The Preterm Brain: Early Neurodevelopmental es

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Objectives

To discuss early es as it relates to brain development

To review the incidence of neurodevelopment impairment in the extreme preterm infant

To review the role of neuro-imaging on prognostication

To discuss the development of the preterm brain

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World's smallest baby born in US

The world's smallest known surviving baby has made her first public appearance at a US hospital, alongside her slightly larger twin sister.



Rumaisa is expected to develop normally despite her tiny size

Rumaisa Rahman weighed just 244g (8.6 ounces) when she was born prematurely in Chicago on 19 September - less than a can of soft drink.

Rumaisa's Indian-born parents hope to take her and sister Hiba to their home in the city by early next month.

"It's a blessing, it's a great blessing," said the girls' mother.

Doctors had waited to announce the girls' birth until after it was clear they were healthy and were nearly ready to leave the hospital.

"They're maintaining their temperature, they don't need an incubator.... They're normal babies," said Dr William MacMillan at Loyola University Medical Center.

Have we gone too far?





Cost of Prematurity

Hospital costs (California, 1996)

- Gestational age
  - $202,700 for 25 wks
  - $2600 for 36 wk newborn
  - $1100 for 38 wk newborn
- Birthweight
  - $224,400 for newborn 500 - 700g
  - $4300 for newborn at 2250 - 2500g
  - $1000 for newborn > 3000g

Gilbert, et al., Obstet Gynecol 2003

Cost of Hospitalization

- 2001 US Nation - Inpatient Sample

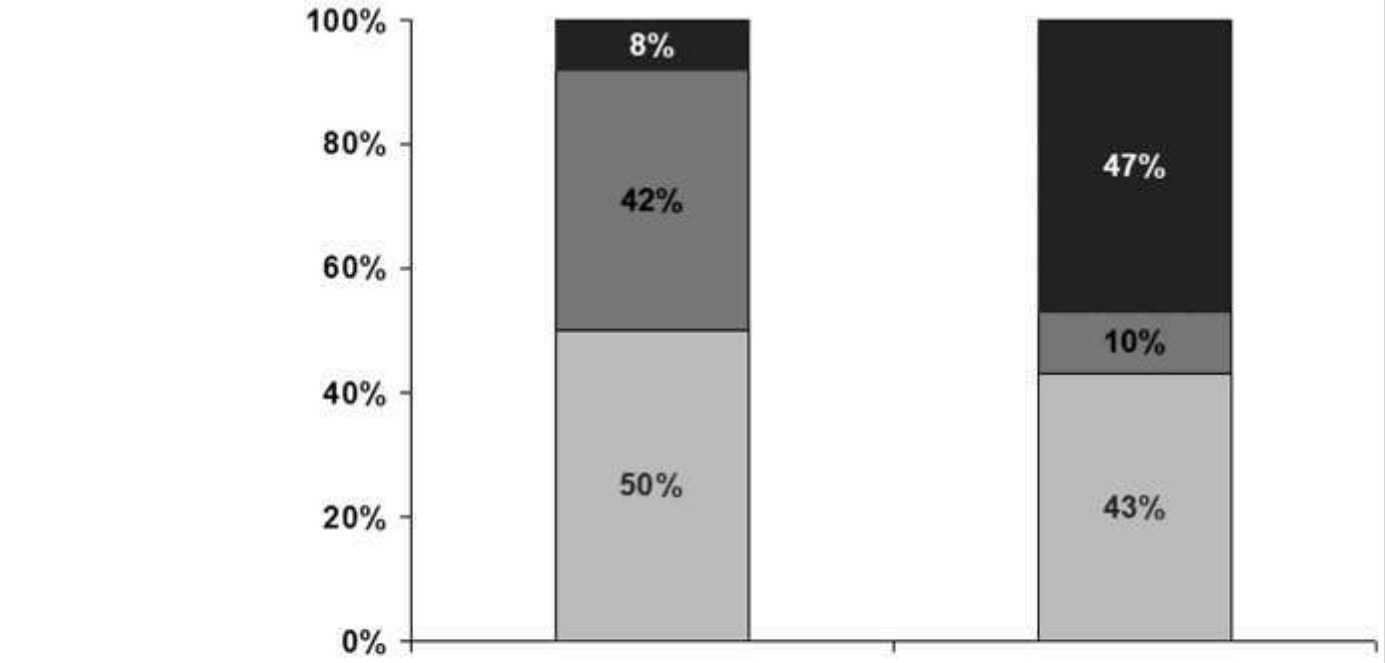
  8% (384,200) of all 4.6 million infants stays included a diagnosis of preterm birth / LBW

  - Costs $5.8 billion, representing 47% of the costs for all infant hospitalizations and 27% of all pediatric stays.
  - Costs highest for extreme preterm infants (<28 wks / BW < 1000g) and specific respiratory related complications
  - BUT 2/3 of total hospitalizations costs for preterm birth / LBW were for infants who were not extreme preterm infants
  - Larger no. of moderately preterm / LBW infants contributed more to the overall costs

Russell, et al., Pediatrics, 2007

Russell, et al., Pediatrics, 2007

FIGURE 1 Distribution of infant hospital discharges and costs: United States, 2001



	Discharges	Total Costs
Preterm/LBW (■)	384 200	$5 786 932 000
Uncomplicated newborn (■)	1 929 800	$1 223 076 000
All other (□)	2 297 400	$5 338 421 000
Total	4 611 400	$12 401 449 000

Russell, R. B. et al. Pediatrics 2007;120:e1-e9

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Costs during first 2 years

Preterm infants (regional cohort, New Zealand)

- Similar no. of GP visits to term infants
- More outpatient hospital visits
- 55% of very preterm infants were admitted compared to 26% of terms infants
- Main reason for hospitalization - respiratory disorder
- Frequency of hosp admissions related to BW, GA and no. of people living in the home
- No association between hospital admission and neurodevelopment at 2 yrs

Gray, et al., J Paediatr Child Health, 2006

Gray, et al., J Paediatr Child Health, 2006

Cost of Early Intervention Services

Cost decreased with increasing GA

Mean cost per child was higher for preterm infants than term infants

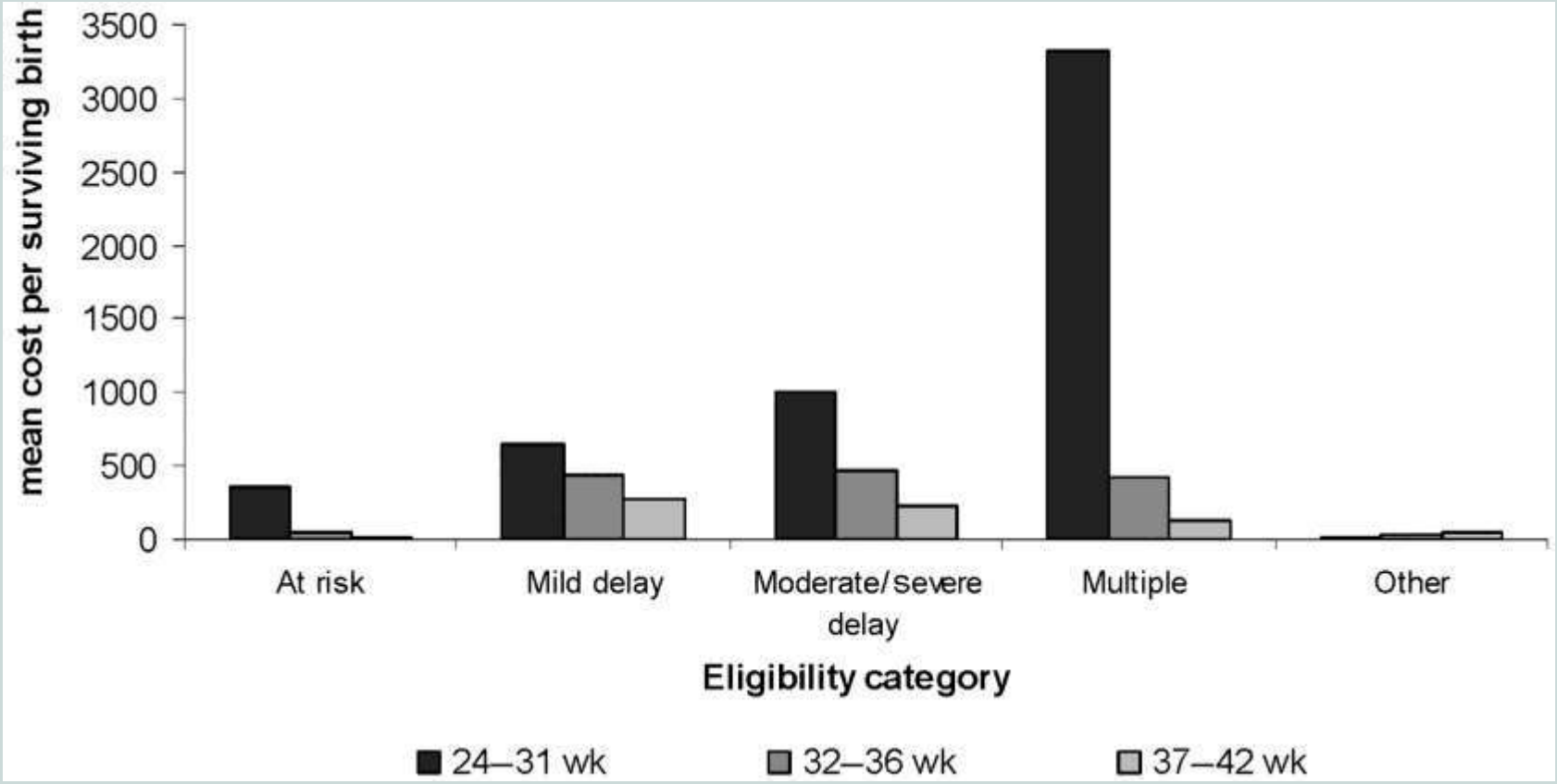
At each Gestational Age -

- Mean cost per surviving infant higher for multiples than for singletons
- Early intervention costs higher for toddlers than for infants

Clements, et al., Pediatrics, 2007

Clements, et al., Pediatrics, 2007

FIGURE 1 Mean EI cost per surviving infant by eligibility category, July 1999 to June 2003, for Massachusetts children born July 1999 to June 2000

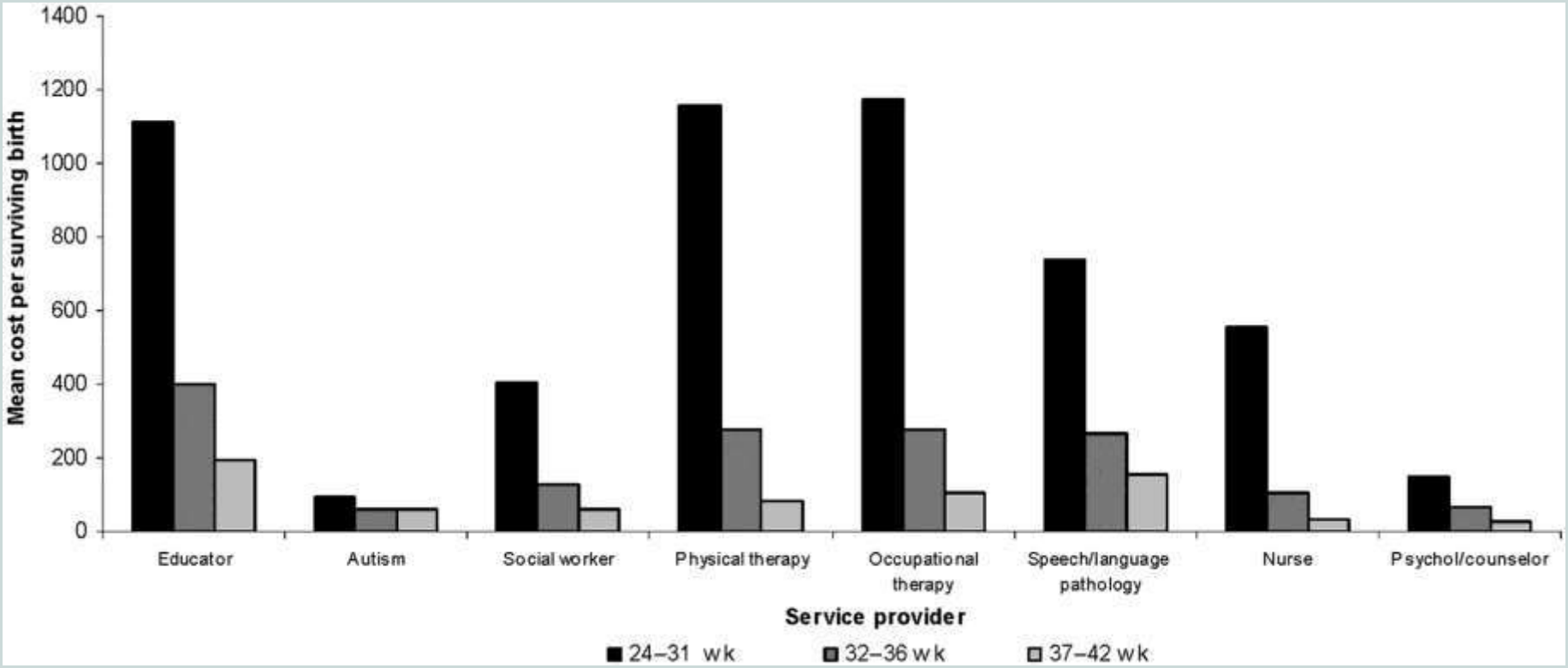


Clements, K. M. et al. Pediatrics 2007;119:e866-e874

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FIGURE 2 Mean EI cost per surviving infant by service provider, July 1999 to June 2003, for Massachusetts children born July 1999 to June 2000



Clements, K. M. et al. Pediatrics 2007;119:e866-e874

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Do early intervention programs improve
e?

Systematic reviews

Positive influence on cognitive es in the short to medium term (infant to preschool age) but not sustained at school age

Significant heterogeneity of interventions

Little effect on motor e at infant or school age

No study reporting motor e at preschool age

Cochrane Database Systematic Rev, 2007

Orton, et al., Dev Med Child Neurol, 2009

Why the need for es research?



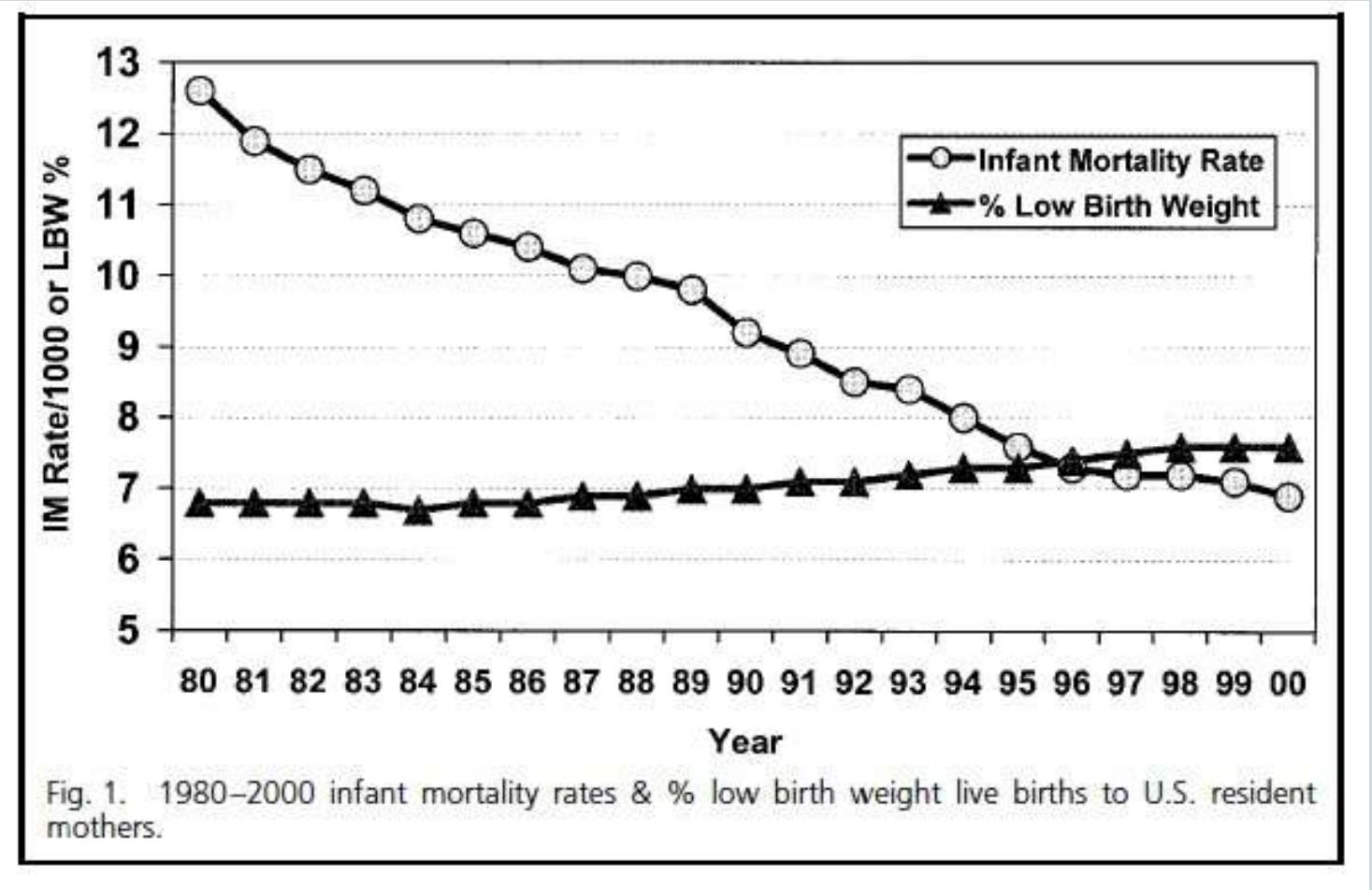


Fig. 1. 1980–2000 infant mortality rates & % low birth weight live births to U.S. resident mothers.

Alexander & Slay, 2002

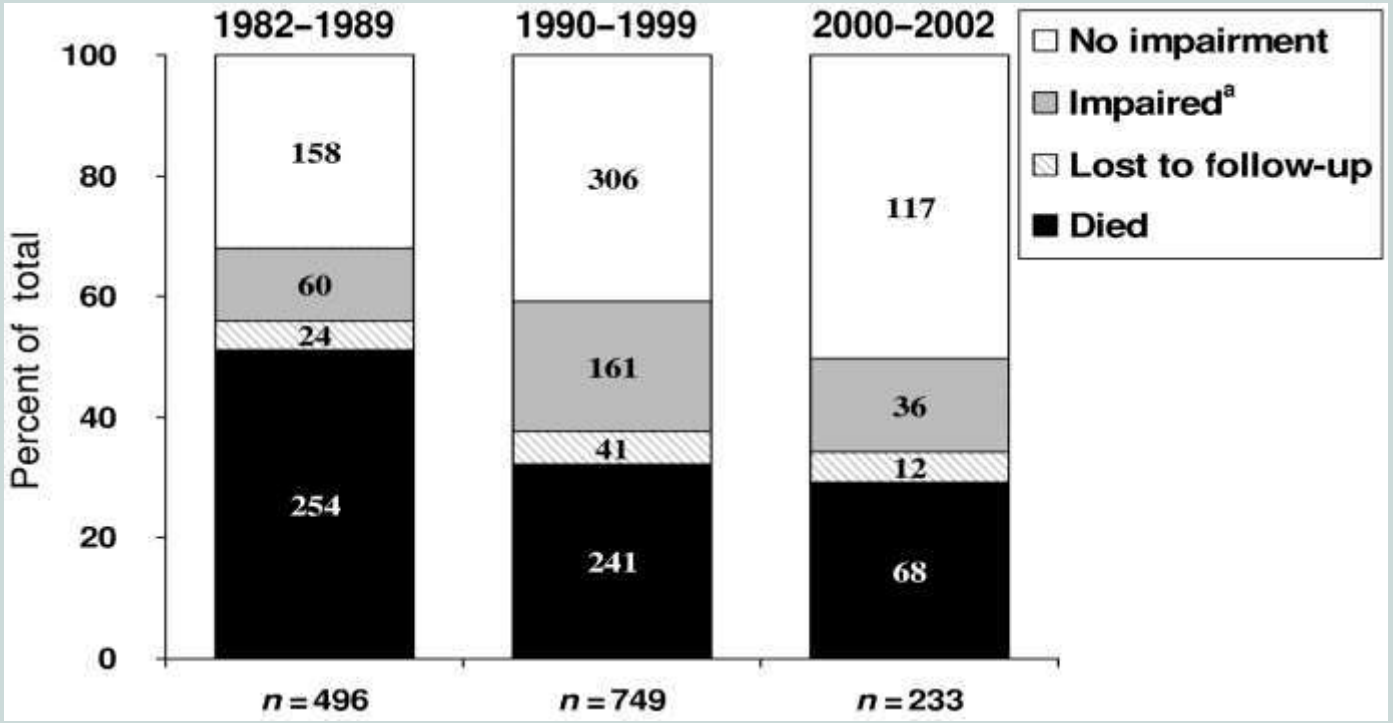
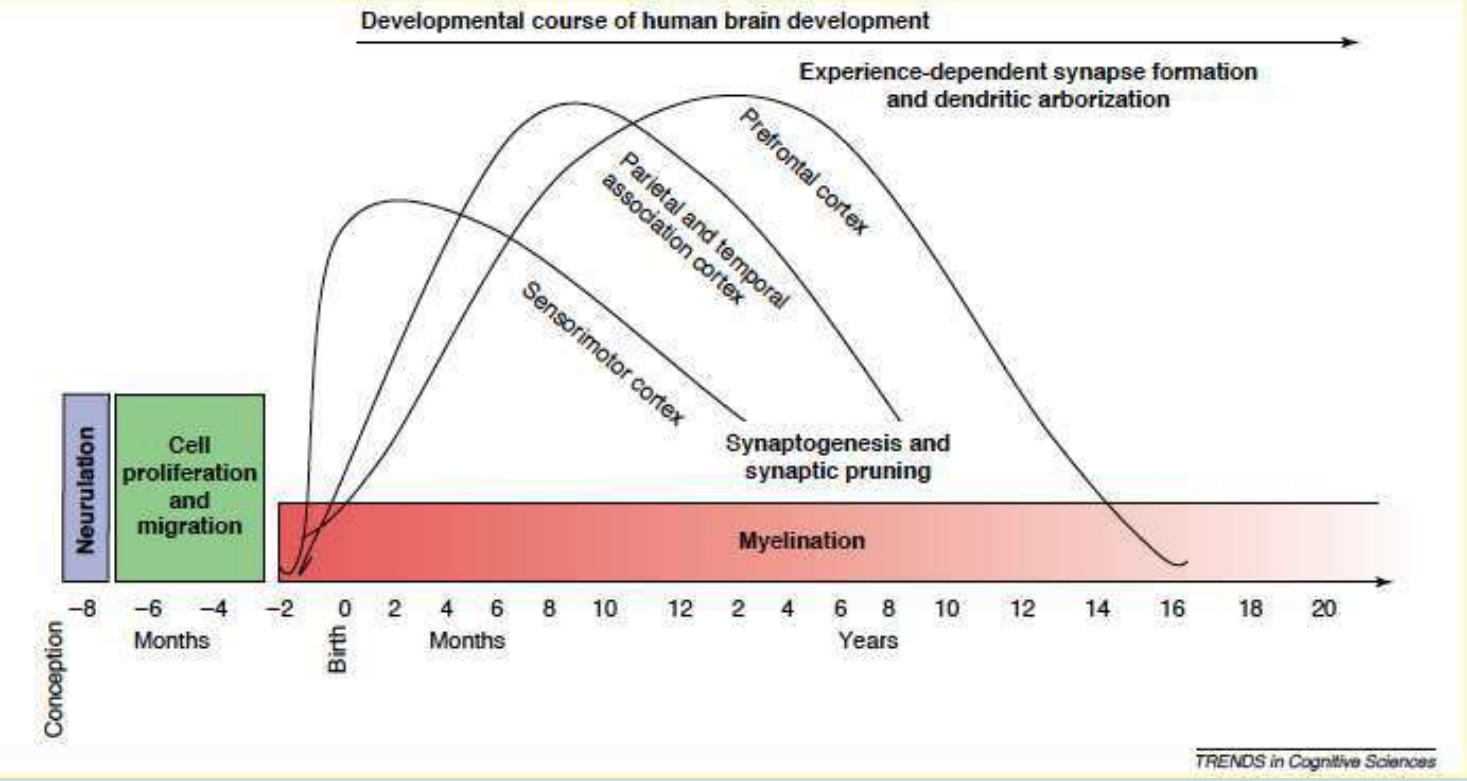


FIGURE 1 Comparison of death and survival with and without neurodevelopmental impairment at 20 months' CA for 500- to 999- g birth weight infants born during 3 periods: 1982-1989; 1990-1999, and 2000-2002

Wilson-Costello, D. et al. Pediatrics 2007

Neuroanatomy of Early Brain Development



Casey, 2005

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