<td>Complex medical problems</td>
<td>Hyperbilirubinemia requiring exchange</td>
</tr>
<tr>
<td>Small for gestation</td>
<td>Failure to grow in the NICU</td>
</tr>
<tr>
<td>Higher-order multiples</td>
<td>Multiparity</td>
</tr>
<tr>
<td>Twin-twin transfusion</td>
<td>Abnormal neurologic exam at discharge</td>
</tr>
<tr>
<td>Complex congenital anomalies</td>
<td></td>
</tr>
<tr>
<td>Recurrent apnea and bradycardia</td>
<td></td>
</tr>
<tr>
<td>Hyperbilirubinemia requiring exchange</td>
<td></td>
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<tr>
<td>Abnormal neurologic exam at discharge</td>
<td></td>
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<tr>
<td>Failure to grow in the NICU</td>
<td></td>
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<tr>
<td>Sepsis, meningitis, nosocomial infections</td>
<td></td>
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<tr>
<td>Multiparity</td>
<td></td>
</tr>
</tbody>
</table>
High risk infant both term or preterm......
Interventions/ social- environmental risks

<table>
<thead>
<tr>
<th>Interventions</th>
<th>Resuscitation</th>
<th>Postnatal steroids</th>
<th>High-frequency ventilation</th>
<th>Prolonged ventilation &gt;7 days</th>
<th>Total parenteral nutrition</th>
<th>Prolonged oxygen requirements</th>
<th>Nutritional therapies</th>
<th>Other medications</th>
<th>Surgical interventions for NEC, patent ductus arteriosus, shunt</th>
</tr>
</thead>
<tbody>
<tr>
<td>Social/environmental</td>
<td>Low maternal education, teen mother</td>
<td>Low SES: Hollingshead, Hauser</td>
<td>Low income</td>
<td>Drugs/alcohol, smoking, substance abuse</td>
<td>No prenatal care</td>
<td>Environmental stress</td>
<td>Extracorporeal membrane oxygenation</td>
<td>Low maternal education, teen mother</td>
<td>Low SES: Hollingshead, Hauser</td>
</tr>
<tr>
<td>Level 1</td>
<td>Level 2</td>
<td>Level 3</td>
<td>Level 4</td>
<td></td>
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<tr>
<td>Telephone interview to screen: developmental screeners; Ages and Stages and CAT/CLAMS Refer for diagnostic or intervention services as needed Collect data Clinical</td>
<td>clinic single visit: growth; neurologic exam; screen; Developmental screeners; Ages and Stages and CAT/CLAMS developmental screeners: BINS Refer for diagnostic or intervention services as needed Collect data Clinical</td>
<td>Single visit: comprehensive assessment; growth; neurologic exam; developmental assessment (behavior, other reduced comprehension or comprehension) Refer for diagnostic or intervention services as needed Collect data Clinical Clinical/Research</td>
<td>Serial comprehensive assessments: growth; neurologic exam; developmental assessment, behavior (may include videotapes, MRIs, actigraphy, parent IQ, telemedicine, biochemical parameters, genetics Refer for diagnostic or intervention services as needed Collect data Clinical/Research</td>
<td></td>
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</tbody>
</table>
Origin of high risk follow up at perinatal centres

- Surveillance
- Research purpose
• Comprehensive care of high risk neonate
• Family centred comprehensive care
When to assess what – General protocol based approach or need driven approach?

- The selection of age of assessment is driven by several factors: developmental acquisitions available at a given age;
- availability and applicability of appropriate test instruments at specific ages;
- trends found in existent studies;
- cost and feasibility of long-term tracking in the population in question.
- In many NICU programs, all very low birth weight (VLBW) infants are referred to early intervention at the time of discharge from the NICU.
Status of high risk follow up programmes in United States

- Ninety three percent of the respondents have a follow-up program associated with their NICU.
- Birth weight, gestational age and critical illness in the NICU were the major criteria for follow-up care.
- Management of nutrition and neurodevelopmental assessments was the most common service provided.
- Over 70% have health care trainees in the clinic.
- Most of the respondents reported multiple funding sources. Lack of personnel and funding were the most common causes for not having a follow-up program.
- CONCLUSION: High-risk infant follow-up programs associated with academic centers in the United States are functioning as multidisciplinary programs providing clinical care, trainee education and facilitating outcomes research.

- Neonatal follow-up programs are the best tools (up-to-date) available for proper neurodevelopmental evaluation and follow-up of high-risk infants who are increasing in numbers.

- Each neonatal intensive care unit should have its own program, or, collaborate with other big units to develop a referral program that can cover all these units.

- More and more exposure and introduction must be made to all persons working in the field of neonatology to the importance of NFP which should be the first step of developing proper programs in the third world countries.

- Resources are the major obstacle in developing NFP, but this should not prevent us from proceeding according to our own available resources.

- Means and ways to overcome financial issues should be entertained by both professionals and policy makers. The ultimate aim is to prevent developmental delay and ensure healthy future for at risk neonates.
• Following review of the scientific literature on predictors of neurodevelopmental outcomes for VLBW children and the clinical practice guidelines relevant to their care after hospital discharge.

• RESULTS. The panel recommended a total of 70 indicators in 5 postdischarge follow-up areas: general care; physical health; vision, hearing, speech, and language; developmental and behavioral assessment; and psychosocial issues. Of these, 58 (83%) indicators were in preventive care, 5 (7%) were in acute care, and 7 (10%) were in chronic care.

Neurodevelopmental outcome of ELBW infants from centers of the ELBW Infant Follow-Up Group of the Vermont Oxford Network (VON) and to identify characteristics associated with severe disability over the study period.
• Severe disability occurred in 34% of the assessed infants.
• There were marked variations among the follow-up clinics in the attrition rate.
• Conclusion: ELBW infants completing evaluation were at a high risk for severe disability. There are considerable differences among participating centers in attrition at follow-up. Further resources will be needed to study the effect of follow-up care for this group of infants.
Concordance between school outcomes and developmental follow-up results of very preterm and/or low birth weight children at the age of 5 years Eur J Pediatr (2007) 166:693–699

- Developmental and school outcomes of 355 children, age 5 years at the time of the study, who had a mean gestational age of 30.2 weeks (SD: 1.95) and a mean birth weight of 1272 g (SD: 326) were investigated.

- Results An agreement of 72% was found between developmental follow-up and school outcomes. Problematic school outcomes were significantly more in the high risk group.
Conclusions:

• Schools have a good insight in the school functioning of children who are developing well and of children with the lowest developmental scores and the most complicated neonatal histories.

• How school and developmental outcomes interrelate in the in between groups remains a challenging question that could be answered by following these children throughout their school career.
NEUROLOGIC SEQUELAE IN HIGH RISK INFANTS- A THREE YEAR FOLLOW UP
Indian pediatrics  August 1996

• Objective: To determine the neurologic sequelae in high risk infants. Design: A three year longitudinal follow up. Setting: Inborn and outborn infants discharged from the Neonatal Special Care Unit (NSCU) of a referral hospital

• Results: Three hundred and thirty six high risk infants and 70 normal control infants came for regular follow-up. Out of these, 16 (4.8%) had cerebral palsy and 11 had associated mental retardation. Six other children had mental retardation without motor problems. None of the children in the control group had any neurological problems. Sensorineural hearing loss was present in 5 (1.5%) children while 1 subject had cortical blindness.

• Three children with cerebral palsy had infantile myoclonus, nine had generalized seizures and one child had a focal seizure. The incidence of seizure disorders was 3.9%.
Conclusions: The incidence of major handicap in our study was low. Many of the risk factors which caused adverse outcome could have been prevented by good antenatal and perinatal care.
The study was conducted in 3 Canadian tertiary-level NICUs that referred to 2 affiliated, regional NFU programs.

A total of 357 mothers and 400 infants were consecutively recruited during NICU hospitalization.

Attendance at NFU decreased over time from 84% at the first appointment to 74% by 12 months, with the highest withdrawal from NFU after NICU discharge, followed by withdrawal after the first NFU appointment.

Nonattendance at NFU results in less access to required services and underreporting of the developmental outcomes of these infants.

Given these findings, mothers should be screened earlier in the NICU to identify those at greatest risk of not attending NFU. Strategies should be implemented to address potential barriers and provide effective transition and access to the NFU program.
Growth and neurodevelopment outcome of NICU graduates till 1 year at a tertiary care centre in eastern India and identification of the clinical and electrophysiological predictors of adverse developmental outcome

**Objectives:** To study the outcome of growth and development till one year of age of NICU graduates from a tertiary care centre in eastern India.

**Design and setting:** A prospective neurodevelopmental follow-up study on graduates from the Calcutta National Medical College and Hospital NICU.

**Methodology:** A cohort of 177 consecutive NICU graduates according to high-risk criteria.

Followed them up at the high risk clinic of Paediatrics department up to 1 year of age on a predetermined schedule.

- Growth monitoring (weight, length, head circumference measurements)
- Neurologic examination by Amiel-Tison method
- Developmental assessment using Denver Development Screening Test (DDST) as screening tool and Developmental Assessment Scale for Indian Infants (DASII) as a definitive test
- Neuroimaging (cranial ultrasound or magnetic resonance imaging of brain) and electrophysiological investigations visual evoked potential (VEP), brainstem auditory evoked response (BAER), and electroencephalogram (EEG) were done.
- Early stimulation and physiotherapy were advised as per need. Ongoing illnesses were identified and treated.
Growth and neurodevelopment outcome of NICU graduates till 1 year at a tertiary care centre in eastern India and identification of the clinical and electrophysiological predictors of adverse developmental outcome

• **Results**: Out of 177 consecutive NICU graduates enrolled in the study, 155 were followed up to 1 year of age. There were no statistically significant difference in the occurrence of growth failure, and neurodevelopmental delay between term and preterm and between appropriate for gestational age (AGA) and small for gestational age (SGA) infants. However growth failure was significantly higher among infants with neurodevelopmental delay.

• **Conclusion**: Persistence of abnormalities in tone, BAER, EEG & neuroimaging strongly predicted adverse neurodevelopmental outcome. Recurrent respiratory tract infection was found to be the most common morbidity among NICU graduates followed by seizure disorder.
Golden first year

- Growth and nutrition
- Reviewing medical conditions and treatment, immunization
- Neurological assessment & neuroimaging
- Feeding, sucking and swallowing issues – early intervention by speech and language pathologist
- Bayley Scale MDI, PDI
- Early intervention – physiotherapist, occupational therapist.
Old is gold..

- Tracing the history of high risk infant follow up........the tales and scales
- Motor delays were the earliest objective measure of an infant’s overall condition.
Sherrington studying the neuro-physiology of muscle tone, had developed the classic animal models and observed that postural tone patterns were altered by a variety of imposed body position changes.

These subcritical responses and other primitive reflex postures, almost all of which were first described in the late 1800s and very early 1900s, have been the subject of intense study by modern day researchers.

The late 1960s and early 1970s, Dr. Arnold Capute and his colleagues at the John F. Kennedy Institute in Baltimore rejuvenated interest in the clinical utility and underlying concepts of primitive reflexes.
Evolution in the diagnosis of cerebral palsy

Five general areas of information eventually evolved
1. motor mile-stone attainment,
2. the classic neurological examination,
3. primitive reflex and postural re-action patterns,
4. progressive vs static nature of the dysfunction, and
5. associated evidence for neurological or structural system damage.
6. Age of onset emerged is relevant - but controversial - to making the specific diagnosis of cerebral palsy.
Do you recognise who she is ....
Tone assessment …… lot of work
On further evolution

- Two well-established motor tests are the Test of Infant Motor Performance, used for infants 32 weeks’ corrected gestational age to 4 months.
- Alberta Infant Motor Scale used to detect delayed motor performance at adjusted age 6, 9, and 12 months. The Test of Infant Motor Performance shows 80% diagnostic agreement with the Alberta Infant Motor Scale.
Alberta infant motor scale

The AIMS was designed to identify infants with motor delays and to evaluate over time the motor development in all infants younger than 18 months. The AIMS consists of 58 test items administered in 4 different positions, that is, prone, supine, sitting, and standing.
TIMP

- TIMP is carried out every week until approximately 4 months of corrected age.
- consists of observation of spontaneous activity in addition to head control in supported sitting, and a series of supine, prone, and righting reactions during tilting and side lying.
The General Movement (Fidgety) assessment is a new tool that aids providers in the detection of early normal and abnormal infant movement patterns.

Infants are video taped and their typical movements are analyzed using the General Movement Toolbox software or a trained practitioner.

Generalized movements, described as either writhing (33 weeks to 7 weeks post-term) and fidgety movements (8–17 weeks post-term), are characterized as normal or abnormal.

Those infants with generalized movement patterns devoid of complexity and variation are most at risk for CP.
Gross motor function

- The Gross Motor Function Classification System (GMFCS) is the first reliable and validated system available to describe the severity of motor dysfunction in children with cerebral palsy.
- Shown to be reasonably stable between the ages of 2 and 12 years.
- The GMFCS is quick and easy to use.
- Classification is made by determining which level best represents the child’s present abilities and limitations in gross motor function.
GMFCS – E & R
Gross Motor Function Classification System
Expanded and Revised

LEVEL I - Walks without Limitations
LEVEL II - Walks with Limitations
LEVEL III - Walks Using a Hand-Held Mobility Device
LEVEL IV - Self-Mobility with Limitations; May Use Powered Mobility
LEVEL V - Transported in a Manual Wheelchair
## Story of combining handling and walking assessment

<table>
<thead>
<tr>
<th>GMFCS</th>
<th>MACS</th>
</tr>
</thead>
</table>
| Level I  
Walks without restrictions, limitations in more advanced gross motor skills | Level I  
Handle objects easily and successfully |
| Level II  
Walks without restrictions, limitations walking outdoors and in the community | Level II  
Handles most objects but with somewhat reduced quality and/or speed of achievement |
| Level III  
Walks with assistive mobility devices, limitations walking outdoors and in community | Level III  
Handles objects with difficulty; needs help to prepare and/or modify activities |
| Level IV  
Self mobility with limitations, children are transported or use power mobility outdoors and in the community | Level IV  
Handles a limited selection of easily managed objects in adapted situations |
| Level V  
Self mobility is severely limited, even with use of assistive technology | Level V  
Does not handle objects and has very limited ability to perform even simple actions |
Children with spastic hemiplegia generally had a lower level of manual ability than gross motor function \( (p < 0.001) \).

The reverse association was generally found in children with spastic diplegia \( (p < 0.001) \).

Children with dyskinetic CP had large limitations in both gross motor function and manual ability, with no significant discrepancy between GMFCS and MACS levels.

Concluded: To give a complete clinical picture when evaluating these children, both aspects have to be described. The GMFCS and the MACS seem to work well in this context and seem very useful in population-based studies, in health care registers for children with CP, and in clinical practice.
• Environmental factors are less influential
• biomedically issues such as oxygen supplementation for chronic lung disease have resolved etc
• more varied behavioral repertoire is available, and cognitive processes and emerging language can be assessed.
• Evaluation at this age also encourages family involvement in the program.
• However, cognitive and motor functions are still highly intertwined at 12 months’ corrected age, and the period of developmental acquisition is a time of variability.
• some neurologic abnormalities that are identified in the first year of life are transient or improve, whereas findings in other children may worsen over time.
FOLLOWUP AT 12-14 MONTHS

<table>
<thead>
<tr>
<th>12–14 mo CA</th>
</tr>
</thead>
<tbody>
<tr>
<td>Wt, Lt, HC</td>
</tr>
<tr>
<td>BMI, skinfolds</td>
</tr>
<tr>
<td>Caloric/protein fat intake; energy expenditure</td>
</tr>
<tr>
<td>Standard for age Amiel-Tison\textsuperscript{55}</td>
</tr>
<tr>
<td>Conventional MRI, DTI, DWI, CT</td>
</tr>
<tr>
<td>Bayley PDI</td>
</tr>
</tbody>
</table>

- Limited for young children; parent checklist
- WeeFIM\textsuperscript{95}; Vineland\textsuperscript{96}; PEDI CBCL\textsuperscript{109,110}
- QOL; HRQL; health status
18 – 24 months corrected gestational age

environmental factors begin to exert a stronger influence on test results,

cognitive and motor abilities diverge,

language and reasoning skills are developing, and there is improved prediction to early school-age performance.

potential problem is that many intelligence tests have weak floors at this age, thereby restricting use to developmental tests, and therefore impairment
MONTHS

@ 18 MONTHS

18 mo CA

Wt, Lt, HC  
BMI, skinfolds  
Caloric/protein fat intake; energy expenditure  
Standard for age  
Amiel-Tison55  
Conventional  
MRI, DTI, DWI, CT

Bayley PDI

Bayley MDI  
Bayley PDI

Limited for young children; parent checklist  
WeeFIM85; Vineland96; PEDI98  
CBCL109,110

QOL; HRQL; health status
At 3 to 4 years, “intelligence” can first be assessed, as well as concept development, preacademic skills, early indicators of executive function, and visual-motor integrative abilities.

Verbal and nonverbal skills can be better differentiated.

There is also an acceptable level of prediction from scores at this age to later IQ scores.

SES and social support, as well as other environmental factors, influence test results more strongly from age 3 years onward.
6 years

- 6 years of age, a variety of tests and procedures can be used, and attention problems and school achievement (approximately first grade) can be assessed.
School Age

Wt, Lt, HC
BMI, skinfolds
Caloric/protein fat intake; energy expenditure
Standard for age

Conventional
Functional, MRI, DTI, DWI, CT

GMFCS
IQ, Visual-motor skills, reasoning, memory, ADHD, executive function

School placement; achievement; executive function; academic performance; abdominal circumference
Limited for young children;
PPVT\textsuperscript{101}; Grammar TEGI\textsuperscript{104}

WeeFIM\textsuperscript{95}; Vineland\textsuperscript{96}; PEDI\textsuperscript{98}
CBCL\textsuperscript{10,110}; Conners CPT\textsuperscript{73}; Conners RS\textsuperscript{111,112}
QOL; HRQL; health status

ion imagine: DWI, diffusion weighted
Neuropsychological function, learning disabilities, school performance, and behavioral adjustment can be adequately assessed at 8 years (approximately third grade). IQ measured at 8 years predicts later IQ more accurately than at earlier ages.
• Although major deficits can be detected in infancy, more subtle high-prevalence/low-severity dysfunctions become increasingly obvious as the child grows older, which is assumed to be because of continued cortical development and increased demands for performance in emerging areas of cognitive function.

• Moreover, there is some evidence that the cognitive function of infants with severe CNS injury tends to deteriorate over time.

• The cognitive scores of neurologically intact but immature infants tend to improve as they mature.69 These data support the importance of long-term follow-up to obtain school-age outcomes on high-risk infants.
Specific tests and rating scales to be considered in follow up protocols

• Intelligence (including verbal and nonverbal aspects) and executive function
• Achievement
• Functional status (self-care, mobility, communication)
• Language (phonological awareness, syntax, verbal fluency, comprehension of instructions, speed naming, higher-order abstracting function)
Sensorimotor functions (visual-motor precision, fine-motor speed)

Visual spatial processes (design-copying, visual closure)

Memory and learning (list-learning, delayed recall, narrative memory, and use of semantic/strategic and rote/episodic verbal and visual tasks)

Behavioral adjustment (ADHD, internalizing and externalising behaviors, and social functioning).
We have moved from

Motor

TO

Integrated tests
Gross motor
Fine motor
Cognitive
Language
Functional adaptive
Screening

Diagnostic tests
## Screening tests

<table>
<thead>
<tr>
<th>TEST</th>
<th>ASPECTS</th>
<th>AGE GROUP</th>
<th>TIME OF ADMINISTRATION</th>
</tr>
</thead>
<tbody>
<tr>
<td>DENVER</td>
<td>Motor, behaviour, language</td>
<td>0-6 years</td>
<td>20 min</td>
</tr>
<tr>
<td>MOVEMENT ASSESSMENT OF INFANTS</td>
<td>Motor</td>
<td>0-1 years</td>
<td>60/90</td>
</tr>
<tr>
<td>ALBERTA INFANT MOTOR SCALE</td>
<td>Motor</td>
<td>0-18 months</td>
<td>20</td>
</tr>
<tr>
<td>GENERAL MOVEMENTS</td>
<td>Motor</td>
<td>Preterm to 20 weeks post term</td>
<td>10/50</td>
</tr>
<tr>
<td>TEST OF INFANT MOTOR PERFORMANCE</td>
<td>Motor</td>
<td>32 weeks GA – 4 months</td>
<td>30/45</td>
</tr>
<tr>
<td>FACTORS</td>
<td>BARODA DEVELOPMENTAL SCREENING TEST (BDST)</td>
<td>TRIVANDRUM DEVELOPMENTAL SCREENING CHART (TDSC)</td>
<td>ICMR PSYCHOSOCIAL DEVELOPMENTAL SCREENING TEST</td>
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</tr>
<tr>
<td>DEVELOPED FROM</td>
<td>BAYLEY SCALE OF INFANT DEVELOPMENT, NORMATIVE DATA FROM INDIAN CHILDREN</td>
<td>BAYLEY SCALE OF INFANT DEVELOPMENT (BARODA NORMS)</td>
<td>PROGRAMME FOR ESTIMATING AGE RELATED CENTILES USING PIECE WISE POLYNOMIALS</td>
</tr>
<tr>
<td>AGE</td>
<td>0-30 MONTHS</td>
<td>0-24 MONTHS</td>
<td>0-6 YEARS</td>
</tr>
<tr>
<td>FORMAT</td>
<td>54 ITEMS</td>
<td>17 ITEMS</td>
<td>PARENTS INTERVIEW</td>
</tr>
<tr>
<td>DOMAINS</td>
<td>MOTOR AND COGNITIVE</td>
<td>MENTAL AND MOTOR</td>
<td>GROSS MOTOR, VISION, HEARING, FINE MOTOR AND SOCIAL SKILLS</td>
</tr>
</tbody>
</table>
Speech assessment in Indian scenario

- Language assessment tool (3 years)
- Assessment of language development (till 7 years)
- Receptive and expressive language scales (0–3)
- E-REELS (3–5 years)
- COMDELL
Instruments for measuring functional status in essential activities of self-care, mobility, communication, and learning are assessed with the Functional Independence Measure for Children.

the Vineland Adaptive Behavior Scale, Pediatric Evaluation of Disability Inventory

Tests for visual motor coordination – Beery VMI 6
Tests for cognitive delay

AAP – for former premature infants between ages 0 and 3 years, a formal developmental evaluation be performed at least once between 9 and 18 months corrected age and within 2 months of a suspect or abnormal developmental screening test.

Often when formal developmental testing is performed, a battery of tests are done to fully represent the strengths and weakness of the child.

Older children- Wechsler Preschool Scale of Intelligence or Wechsler Intelligence Scale for Children, Standardized Behavior and adaptive questionnaires.
Testing for behavioural delays

High risk infants were found to have an increase in

externalizing (ie, impulsivity, hyperactivity, oppositional behavior) or internalizing (ie, depression, anxiety) behaviors.

Inversely proportional to gestational age and birth weight
## Screening tests for autism

<table>
<thead>
<tr>
<th>Infant toddler check list</th>
<th>6 – 24 months of age</th>
</tr>
</thead>
<tbody>
<tr>
<td>MCHAT (modified checklist for autism in toddlers)</td>
<td>16 – 30 months</td>
</tr>
<tr>
<td>STAT (screening tool for autism in toddlers and young children)</td>
<td>24 – 36 months</td>
</tr>
</tbody>
</table>

### Preschool and school level

- Social communication questionnaire
- Autism spectrum screening questionnaire
- CAST (childhood autism spectrum test)
Diagnostic tests for autism

CARS 2 (childhood autism rating scale 2) 2 years and above. Takes about 30 min to administer. Sensitivity 80%

ADOS 2 (Autism diagnostic observation schedule) 12 months to adulthood. Takes about 60 min.

ADOS toddler module 12 – 30 months

ADI (autism diagnostic interview-revised) takes about 2-3 hours. Excellent psychometric properties. Often combined with ADOS as reference standard.
THANK YOU