Those who have knowledge, don't predict. Those who predict, don't have knowledge.

~ Laozi

AZ QUOTES

Predicting long term outcomes in NICU

Naveen Jain

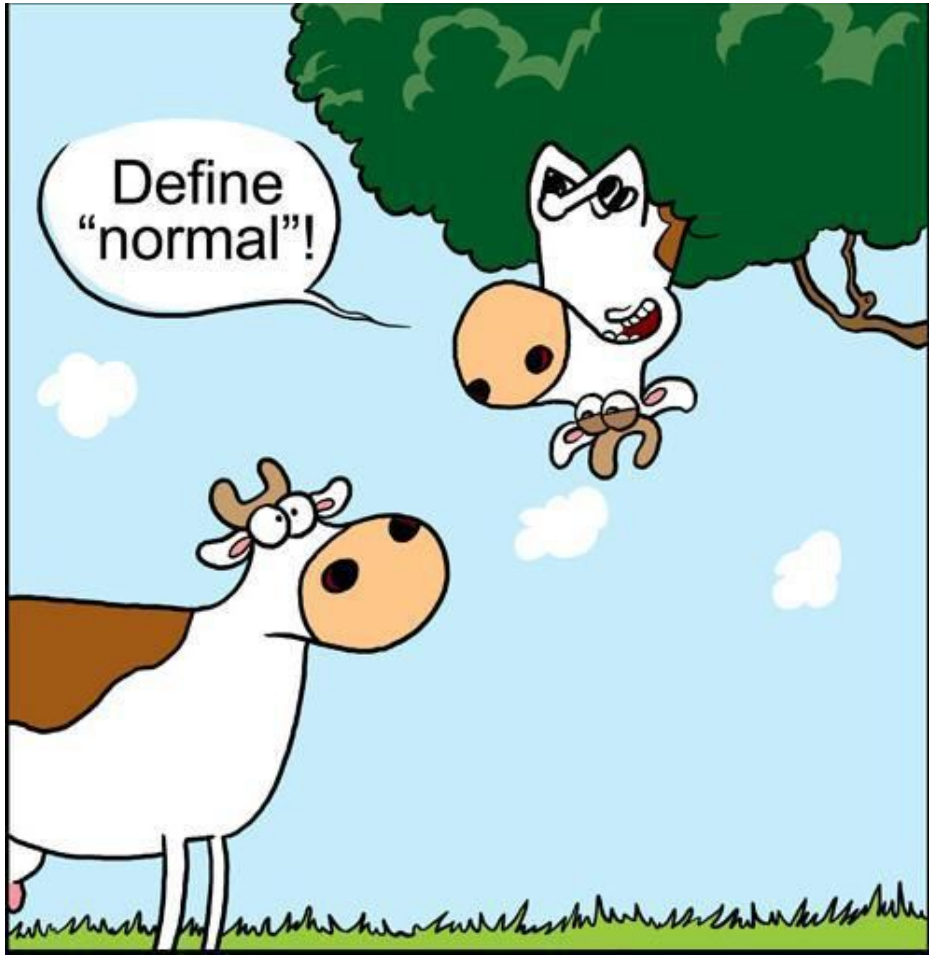
Kerala Institute of Medical Sciences

Trivandrum

Outcomes are not just brain outcomes

- CP / cognition
- Behaviour / learning
- Neurosensory
- Chronic lung disease
- Renal – hypertension
- Growth …

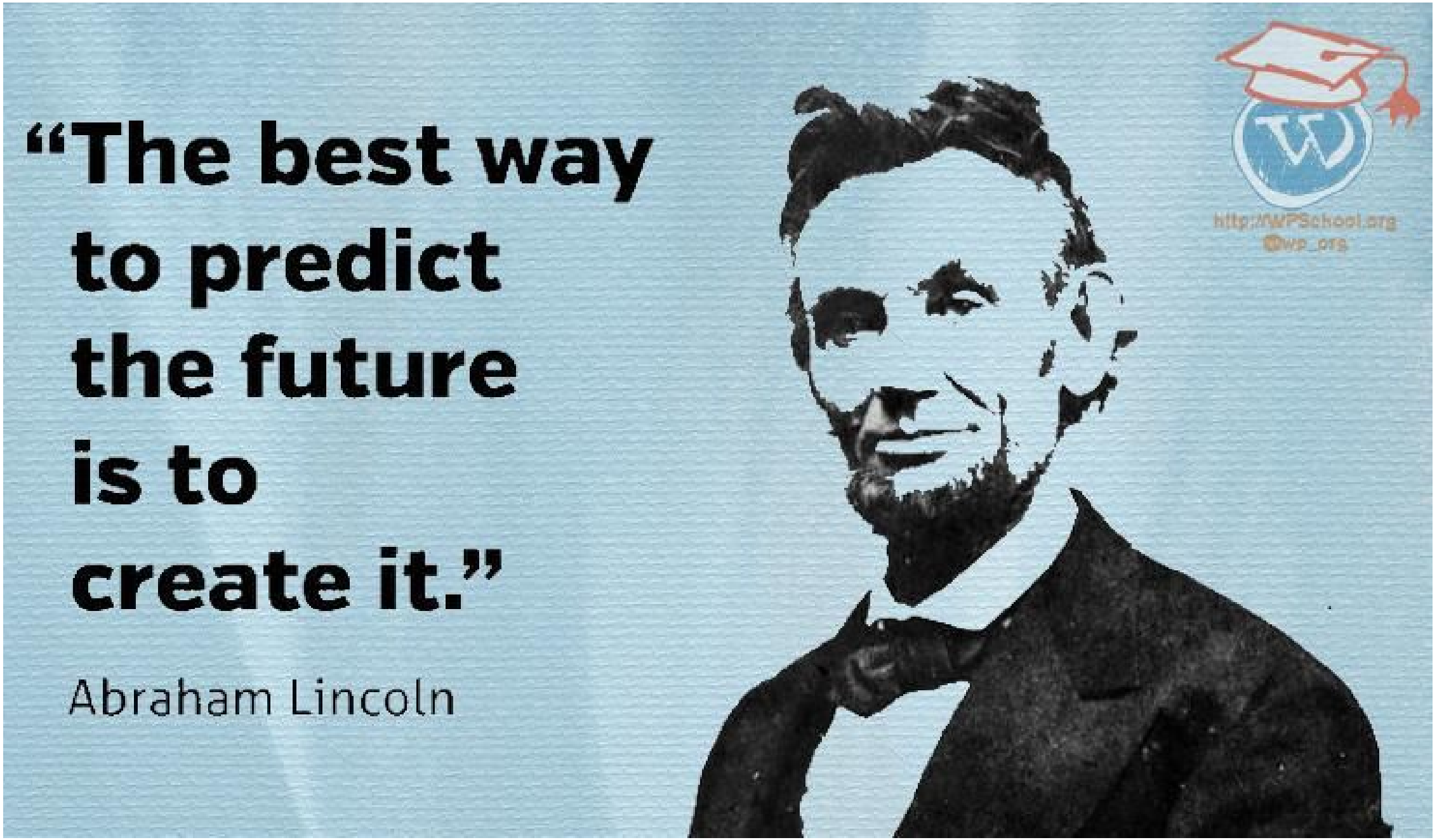
Intact survival?



Why predict

- **Improve Care processes**

- Individual case – anticipatory guidance


“The best way to predict the future is to create it.”
Abraham Lincoln
http://WPSchool.org
@wp_org

Antenatal steroids - dose-dependent protective effect – death or neurodevelopmental impairment - extremely preterm

	No ANS	Partial ANS	Complete ANS
n	848	1581	3692
Mortality %	43	30	25
Severe IVH	23	19	11
Death / NDI %	68	54	48

infants (birth weight range, 401-1000 g; gestational age, 22-27 weeks)

JAMA Pediatr. 2016 Oct

Effects and safety of MagSulf in neuroprotection

	Magsulf	No magsulf	
Moderate to severe CP	45 / 3504	75 / 3588	0.61 (0.42 – 0.89)

Medicine 2016 Jan

Human Milk Feeding as a Protective Factor for Retinopathy of Prematurity: A Meta-analysis

Severe ROP	Any BM vs formula	Exc BM vs formula
	0.42 (0.08 to 2.18)	0.10 (0.04 to 0.29)

5 studies with 2208 preterm infants, observational studies

Pediatrics 2015 dec

Care process – QI

- Best science
- Best implementation

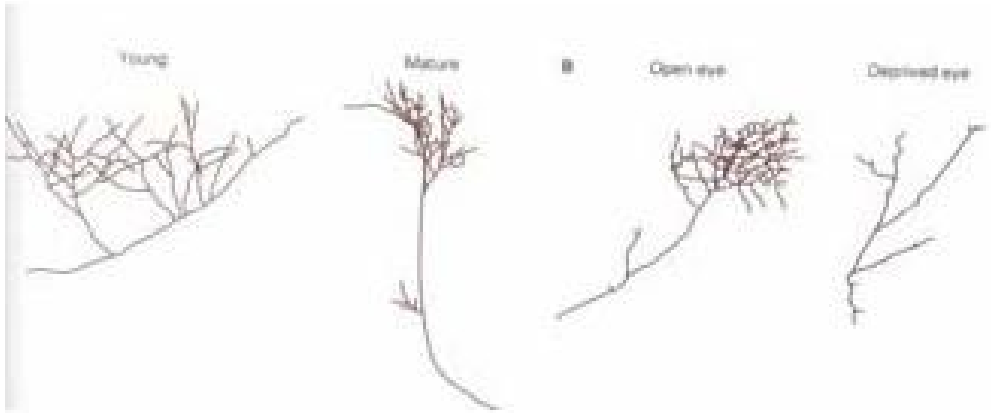
Avoiding excess of Therapies

- Hyperoxia
- Hypocarbia
- Alkali
- Steroids
- Hyperthermia …
- Caffeine
- Fluids
- Parenteral nutrition

Family centered development supportive care

Role of stimuli – PATCHED EYE – POOR SYNAPSE

Exogenous activity !



BEYOND INJURY

Thyroid function

- Repeat even if newborn TFT n

Eye

- Rop

- **Refraction**

Hearing

- Picking up mild to moderate hearing loss is critical

Predicting long term outcome in NICU

Naveen Jain

Kerala Institute of Medical Sciences

Trivandrum

MRI + GM assessment

Predictive value of qualitative assessment of general movements for adverse outcomes at 24 months of age in infants with asphyxia

- 114 full-term asphyxiated infants
- qualitative assessment of GMs within 3 months after birth
- Bayley Scales of Infant Development at 24 months of age
- **cramped-synchronized movements** during the writhing movements period
  - predictive validity 98.2%,
  - positive predictive value 85.7%, and negative predictive value 99.1%.
- **absence of fidgety movements** during the fidgety movements period
  - predictive validity 97.4%,
  - positive predictive value 75.0%, and negative predictive value 99.1%.

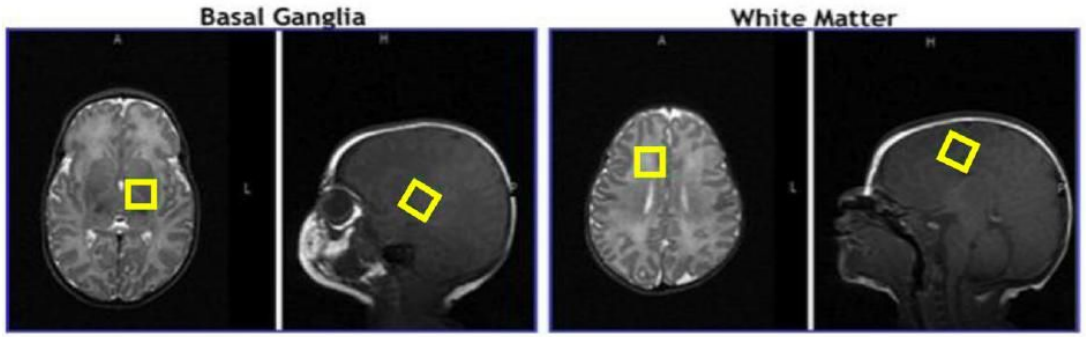
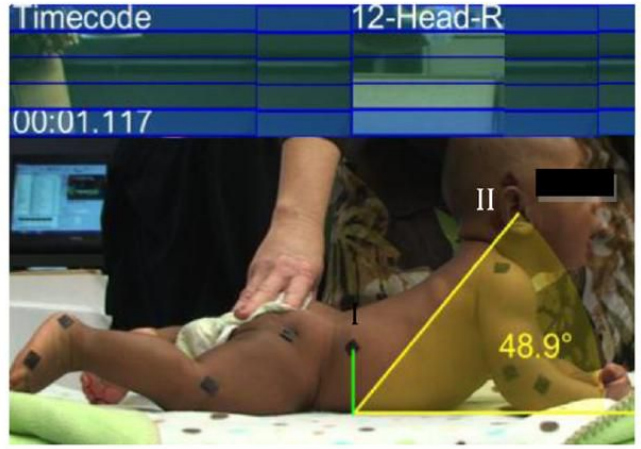
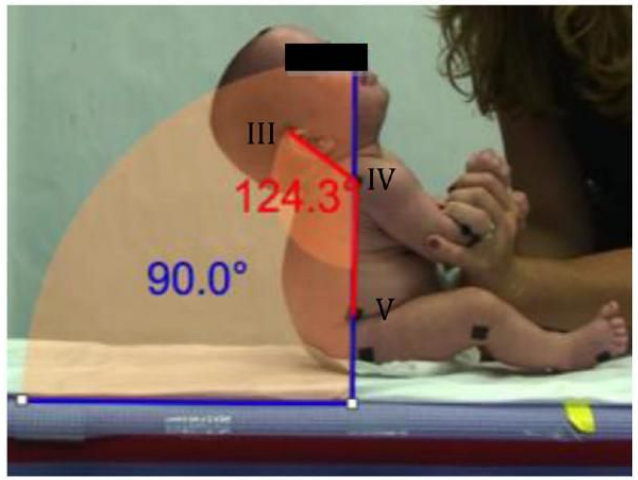


Figure 2.
A15 mm^3 voxel box was placed in the basal ganglia (BG) and frontal white matter (WM) for magnetic resonance spectroscopy data acquisition.





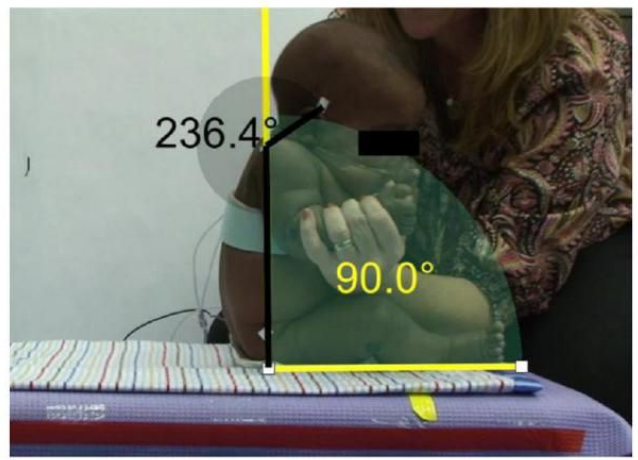


Figure 1. Kinematic analysis of prone head lift and pull-to-sit tasks using Dartfish®. Anatomical markers: I = posterior iliac crest, II = tragus, III = temporal window, IV = acromion process, V = anterior superior iliac crest

1A. Maximum prone head lift angle measured with Dartfish® Analyzer tracking tool. An embedded Dartfish® Analyzer data table is shown.

1B. Head angle at a 90° trunk angle during pull-to-sit measured with Dartfish® Analyzer tracking tool.

1C. Head angle at a 90° trunk angle during pull-to-sit measured with Dartfish® Analyzer tracking tool.

Anatom

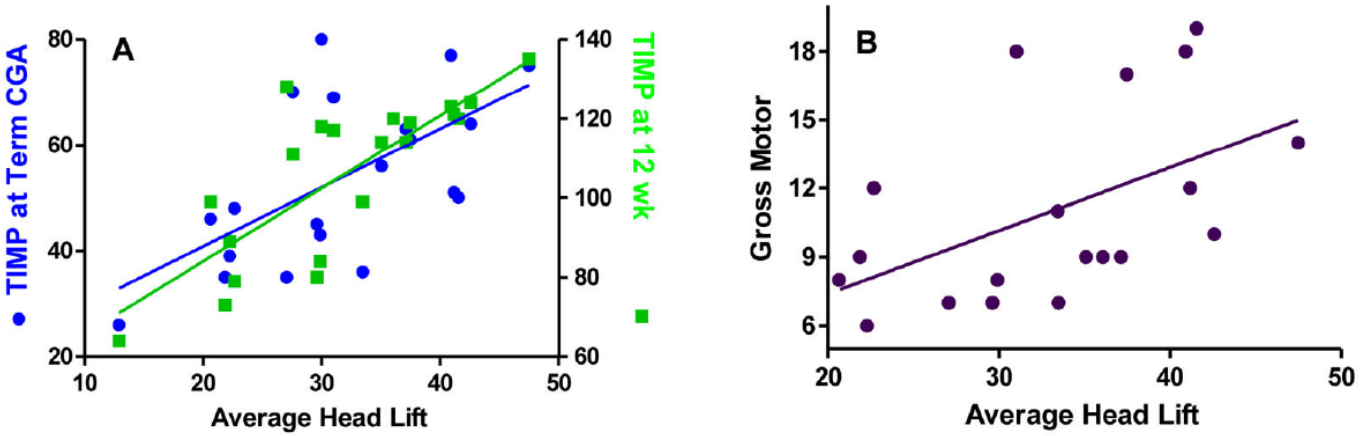


Figure 3.
Relationships between average prone head lift angle and motor developmental tests. Average prone head lift angle was associated with TIMP at term and 12 weeks CGA (A) and Bayley gross motor scores at 12 months CGA (B).

Early human dev 2015 feb

Neonatal MRI Pattern of Brain Injury as a Biomarker of Childhood Outcomes following a Trial of Hypothermia for Neonatal Hypoxic-Ischemic Encephalopathy

- Death or IQ <70
  - 4 of 50 (8%) of children with pattern 0 (normal MRI),
  - 1 of 6 (17%) with 1A (minimal cerebral lesions),
  - 1 of 4 (25%) with 1B (extensive cerebral lesions),
  - 3 of 8 (38%) with 2A (basal ganglia thalamic, anterior or posterior limb of internal capsule, or watershed infarction)
  - 32 of 49 (65%) with 2B (2A with cerebral lesions)
  - 7 of 7 (100%) with pattern 3 (hemispheric devastation)
- IQ
  - 90 ± 13 -46 children with a normal MRI
  - 69 ± 25 -50 children with an abnormal MRI

J Pediatr 2015 Nov

MRI – HIE

- Benefit of cooling

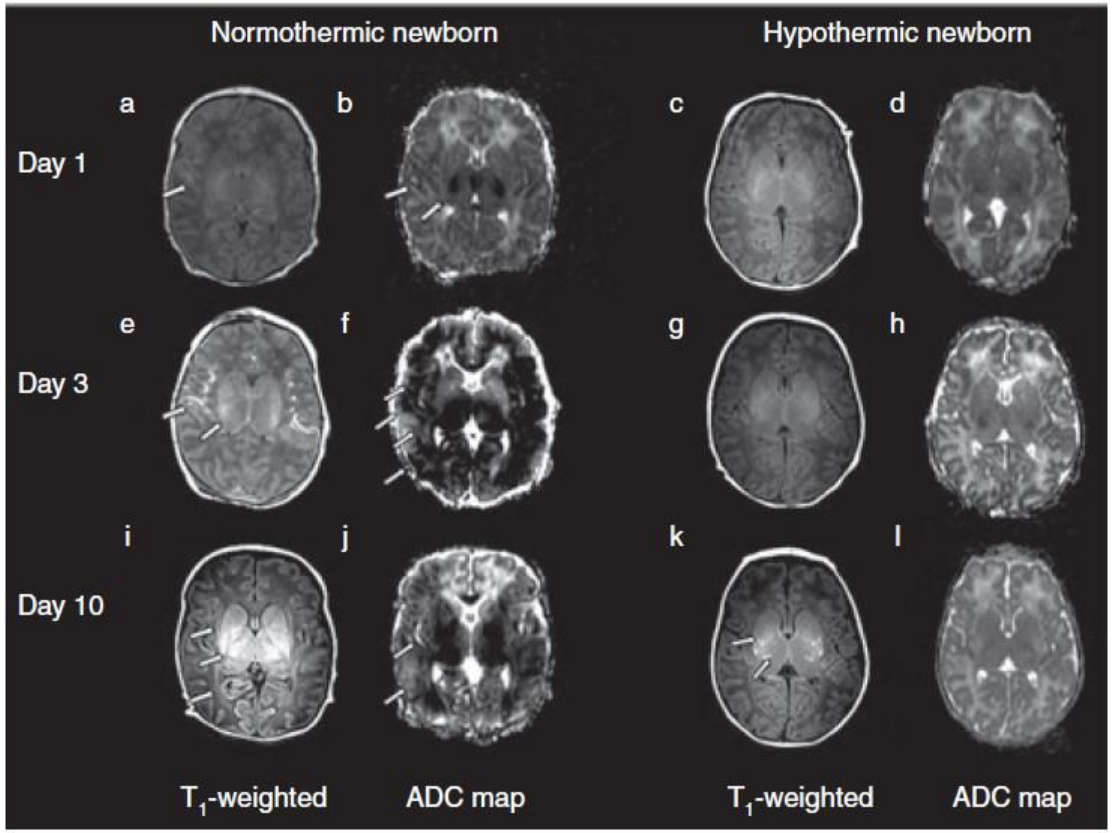
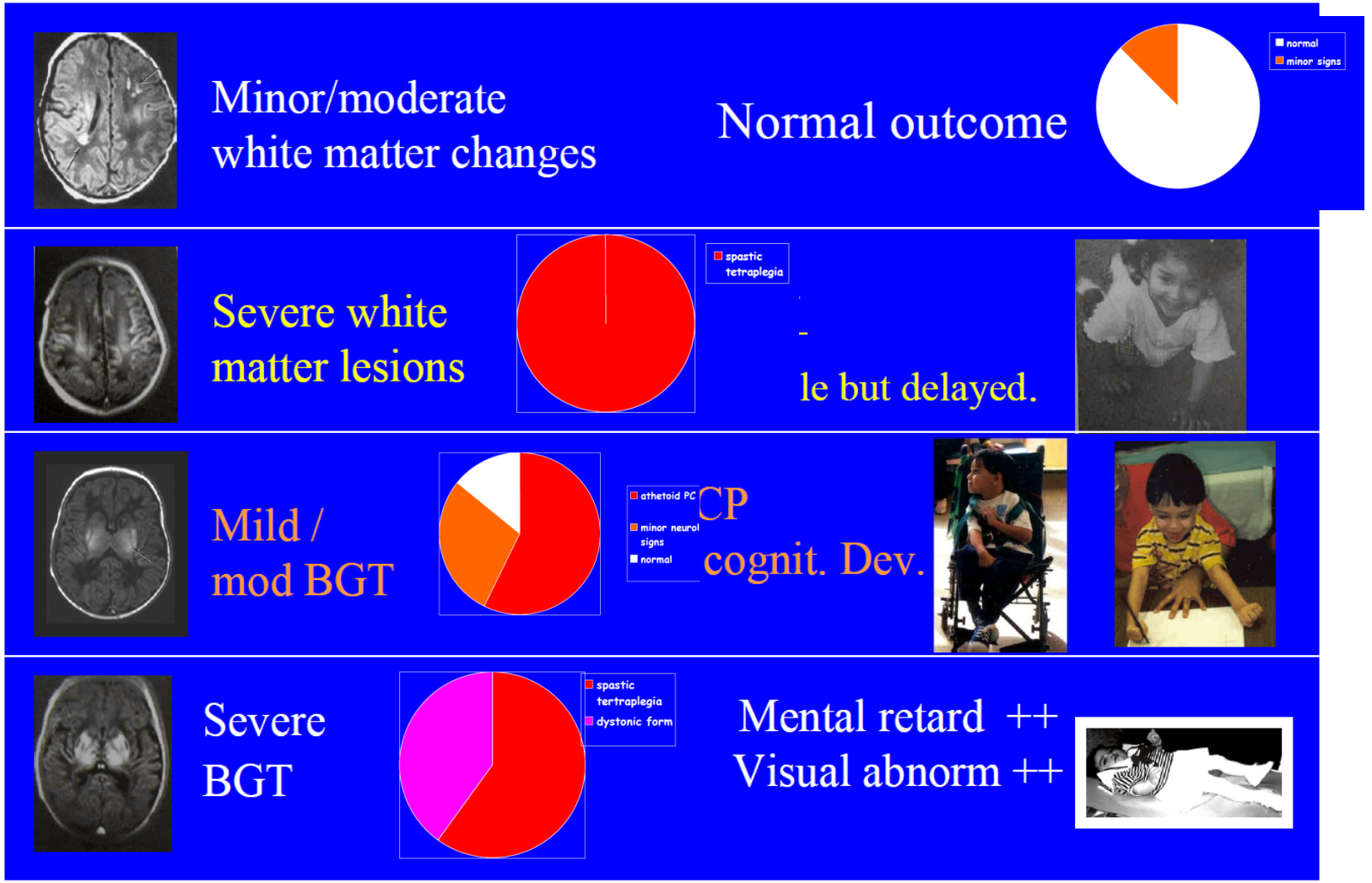


Figure 2. Progression of brain injury. Normorthermic newborn demonstrates (**a**,**b**) basal nuclei pattern on day 1, (**e**,**f**) progression to total brain injury on day 3, and (**i**,**j**) ongoing diffusion abnormalities on day 10. Hypothermic newborn shows (**c**,**g**) normal T_1 and (**d**,**h**) apparent diffusion coefficient (ADC) maps on days 1 and 3. (**k**) Note the T_1 shortening in the posterior lentiform nuclei and ventrolateral thalami that develops on day 10. Area of signal abnormality indicated by white arrows. (**l**) Normal ADC map.

MRI


Minor/moderate
white matter changes
Normal outcome
normal
minor signs
Severe white
matter lesions
spastic
tetraplegia
le but delayed.
Mild /
mod BGT
athetoid PC
minor neurol
signs
normal
CP
cognit. Dev.
Severe
BGT
spastic
tertraplegia
dystonic form
Mental retard ++
Visual abnorm ++

How early?

One can't predict the weather more than a few days in advance.

— Stephen Hawking —

AZ QUOTES

At birth – gestation

Vs 30 ODDS	Severe vs no morbidity	Mortality vs no morbidity
23-24	36 (22-58)	171 (87-334)
26	13	25
29	1.6	2

Probability	Severe vs no morbidity	Mortality vs no morbidity
23-24	0.35	0.164
26	0.18	0.034
29		
30	0.04	0.004

At discharge from NICU

Prediction of neurodevelopment outcome of preterm babies using a risk stratification score

Score	Risk	Normal	abnormal	total
1,2	Low	188 (95.5%)	9 (4.5%)	197
3, 4, 5	High	23 (82.2%)	5 (17.8%)	28

Radhika S, Naveen Jain Indian Pediatrics July 2016

- This scoring helped to stratify preterm babies into low and high risk
- This will help in planning intensity of follow up and intervention

Table 3 Risk score for prediction of major NDD

Score	0	1	2
Gestation in weeks	≥28	<28	
Resuscitation at birth	No resuscitation/only Positive pressure ventilation	Extensive resuscitation	
Ventilation	Not ventilated/ Duration ≤ 7 d	Duration >7 d	
Hypoglycemia	No/Asymptomatic	Symptomatic	
Neurosonogram findings	No intraventricular hemorrhage (IVH) /Periventricular leucomalacia (PVL)	Grade 1,2 IVH	Grade 3 IVH/ ventriculomegaly/ PVL

HD Neonatal Research Network (NRN): Extremely term Birth Outcome Data

Share this:

I use the data to determine individual outcomes?

se data are not intended to be predictive of individual infant omes. Instead, the data provide a range of possible outcomes ed on specific characteristics.

u choose to use these data to determine possible outcomes, se remember that the information provided is not intended to he sole basis for care decisions, nor is it intended to be a nitive prediction of outcomes if intensive care is provided. Users uld keep in mind that every infant is an individual, and that ors beyond those used to formulate these standardized ssments may influence an infant's outcomes.

r the characteristics below.

cational Age *(Best Obstetric Estimate in npleted Weeks)*: 25 weeks

n Weight *(401 Grams to 1,000 Grams)*: 660 grams

Female Male

leton Birth: Yes No

enatal Corticosteroids *(Within Seven Days ore Delivery)*: Yes No

Related A-Z Topics

Bacterial Vaginosis

Birth Defects

Breastfeeding and Breast Milk

All related topics

Related FOAs

Pregnancy in Women with Disabilities (R21)

All related FOAs

NICHD News and Spotlights

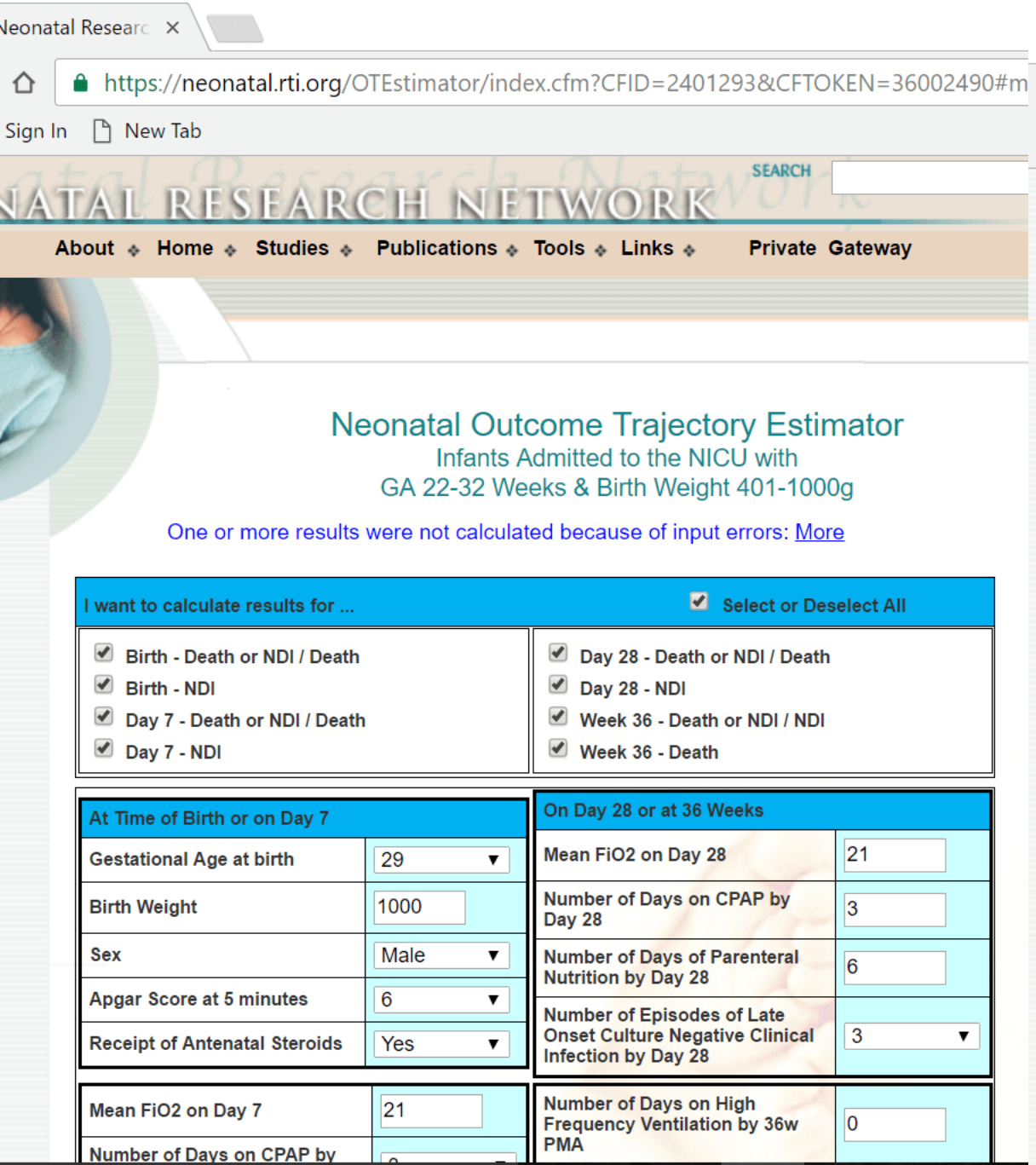
Even partial steroid treatment can benefit extremely preterm infants, NIH study suggests

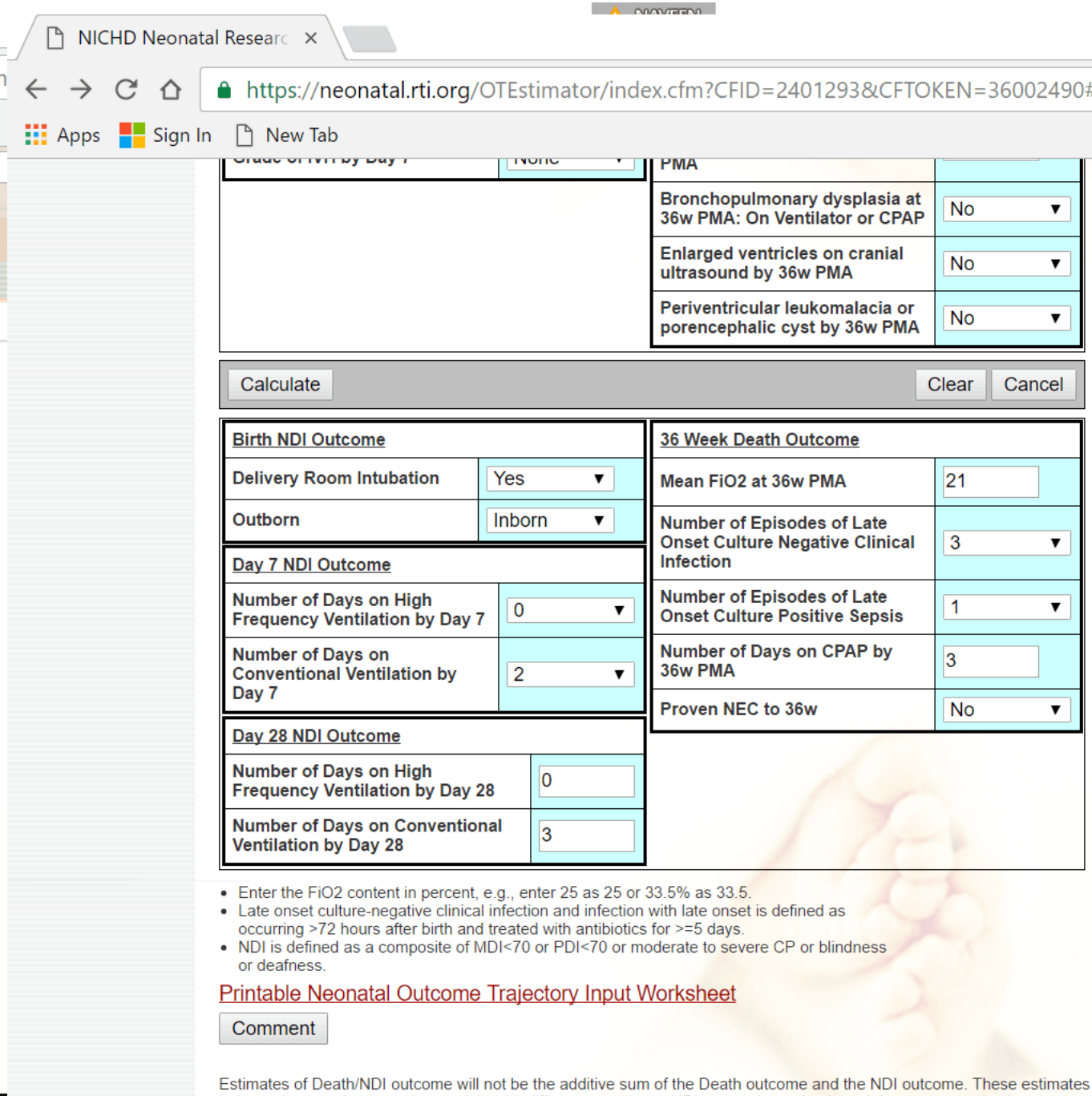
Azithromycin pretreatment lowers infection rate after C-section, NIH-funded study finds

Outcomes	Outcomes for All Infants	Outcomes for Mechanically Ventilated Infants
Survival	77%	78%
Survival Without Profound Neurodevelopmental Impairment	64%	66%
Survival Without Moderate to Severe Neurodevelopmental Impairment	48%	50%
Death	23%	22%
Death or Profound Neurodevelopmental Impairment	36%	34%
Death or Moderate to Severe Neurodevelopmental Impairment	52%	50%

* These estimates are based on standardized assessments of outcomes at 18 to 22 months of infants born at NRN centers between 1998 and 2003; infants were 22 to 25 weeks, between 401 and 1,000 grams at birth. Infants not born at a Network center and Infants with a major congenital anomaly were excluded. The first column of estimates is based on findings for all 4,446 infants in the study. The second column of estimates is based only on the 3,702 infants who received intensive care. The rate of a given outcome had intensive care been attempted for all infants is likely to be intermediate between these two estimates. Sonographic estimates of fetal weight may be used in anticipating birth weight, while assessing the minimum and maximum likely birth weight consistent with the potential error of sonographic estimates.

These data are not intended to be predictive of individual outcomes. Instead, the data provide a range of possible outcomes based on





Neonatal Researc ×

https://neonatal.rti.org/OTEstimator/index.cfm?CFID=2401293&CFTOKEN=36002490#m

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NATAL RESEARCH NETWORK

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Neonatal Outcome Trajectory Estimator

Infants Admitted to the NICU with
GA 22-32 Weeks & Birth Weight 401-1000g

One or more results were not calculated because of input errors: More

I want to calculate results for ... Select or Deselect All

- Birth - Death or NDI / Death
- Birth - NDI
- Day 7 - Death or NDI / Death
- Day 7 - NDI
- Day 28 - Death or NDI / Death
- Day 28 - NDI
- Week 36 - Death or NDI / NDI
- Week 36 - Death

At Time of Birth or on Day 7	
Gestational Age at birth	29
Birth Weight	1000
Sex	Male
Apgar Score at 5 minutes	6
Receipt of Antenatal Steroids	Yes
Mean FiO2 on Day 7	21
Number of Days on CPAP by	

On Day 28 or at 36 Weeks	
Mean FiO2 on Day 28	21
Number of Days on CPAP by Day 28	3
Number of Days of Parenteral Nutrition by Day 28	6
Number of Episodes of Late Onset Culture Negative Clinical Infection by Day 28	3
Number of Days on High Frequency Ventilation by 36w PMA	0

NICHD Neonatal Researc ×

https://neonatal.rti.org/OTEstimator/index.cfm?CFID=2401293&CFTOKEN=36002490#

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Grade of IVH by Day 7	None
PMA	
Bronchopulmonary dysplasia at 36w PMA: On Ventilator or CPAP	No
Enlarged ventricles on cranial ultrasound by 36w PMA	No
Periventricular leukomalacia or porencephalic cyst by 36w PMA	No

Calculate Clear Cancel

Birth NDI Outcome	
Delivery Room Intubation	Yes
Outborn	Inborn

Day 7 NDI Outcome	
Number of Days on High Frequency Ventilation by Day 7	0
Number of Days on Conventional Ventilation by Day 7	2

Day 28 NDI Outcome	
Number of Days on High Frequency Ventilation by Day 28	0
Number of Days on Conventional Ventilation by Day 28	3

36 Week Death Outcome	
Mean FiO2 at 36w PMA	21
Number of Episodes of Late Onset Culture Negative Clinical Infection	3
Number of Episodes of Late Onset Culture Positive Sepsis	1
Number of Days on CPAP by 36w PMA	3
Proven NEC to 36w	No

- Enter the FiO2 content in percent, e.g., enter 25 as 25 or 33.5% as 33.5.
- Late onset culture-negative clinical infection and infection with late onset is defined as occurring >72 hours after birth and treated with antibiotics for >=5 days.
- NDI is defined as a composite of MDI<70 or PDI<70 or moderate to severe CP or blindness or deafness.

Printable Neonatal Outcome Trajectory Input Worksheet

Comment

Estimates of Death/NDI outcome will not be the additive sum of the Death outcome and the NDI outcome. These estimates

NICHD Neonatal Researc

https://neonatal.rti.org/OTEstimator/index.cfm?CFID=2401293&CFTOKEN=36002490#msg

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Neonatal Outcome Trajectory Estimator

Infants Admitted to the NICU with GA 22-32 Weeks & Birth Weight 401-1000g

Gestational Age at birth:	29	Mean FiO2 on Day 28:	21
Birth Weight:	1000	Number of Days on CPAP by Day 28:	3
Sex:	Male	Number of Days of Parenteral Nutrition by Day 28:	6
Apgar Score at 5 minutes:	6	Number of Episodes of Late Onset Culture Negative Clinical Infection by Day 28:	3
Receipt of Antenatal Steroids:	Yes	Number of Days on High Frequency Ventilation by 36w PMA:	0
Mean FiO2 on Day 7:	21	Number of Days on Conventional Ventilation by 36w PMA:	2
Number of Days on CPAP by Day 7:	3	Bronchopulmonary dysplasia at 36w PMA: On Ventilator or CPAP :	No
Grade of IVH by Day 7:	None	Enlarged ventricles on cranial ultrasound by 36w PMA:	No
Delivery Room Intubation:	Yes	Periventricular leukomalacia or porencephalic cyst by 36w PMA:	No
Outborn:	Inborn	Mean FiO2 at 36w PMA:	21
Number of Days on High Frequency Ventilation by Day 7:	0	Number of Episodes of Late Onset Culture Negative Clinical Infection:	3
Number of Days on Conventional Ventilation by Day 7:	2	Number of Episodes of Late Onset Culture Positive Sepsis:	1
Number of Days on High Frequency Ventilation by Day 28:	0	Number of Days on CPAP by 36w PMA:	3
Number of Days on Conventional Ventilation by Day 28:	3	Proven NEC to 36w:	No

Probability of Outcome (expressed as a percent)

NICHD Neonatal Researc

https://neonatal.rti.org/OTEstimator/index.cfm?CFID=2401293&CFTOK

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Proven NEC to 36w:

Probability of Outcome (expressed as a percent)

Time Period	Death or NDI	Death	NDI
Birth	28	4	29
Day 7	24	4	25
Day 28	28	1	44
36 weeks	25	0	24

- Enter the FiO2 content in percent, e.g., enter 25 as 25 or 33.5% as 33.5.
- Late onset culture-negative clinical infection and infection with late onset is defined as occurring >72 hours after birth and treated with antibiotics for >=5 days.
- NDI is defined as a composite of MDI<70 or PDI<70 or moderate to severe CP or blindness or deafness.

Estimates of Death/NDI outcome will not be the additive sum of the Death outcome and the NDI outc independently arrived at using models with different covariates. NDI was estimated only on infants wh evaluated at the 18-22 month follow-up visit.

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New Calculation

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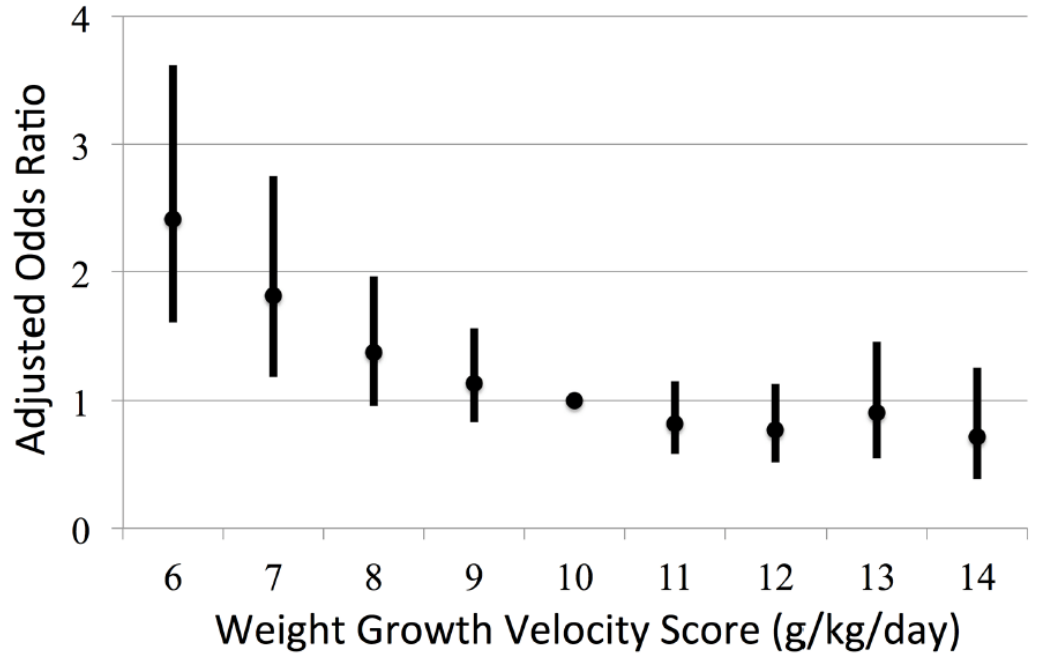
Weight growth velocity and ND outcomes of extremely low birth weight infants

Will nutrition enhancement

improve outcomes



N	158	149	283	522	659	489	356	179	166
Death or NDI	59	46	66	107	119	68	45	25	16
%	37.3	30.9	23.3	20.5	18.1	13.9	12.6	13.9	9.6

Fig 3. Relationship between weight growth velocity (WGV) scores 6–14 and their adjusted odds ratios (AORs) with 95% confidence intervals (CIs). WGV scores 6 and 7 predicted death or NDI at 3 years of age.

PLOS sep 2015

Correlation of serum KL-6 and CC16 levels with neurodevelopmental outcome in premature infants at 12 months corrected age

- KL-6 is preferentially expressed on alveolar type II cells in human lungs, and is a marker of specific lung injury
- Following alveolar injury, regenerating type II cells strongly express KL-6 antigen and this can lead to increased plasma KL-6 levels
- CC16, a lung-specific protein produced by the tracheobronchial epithelium where non-ciliated Clara cells are predominant, is believed to increase in the circulating blood of subjects with pathological conditions that are characterized by increased permeability of the alveolar–capillary barrier

<32 / < 1500 at 12 mo CGA

Table 5 | KL-6 (ng/ml) and CC16 (pg/ml) cut-off levels for predicting poor neurodevelopmental outcome

				Predictive value (%)	
	Cut-off	Sensitivity (%)	Specificity (%)	PPV	NPV
KL-6 (ng/ml)	≥89.99	100	75.5	47.8	100
CC16 (pg/ml)	≤320.27	92.8	85.7	65.0	97.6

Earlier – gives window for intervention

Early assessment of structure and function

- **MRI at ETA** combined with **GMA at 12** weeks CA is currently the most accurate method for early prediction of cerebral palsy at 12 months corrected age
- earlier magnetic resonance imaging combined with neuromotor and neurobehavioural assessments (at 30 weeks postmenstrual age)?

- A combination of neurological
  - (Hammersmith Neonatal Neurologic Examination),
  - neuromotor (General Movements, Test of Infant Motor Performance),
  - neurobehavioural (NICU Network Neurobehavioural Scale, Premie-Neuro)
  - visual assessments will be performed at 30 and 40 weeks PMA

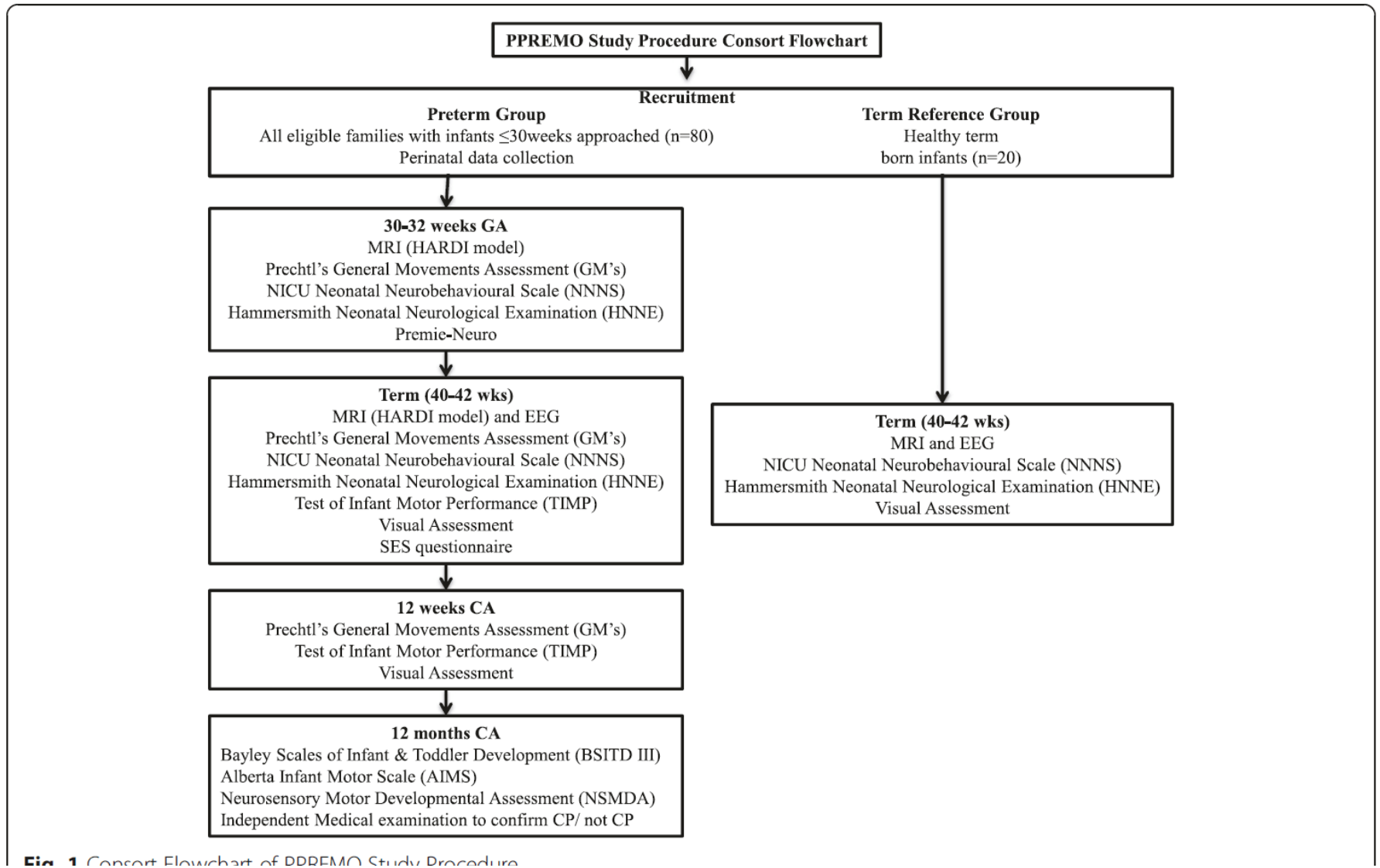


Fig. 1 Consort Flowchart of PPREMO Study Procedure

Even earlier ????

Prognosis of psychomotor and mental development in premature infants by early cranial ultrasound

- By day 3
- Cranial ultrasonic gray-scale value measurement
- Ultrasonic anomalous area of 1 cm2 of -calculate the average of gray-scale value for ultrasonic anomalous areas.

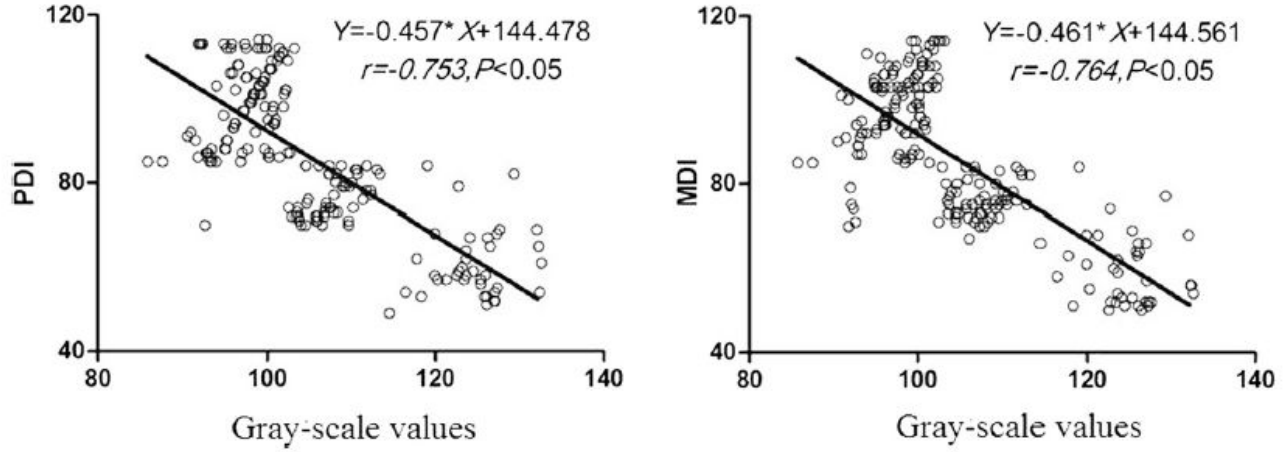


Figure 1 Correlation between ultrasonic gray-scale values of premature infants and both PDI and MDI.

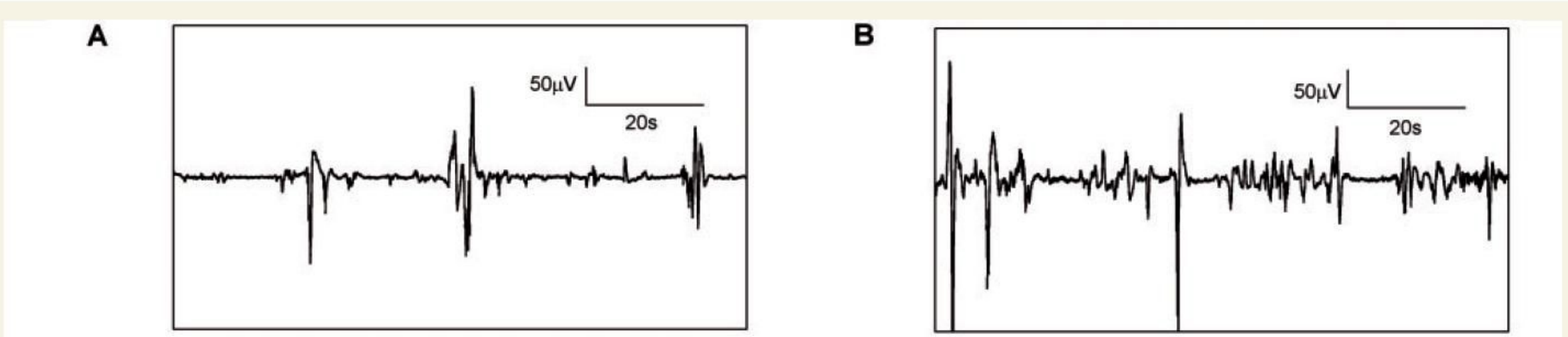
Italian Journal of Pediatrics, 2015

Cortical burst dynamics predict clinical outcome early in extremely preterm infants

- EEG of extremely preterm infants (22- 28 weeks) as early as 12 hours
- N= 43

Typical EEG at 12 hrs – discontinuous at 72 hours

Burst and inter – burst



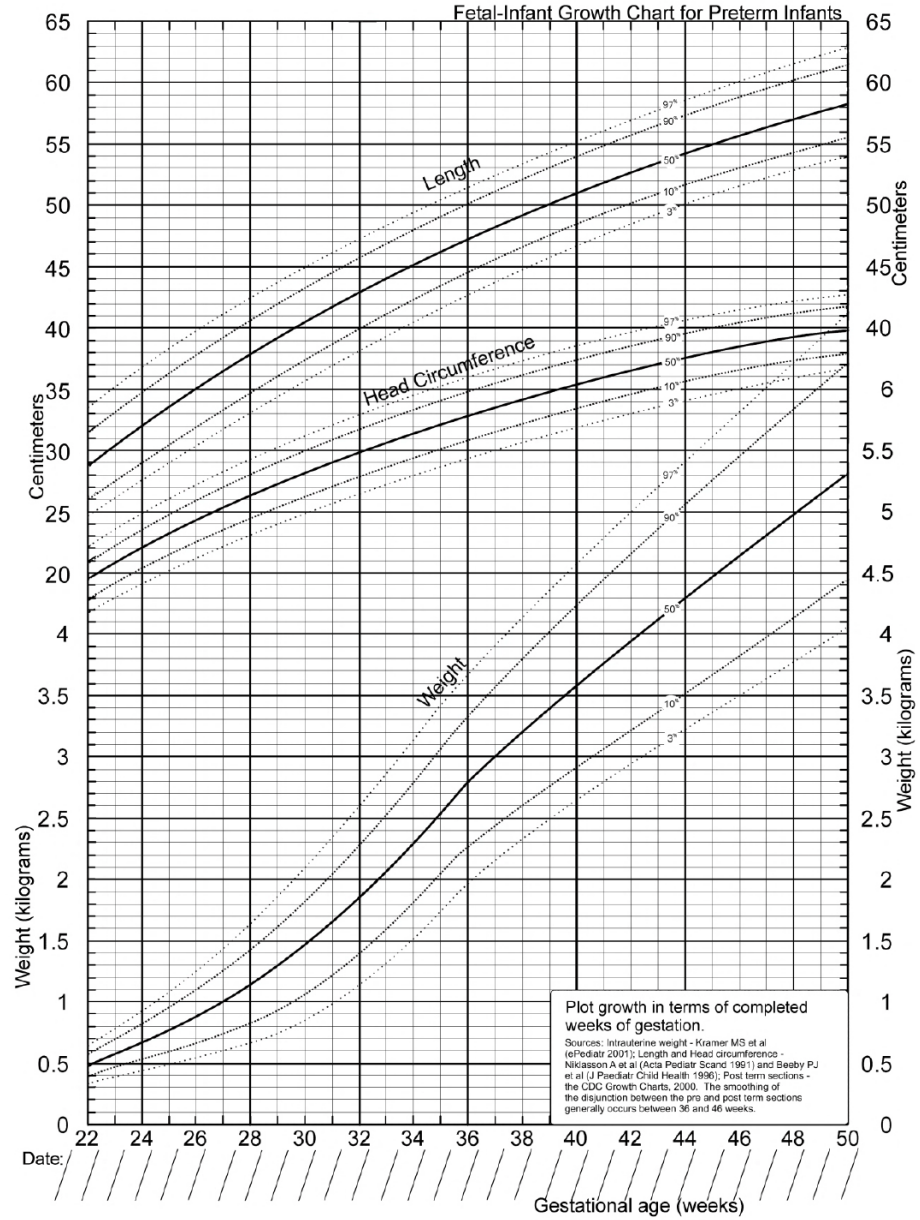
What we practice

ASSIGNING LEVEL OF FOLLOW UP

Risk Categories For Neurodevelopmental Outcomes

	Mild risk	Moderate risk	Severe risk
Gestation	33 -34 weeks	30- 32 weeks	< 30 weeks
Birth weight	>1500 gm	1250 – 1499 gm	<1250 gm
IUGR		Fetal growth 3rd – 10th centile	Fetal growth <3rd centile
Intra-uterine insults		Abnormal NST BPP < 5 Maternal fever pPROM Dichorionic twins	Severe maternal pre-eclampsia (seizures) Monochorionic twins / triplets or higher order Clinical chorioamnionitis Cord prolapse Abruption placenta AEDF, reversal EDF
Antenatal steroids (ANS)		Incomplete course or 24 hours not elapsed from last dose	No ANS
Need for resuscitation at birth		Need for resuscitation (including PPV)	Need for Extensive resuscitation (Chest compressions, Epinephrine)
Need for ventilation		Ventilation with normal blood gases and no airleaks	Ventilation abnormal blood gases and air leaks
Days on ventilator			
Perfusion		Shock (poor perfusion) with normal blood pressure	Shock (poor perfusion) with hypotension
Shock therapy	Saline bolus	Inotropes	Steroids
Hypoglycemia		Hypoglycemia (asymptomatic)	Symptomatic hypoglycemia
Blood sugars mg/ dL		32 – 46	<32
Days of hypoglycemia		1-4 days	> 5 days
Neurosonogram/MRI		IVH < grade III	Grade III IVH or IPE in NICU or ventriculomegaly, PVL at 36-40 wks
Infection		Sepsis	Sepsis with hypotension / Meningitis
NNJ	Jaundice (PT)	NNJ (ET)	BIND (MRI/BERA/clinical)
Hypothyroidism		Hypothyroidism	Treatment delayed (not normalized by one month)
Others			

GROWTH MONITORING



Fetal - infant growth chart for preterm infants(weight , head circumference, and length). Reproduced with permission from Fenton TR; licensee BioMed Central Ltd. This is an Open Access article: Verbatim copying and redistribution of this article are permitted in all media for any purpose, provided this notice is preserved along with the article's original URL. http://www.biomedcentral.com/1471-2431/3/13.)

Neurodevelopment Assessment & Development Supportive Care

Day 1 :
Parental counseling and Early Parent Participation Program (EPPP)
Medical risk factors recorded in risk stratification chart
Encourage mother for expressed breast milk

Day 3- 7 :
Screening for congenital hypothyroidism
OFC
Medical risk factors recorded in risk stratification chart
Early stimulation once hemodynamically stable
Parents touch and talk to baby, get involved in care of baby

1-2 Week :
Neurosonogram
OFC
Repeat Thyroid screening
Multivitamin, HMF (or Calcium phosphate) once on full feed
Medical risk factors recorded in risk stratification chart
Early stimulation once hemodynamically stable: KMC, NNS
NNS may be started as soon as baby is on full feeds (use oral stimulat
oro-gastric feeds are given), put to breast after expressing milk. May
breast feeding / and paladai feeding at 32- 34 weeks

2-3 weeks :
ROP screening for those at risk of AP-ROP#
OFC
Weight (should have regained birth weight)

1month :
ROP screening- subsequent visits based on Ophthalmologist's opinion till 4
S. Ca/P/ALP / Hb
OFC
Weight
S. ferritin, start Iron supplement

6 – 8 Weeks:
Vaccination
Neurobehavior
OFC
Weight
Early stimulation

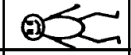
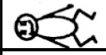
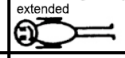
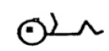
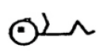
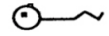
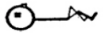
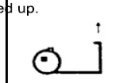
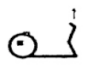
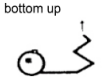
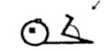
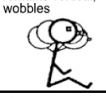
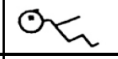
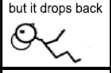
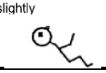
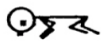
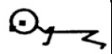
PRE DISCHARGE CHECK LIST

1. Active Medical Problems
   a. ---------- b. ---------- --
2. Nutrition: Breast milk / formula (---: ---), paladai, DBF
3. Medications (ref table)
4. Weight: Tracking postnatal growth chart / NO
5. OFC: Tracking postnatal growth chart / NO
6. Physical Exam
7. ROP
8. Hearing
9. Labs
10. Imaging
11. Neuroexam & Neurobehavior Before Discharge
13. Immunization and Advice
14. Early stimulation: KMC Duration
15. Parent coping: Concerned / Adjusting well / Need guidance

HAMMERSMITH FORM

Name : _____Code_____No.of Exam:_____

O.B_____D.O.E_____Age:_____G.A_____Sex_____BW_____

						STATE	ASYMET
POSTURE Baby lying on back, Look mainly at position of the legs, but also note arms may change drawing.	Arms & legs extended 	legs slightly flexed 	legs well flexed but not adducted	legs well fixed & adducted near belly	arms very flexed, legs very extended 		
ARM RECOIL Quickly exgted straighten) bothe arms: put net to byd. Count to To let go repeat 3 times	arm does not flex	arm flexes slowly, not always, not completely	arm flexes slowly, more completely	arm flexes and remains flexed	arm difficult to exted; snap back forefully		
ARM TRACTION Hold wrist and pull forward. Note flexion at arm, and resistance while shoulder lifts off table.	arm remains straight - no resistance 	arm flexes slightly or some resistance fell 	arm flexes well till shoulder lifts. then straightens	arm flexes and remains flexed as shoulder lifts	arm remains flexed when body lifts up		
LEG RECOIL Take both ankles, blend hips+knee. Quickly extend when infant not pushing. Let go. Repeat X3	No flexion ← → 	incomplete flexion, not every time 	complete slow flexion	complete fast flexion	legs difficult to extend; snap back forcefully		
LEG TRACTION Hold ankle, pull leg upwards. Look at flexion & reistance as bootom pulled up.	leg straight - no resistane 	leg flexes slightly or some resistance felt 	leg flexes well till bottom lifts up	knee flexes–remains flexed when bottom up 	flexion stays when back+bottom up		
POPLITEAL ANGEL Fix knee on abdomen belly), try to extend knee with first finger. Note distance (angle) between upper and lower limb.	180°	=150°	= 110°	 ≈ 90°	<90°		
HEAD CONTROL (1) Baby sitting upright`. encircle chest with both hands holding shoulders Let head drop forward.	no attempt to raise head	infant tries:effort better felt than seen	raises head but drops forward or back	raises head: remains vertical wobbles			
HEAD CONTROL (2) Baby sitting upright. encircle hest with both hand holding shoulders. Let head drop backward.	no attempt to raise head	infant tries: effort better felt than seen	raises head but drops toward or back	raises head: remains vertical, wobbles 	headupright or extended: cannot be passively flexed (pushed forward)		
HEAD LAG Pull baby to sit by the wrists & support head slightly.	head drops & stays back 	tries to lift head but it drops back 	able to lift head slightly 	lifts head in line with body	head in front of body		
VENTRAL SUSPENSION Hold baby horizontal under the belly. Look at posture of back, arms, legs, and head. If it looks different DRAW !	back curved, head & limbs hang straight	back curved head, limb slightly flexed	back slightly curved, limbs flexed	back straight, head in line with body, limbs flexed 	back straight, head abve body 		

HAMMERSMITH FORM

SPONANEOUS MOVEMENT Watch baby while (s) he is lying on back	No Movement	Few stretches, no other movement	Jerky movement, stretches, but also some smooth movement	Smooth move-ments of arms + legs	Fits, cramped or other abnormal movements: DESCRIBE!!
ABNORMAL HAND OR TOE POSTURES	Hands open	Hands fisted or thumbs adduct intermittently but open	Hands fist or thumb adducts or finger & thumb oppose	Big toe up (extended) or all toes flex	
TREMOR	No tremor	Tremor only when crying or after Moro reflex	Some tremor when awake	frequent tremors	Continuous tremors
STARTLE Similar Movements to Moro reflex but not doing Moro test	No Startle	Startie to sudden noise or bang on table	2 or 3 spontaneous startles	3 - 5 spontaneous startles	Morethan 6 sponta-neous startles
REFLEXES = TEST BOTH SIDES					
SUCK & GAG Watch on breast ; if no suck is seen, put little finger into mouth wih pulp of finger upwards	No gag / no suck	Weak suck only ; (a) irregular (b) Regular No stripping	Infant sucks well ont he breast	Strong suck : (a) irregular (b) regular Good stripping	No suck but strong clenching
PALMAR GRASP Stroke inside of hand. DO NOT TOUCH BACK OF HAND !!	No reaction	Short, weak flexion of fingers	Strong flextion of fingers	Strong finger flex tion, shoulder	Strong finger flex ion, whole body v
PLANTAR GRASP Press on sole below toes.	No response	toes flex (bend) slightly	toes curve around finger		
MORO REFLEX Put baby in position shown in drawing 1 below. bring head forward and suddenly let it fall back slightly.	No response	Full abduction of the arms, extension at the elbow, no adduction	Full abduction, little or delayed adduction	Arms do not fully abduct but good adduction	Adduction only Extension at the elbow only
PLACING Hold infant upright, Stroke front of the baby's lower leg on edge of table	Nothing happens	Baby flexes ankle	Baby flexes hip, knee and ankle & steps on table		
ORIENTATION AND BEHAVIOUR					
Eyes	Does not open eyes	Normal eye movement, eyes move together	Abnormal eye movements: DESCRIBE!!		
AUDITOR ORIENTATION Must not be asleep, Wrap infant, Hold rattle 10-15 cm (4-6 inches) from ear.	No reaction	Brightens (Wakes up)	Turns eyes and somtimes turns head a bit also	Turns eyes and head fully to side of noise	turns head and eyes strongly to noise ; does not tire
VISUAL ALERTNESS Wrap infant, wake up with rattle if needed or rock baby a bit. Look if baby can see and follow red ball (R) or a target (T)	Does not follow or focus on red ball or target R T	Stills, Focuses, follows very briefly to side and up but loses it quickly R T	Follows with eyes to the side and up; may trun head R T	Follows with eyes to the side and up; turns head always R T	Follos in a circle R T
ALERTNESS Tested as response to red ball (R) or target (T). How long infant interested	Will not respond to red ball R T	When awake. looks only brietly R T	When awake, looks at red ball but loses it R T	Keeps interest in red ball R T	Does not tire R T
PEAK OF EXCITEMENT Circle "H" if high-pitch cry	Quiet all the time	Awakes briefly, does not only	Awakes briefly, cries sometimes	Cries always when handled	cries always
Consolability How easy is it to make baby quiet ?	Never awake or crying	Awake but never cries, consoling no needed	Becomes quiet when talked to	Needs picking up to console	Cannot be consoled

HEARING ASSESSMENT

Parent information

Screening for hearing impairment is recommended for all babies, irrespective of NICU care. Some disease process increase risk of hearing impairment. Rapid check (OAE) and assessment of nerve and brain hearing (BERA) are both recommended to sick NICU babies, to be completed before 6 months age.

Summary statement

Hearing right left

Hearing impairment

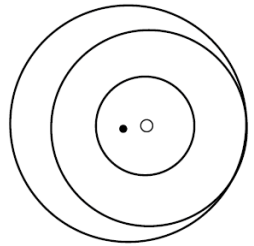
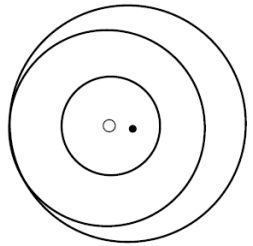
Hearing aid (assistive listening device)

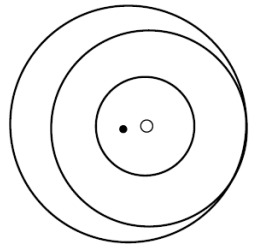
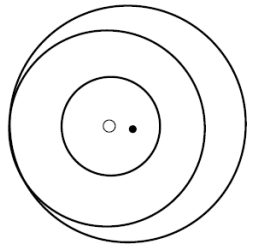
	OAE (discharge)	OAE (repeat, if necessary before 3 months)	BERA (as per appointment, before 6 months)
Date			
Comment			

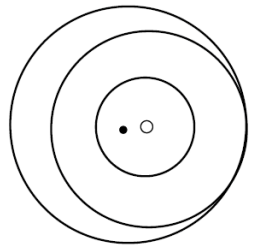
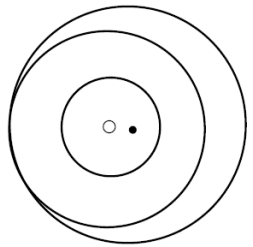
OAE may show retest in babies with normal hearing, if baby has a common cold, wax in ear, or in very small ears. A request for repeat test doesn't suggest impaired hearing.

BERA requires that the baby to remain still, hence, the baby will be sedated (safe) for the procedure. If BERA is abnormal, the baby will be evaluated for hearing intervention. *BERA is interpreted as normal if graph is good at 35 db

ROP SCREENING FORM

	R	L
Date:		
Postmenstrual Age:		
Follow-up:		
Examiner:	Zone: Stage: Preplus: Y / N Plus: Y / N	Zone: Stage: Preplus: Y / N Plus: Y / N
Comments:		

	R	L
Date:		
Postmenstrual Age:		
Follow-up:		
Examiner:	Zone: Stage: Preplus: Y / N Plus: Y / N	Zone: Stage: Preplus: Y / N Plus: Y / N
Comments:		

	R	L
Date:		
Postmenstrual Age:		
Follow-up:		
Examiner:	Zone: Stage: Preplus: Y / N Plus: Y / N	Zone: Stage: Preplus: Y / N Plus: Y / N
Comments:		

Interpretation					
Development Intervention					
Referral					
Feed Back from specialist					

false reassurance, or [create false anxieties]().

N- normal on the day assessment

No further investigations or treatment required on the same day.

Development is a continuous process and needs periodic reassessment

R- some differences from normal noted, needs reassessment (on date specified)

A- abnormal – significant deviation from normal, needs further investigations and treatment.

EDC_____ [redacted]

18 MONTHS (corrected age) Date: _____

Language assessment:

REELS

DASII

Mental development quotient

Motor development quotient

Clusters

Interpretation:

Score >85 is Normal

<75 is Abnormal

Any abnormal movements

Choreoathetoid / Tremors / Ataxia

Oral motor function – Excessive drooling, poor coordination of suck and swallow, inability to chew in children with molars

Diagnosis at 18 months

Normal

Cerebral palsy

Hearing problem

Language delay

Cognitive problems

Visual problem

Chronic medical problem

Gross Motor Function Classification System – Expanded and Revised (GMFCS – E & R)

BEFORE 2ND BIRTHDAY

LEVEL I: Infants move in and out of sitting and floor sit with both hands free to manipulate objects. Infants crawl on hands and knees, pull to stand and take steps holding on to furniture. Infants walk between 18 months and 2 years of age without the need for any assistive mobility device.

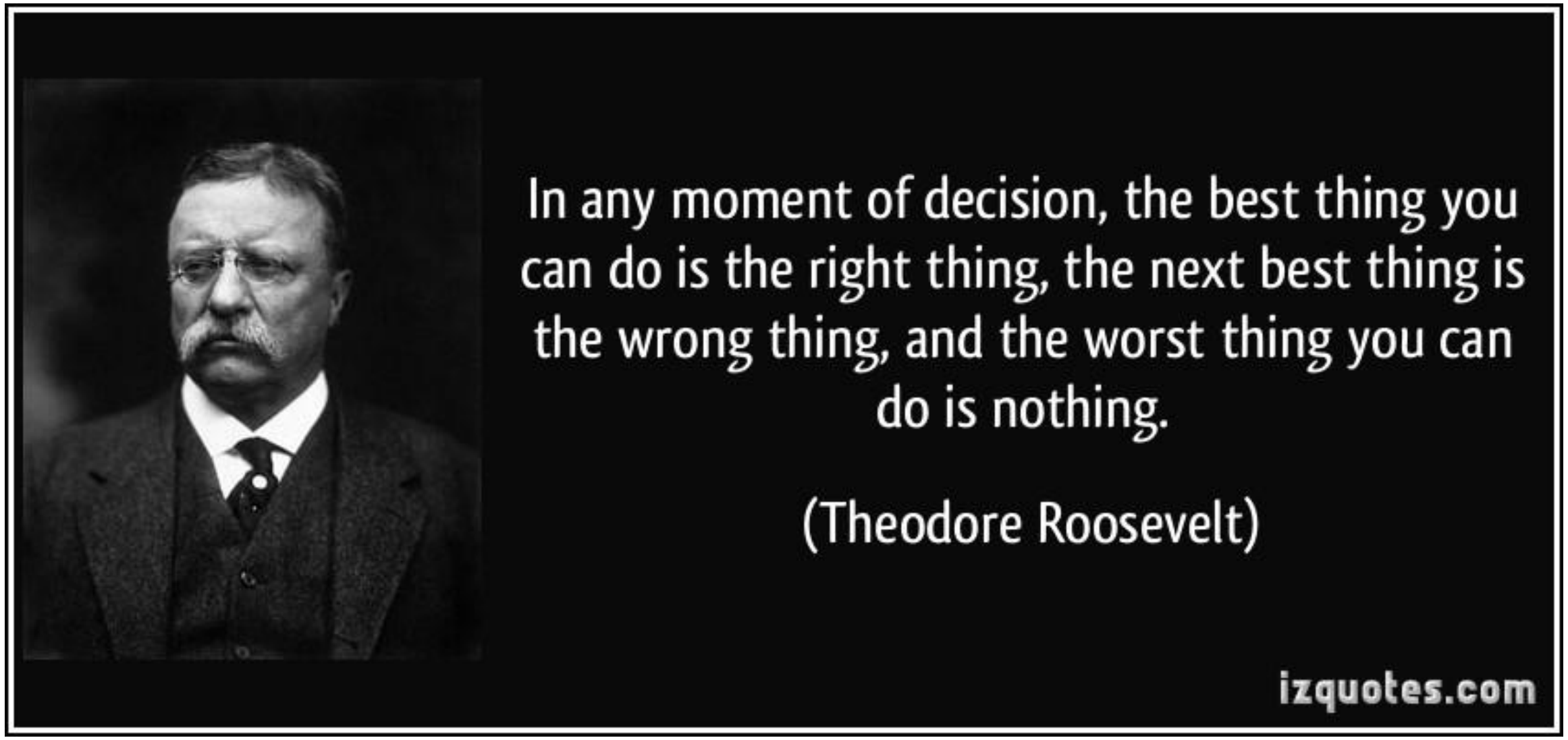
LEVEL II: Infants maintain floor sitting but may need to use their hands for support to maintain balance. Infants creep on their stomach or crawl on hands and knees. Infants may pull to stand and take steps holding on to furniture.

LEVEL III: Infants maintain floor sitting when the low back is supported. Infants roll and creep forward on their stomachs.

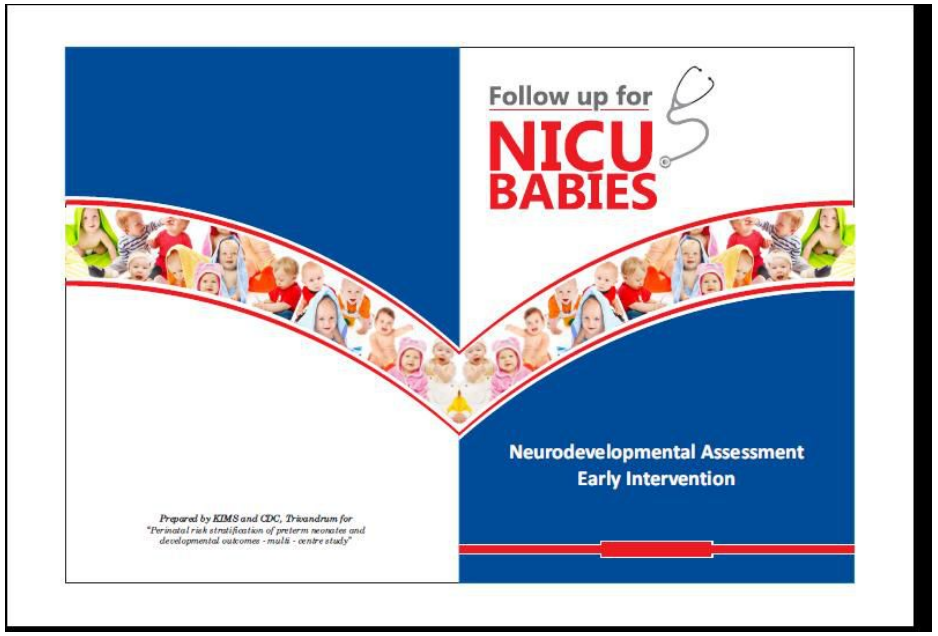
LEVEL IV: Infants have head control but trunk support is required for floor sitting. Infants can roll to supine and may roll to prone.

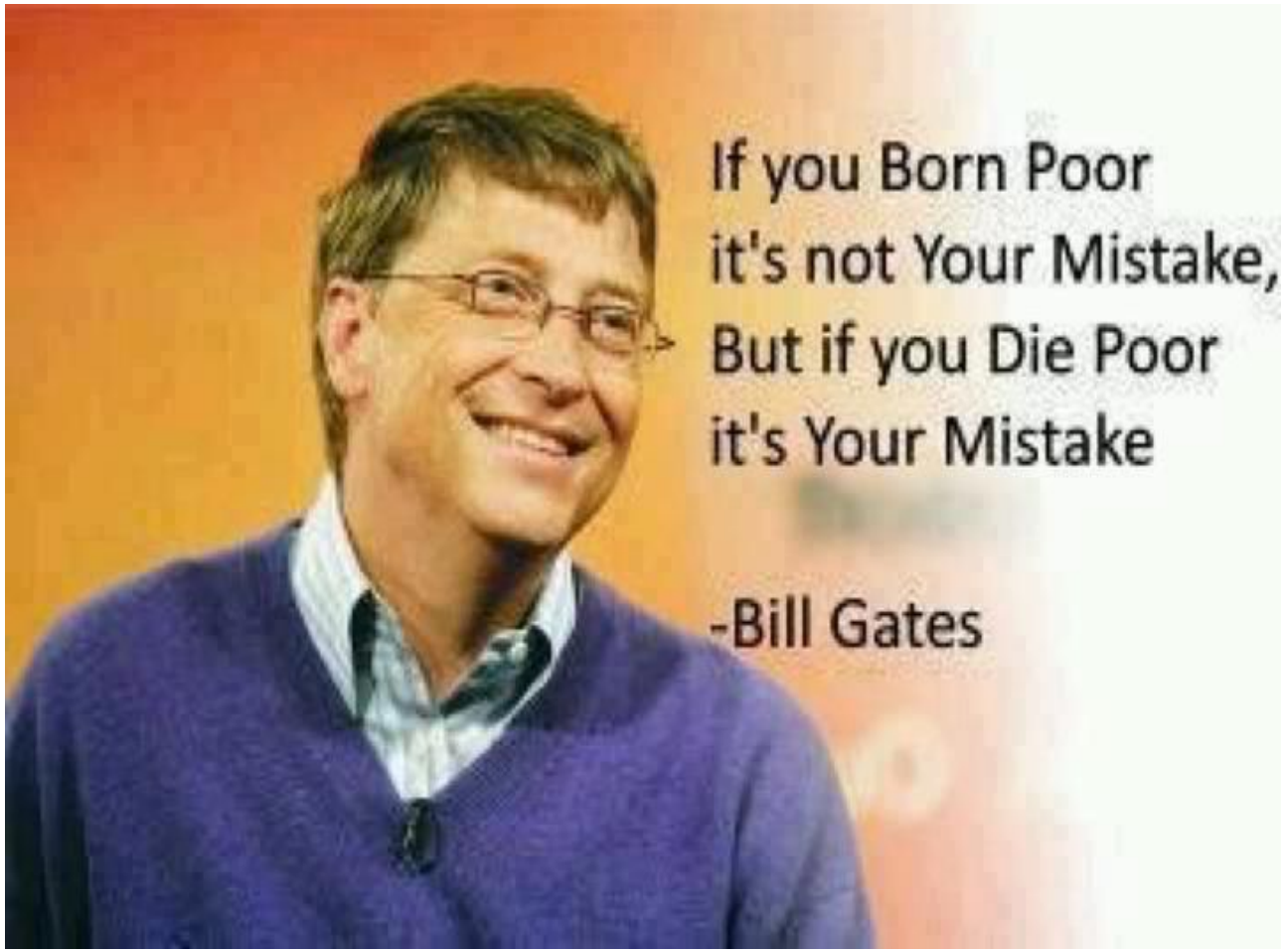
LEVEL V: Physical impairments limit voluntary control of movement. Infants are unable to maintain antigravity head and trunk postures in prone and sitting. Infants require adult assistance to roll.

Prediction - ??


In any moment of decision, the best thing you can do is the right thing, the next best thing is the wrong thing, and the worst thing you can do is nothing.
(Theodore Roosevelt)
izquotes.com

Early detection and intervention - does it really matter?





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