

## Stunting and child development

GMHRG 2015

Ingunn M S Engebretsen, CIH, UiB

## Discussion

- From the context/topic you have the most knowledge – what would be relevant strategies to test and how would you like to monitor that?

## From child survival to child development and thriving

- Child survival is improving:
  - From 2003 figures

CHILD SURVIVAL I

Child survival I

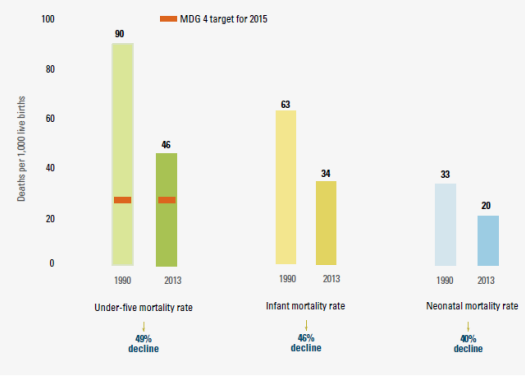
Where and why are 10 million children dying every year?

Robert E Black, Saul S Morris, Jennifer Bryce

More than 10 million children die each year, most from preventable causes and almost all in poor countries. Six countries account for 50% of worldwide deaths in children younger than 5 years, and 42 countries for 90%. The causes of death differ substantially from one country to another, highlighting the need to expand understanding of child health epidemiology at a country level rather than in geopolitical regions. Other key issues include the importance of undernutrition as an underlying cause of child deaths associated with infectious diseases, the effects of multiple concurrent illnesses, and recognition that pneumonia and diarrhoea remain the diseases that are most often associated with child deaths. A better understanding of child health epidemiology could contribute to more effective approaches to saving children's lives.

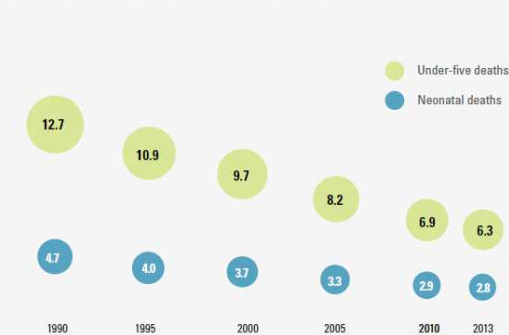
To:

Global under-five, infant and neonatal mortality rates, 1990 and 2013



Note: No MDG targets were set for infant and neonatal mortality. Source: United Nations Inter-agency Group for Child Mortality Estimation (UN IGME) 2014.

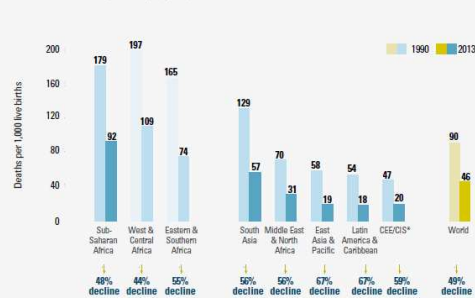
Global under-five and neonatal deaths, 1990–2013 (in millions)



Source: UN IGME 2014.

## Mortality decline by region

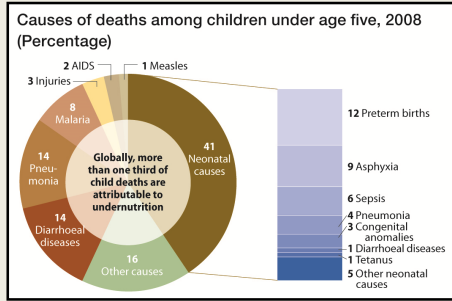
Under-five mortality rate by region, 1990 and 2013



Note: All regional estimates refer to UNICEF's regional classification. Sub-Saharan Africa includes West & Central Africa, Eastern & Southern Africa, Djibouti and Sudan. For further details on this classification please refer to <http://data.unicef.org/regionalclassifications>.

\*Central and Eastern Europe and the Commonwealth of Independent States. Source: UN IGME 2014.

## Main causes of child mortality



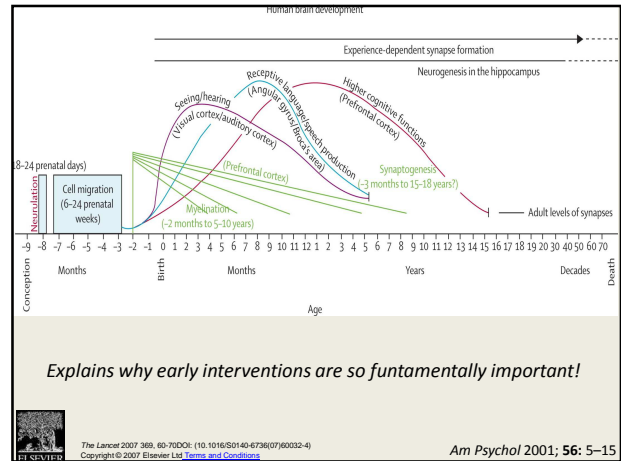
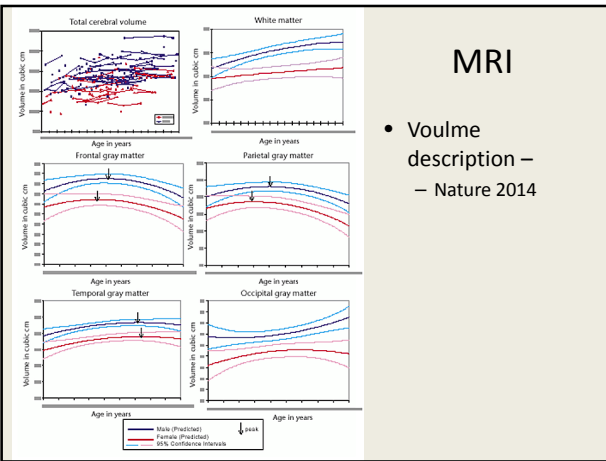
Source: Millennium Development Goals Report 2010 (PDF) [www.un.org/development/dga/ndb/data/millennium-development-goals-report-2010](http://www.un.org/development/dga/ndb/data/millennium-development-goals-report-2010)

## What is child development?

- Sensory/Perception
  - Motor (fine and gross)
  - Cognitive
  - Social/emotional
  - Adaptive
  - Attention
  - Speech/language
- Cognitive has been measured more – that's why reported
- Number of developmental psychologists (Freud, Erikson, Thelen, Kohlberg, LaCross, Ricks, and newer)
- What happens:
    - Neurogenesis
    - Axonal and dendritic growth
    - Synaptogenesis
    - Cell deaths
    - Synaptic pruning
    - Myelination
    - Gliogenesis

## MRI

- Volume description – Nature 2014



## Lots of evidence on

- A. Lack of reaching full potential
  - Death, serious somatic morbidity or growth impairment extreme late outcomes from:
    - i. harmful exposure
    - ii. lack of enhancing stimuli
- B. Risk factors for neuro-developmental impairment
  - What is causing growth impairment or death might cause neurodevelopmental as part of it's casual pathway
    - E.g. cerebral malaria
  - Death is the latest outcome – give us only the tip of the iceberg of impairment/function loss (Lancet 2007; 369: 60-70)

**Is 25 the new cut-off point for adulthood?**

By LIQI WANG  
BBC News  
23 September 2013 | Magazine

New guidance for psychologists will acknowledge that adolescence now effectively runs up until the age of 25 for the purposes of treating young people. So is this the new cut-off point for adulthood?

The idea that suddenly at 18 you're an adult just doesn't quite ring true," says child psychologist Lessem Antrobus, who works at London's Tavistock Clinic.

"My experience of young people is that they still need quite a considerable amount of support and help beyond that age."

**Top Stories**

- Greece holds critical debt talks
- Aligan parliament attackers killed
- Apple Music in Taylor Swift backlash

**Features & Analysis**

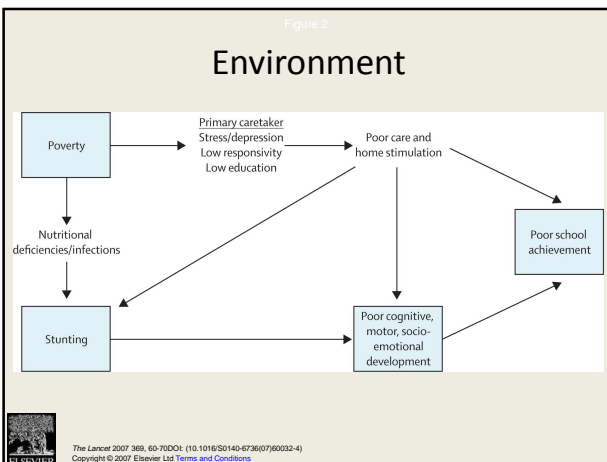
- Saved by the city
- Meeting the widows of the Everest avalanche
- The ice-cream maker of Gaza
- Children of Everest
- The shadowy figures passing through Europe

### A. Lack of reaching full potential

- Associated with stunting in cross-sectional and cohort studies (same factors contribute to both)
- Gradient with longitudinal growth
  - Termination of education
  - Grades
- Associated with poverty
  - Inadequate food
  - Inadequate hygiene
  - Infections
  - Stress
  - Depression
  - Inadequate stimulation
  - Subsequently poor school achievement



### Environment



### B. Risk factors for neuro-developmental problems

- 4 main domains
  - Malnutrition that leads to stunting
  - Iodine and iron deficiency
  - Inadequate stimulation
- + + +  
And most important:
- Lack of professional and political commitment

### Other bold exposures

- Interventions for malaria
- Certain infections
- Intrauterine growth restriction
- Maternal depression
- Exposure to violence
- Exposure to heavy metals
- Is lack of harm enough for good development?

### With current knowledge suggest interventions

- Nutrition?
- Financial?
- Therapeutic?
- Parent-child dyad?
- Consider quality of studies, interventions, active factors in interventions, measurements of outcomes, interpretation, presentations

**Food supplementation for improving the physical and psychosocial health of socio-economically disadvantaged children aged three months to five years**

Types of Feeding Programmes for preschool aged children

Preventative		Curative (Selective feeding programmes)	
<b>Complementary Feeding Programme</b> (Dine or 50-minute) Usual Location: Homebased, Community Health Facility	<b>Pre-school/Nursery school Feeding</b> Usual location: school or child institution	<b>Supplementary Feeding programme</b> (for one child or more) Usual Location: Community health facility, village camp	<b>Therapeutic Feeding Programme</b> (Severe malnutrition with SAM) Usual Location: community health facility, child-care centre
<b>Prevention of malnutrition (avoided or avoided) with or without Nutrition Education</b>  <b>Most Common Products:</b> <ul style="list-style-type: none"> <li>Mostly nutrient powder (e.g. groundnut)</li> <li>100% fat-free natural/processed (FPL) (e.g. egg)</li> <li>100% fat-free natural/processed (FPL) (e.g. egg)</li> <li>Supplement e.g. milk-based +1 unflavoured blended feeding (e.g. corn, egg-based, milk, etc.)</li> </ul>	<b>Prevention of food (energy and other nutrients) with or without Nutrition Education</b>  <b>Most Common Products:</b> <ul style="list-style-type: none"> <li>(1) Hot feeding: cooked rice, mung, lentils, etc.</li> <li>(2) Cold feeding: cooked rice, mung, lentils, etc.</li> <li>(3) Unflavoured milk-based powder +1 unflavoured blended feeding (e.g. corn, egg-based, milk, etc.)</li> </ul>	<b>Blended (for all under-5 children in areas with high rates of moderate acute malnutrition)</b>  <b>Most Common Products:</b> <ul style="list-style-type: none"> <li>(1) Hot feeding: Cooked rice, mung, lentils, etc.</li> <li>(2) Cold feeding: Cooked rice, mung, lentils, etc.</li> <li>(3) Unflavoured milk-based powder +1 unflavoured blended feeding (e.g. corn, egg-based, milk, etc.)</li> <li>(4) High-energy biscuits, etc.</li> </ul>	<b>Targeted (for under-5 children screened to have moderate acute malnutrition)</b>  <b>Most Common Products:</b> <ul style="list-style-type: none"> <li>(1) Hot feeding: Cooked rice, mung, lentils, etc.</li> <li>(2) Cold feeding: Cooked rice, mung, lentils, etc.</li> <li>(3) Unflavoured milk-based powder +1 unflavoured blended feeding (e.g. corn, egg-based, milk, etc.)</li> <li>(4) High-energy biscuits, etc.</li> </ul>

References for feeding programmes:  
[http://www.who.int/nutrition/implementation/feeding\\_programmes\\_comprehensive\\_blended.pdf](http://www.who.int/nutrition/implementation/feeding_programmes_comprehensive_blended.pdf)  
<http://www.unicef.org/emulsions/files/implementation2.pdf>  
<http://www.unicef.org/emulsions/files/implementation3.pdf>  
 as per S. Bhanu Prasad. Current and potential role of specially formulated foods and supplements for preventing malnutrition among 5- to 23-month-old children and for rearing malnourished children among 5- to 59-month-old children. Food Nutr Bull 2009;28(3):349-359

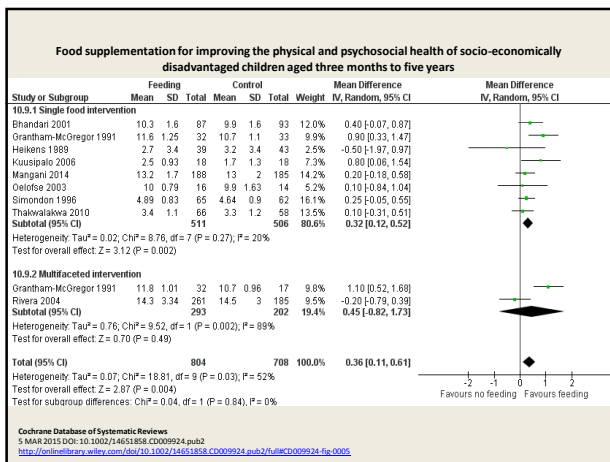
1. MAM: Moderate acute malnutrition refers to children under the age of 5 years with -3 ≤ MZC < -2, or 15 ≤ less than 15 PLAC; 2. SAM: Severe acute malnutrition refers to children under the age of 5 years with WHZ < -3, or < 10 PLAC; 3. SAM: Severe acute malnutrition refers to children under the age of 5 years with WHZ < -3, or < 10 PLAC, or bilateral oedema.

Cochrane Database of Systematic Reviews  
 5 MAR 2015 DOI: 10.1002/14651858.CD009924.pub2  
<http://onlinelibrary.wiley.com/doi/10.1002/14651858.CD009924.pub2/full/CD009924.pub2>

Small benefits growth in LMICS: We found that, in low- and middle-income countries, providing additional food to children aged three months to five years led to small gains in weight (0.24 kg a year in both RCTs and CBAs) and height (0.54 cm a year in RCTs only; no evidence of an effect in other study designs), and moderate increases in haemoglobin.

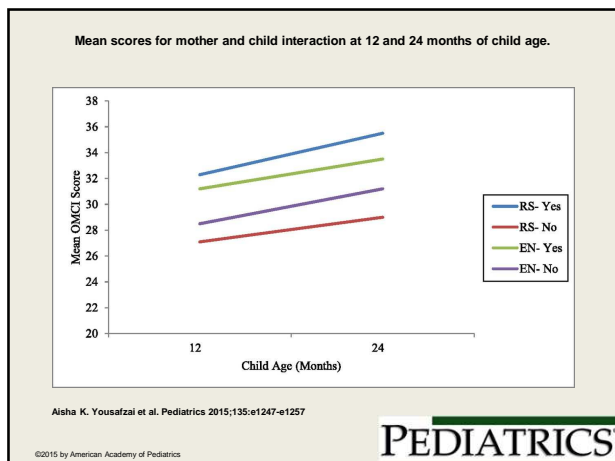
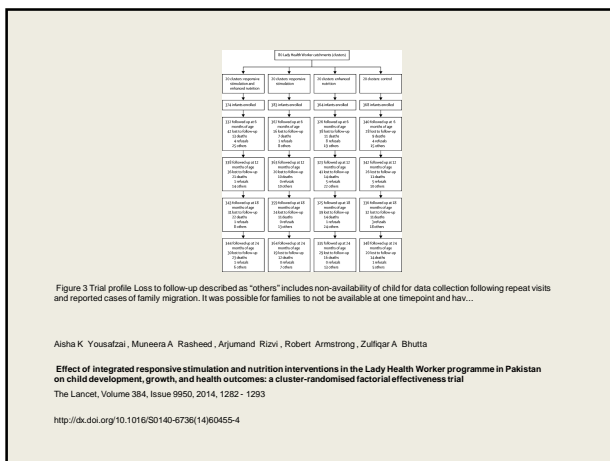
Small benefits psychomotor: We also found positive impacts on psychomotor development (skills that involve mental and muscular activity). Cognitions: We found mixed evidence on effects of supplementary feeding on mental development.

Ob: Leakage of food in nutrition programmes



**What about interventions enhancing neurodevelopment**

- Nutrition (Enhanced Nutrition) & Responsive Stimulation**
  - Lancet 2014/Pediatrics 2015
  - Cognitive and growth benefits measured by:
    - Bayley Scales of Infant and Toddler Development, Third Edition and growth at 24 months of age from the 2 interventions
    - Improved mother-child interaction



## 2-way purpose

### Document benefits

- strengthen argument for programmatic intervention
- Nutrition (macro/micro), eg. Vit 12
- Stimulation after harmful exposure (post-malaria training/stimulation)

### Document risk/harm

- Improved care
- (E.g. life-saving necessary toxic drugs)

Background of BMC Neurology 2011, 11:16  
http://www.biomedcentral.com/10.1186/1471-2288-11-16

**RESEARCH ARTICLE** Open Access

**Cognition, behaviour and academic skills after cognitive rehabilitation in Ugandan children surviving severe malaria: a randomised trial**

Tad Berglund<sup>1\*</sup>, Peter Albeck<sup>2</sup>, Michael J Boshuizen<sup>3</sup>, Chandu C Ishii<sup>4</sup>, Corine Pagi<sup>5</sup>, Anna Brindahl<sup>6</sup> and Ogochike Nsofor<sup>7</sup>

**Abstract**  
Background: Infection with severe malaria in African children is associated with not only a high mortality but also a high risk of cognitive deficits. There is evidence that interventions done a few years after the illness are effective but nothing is known about their value immediately after the illness. We designed a study to assess children who

**PROMISE consortium study**

- The PROMISE consortium has done 2 larger multi-site trials (EBF & PEP)
- The PROMISE EBF (Exclusive Breastfeeding) trial
  - 2006-2008
  - Cluster-randomised community intervention
  - Burkina Faso, Uganda, (Zambia), South Africa
  - ≈2500 mother-infant pairs
  - Intervention: Promotion of exclusive breastfeeding by peers
  - EBF increased by 2\* in Burkina Faso, Uganda and South Africa
  - Absolute change largest in Burkina Faso and Uganda from ≈40 to 80%

**PROMISE**

**Exclusive breastfeeding promotion by peer counsellors in sub-Saharan Africa (PROMISE-EBF): a cluster-randomised trial**

Theresa Zuber, Debra Jackson, Neelke Meek, Ogochike Nsofor, Hilary Owen, Abimbola Hana Dada, Temu Dabire, Fauziah Khairun, Len Tadesse, Annetta Ochi, Chigagor Franka, Jani Hillebrand, Carlene Kizito, Neelke Meek, Jilly Kibuka, Phylip van de Pave, David Sanders, Rebecca Sherrington, Helen Sommerfeld, Henry Wama, James K Tumwine, for the PROMISE EBF Study Group

**Summary**  
Background: Exclusive breastfeeding (EBF) is reported to be a life-saving intervention in low-income settings. The effect of breastfeeding counselling by peer counsellors was assessed in Africa.

**Methods:** 24 communities in Burkina Faso, 24 in Uganda, and 14 in South Africa were assigned in a 1:1 ratio to one of a computer-generated randomisation sequence, to the control or intervention clusters. In the intervention group we scheduled one universal breastfeeding peer counselling visit and four post-delivery visits to trained peers. The data gathering team were masked to the intervention allocation. The primary outcomes were prevalence of EBF and diarrhoea reported by mothers for infants aged 12 weeks and 24 weeks. Country-specific prevalence ratios were adjusted for cluster effects and sites. Analysis was by intention to treat. This study is registered with ClinicalTrials.gov, number NCT00791729.

**Results:** 2579 mother-infant pairs were assigned to the intervention or control clusters in Burkina Faso (n=703 and n=402, respectively), Uganda (n=296 and n=308, respectively), and South Africa (n=535 and 451, respectively). The EBF prevalence based on 24h recall at 12 weeks in the intervention and control clusters were 380 (79%) of 476 and 139 (55%) of 252, respectively, in Burkina Faso (prevalence ratio 1.29, 95% CI 1.13-1.47); 313 (85%) of 364 and 161 (44%) of 369, respectively, in Uganda (1.35, 1.19-1.51); and 56 (19%) of 293 and 39 (13%) of 285, respectively, in South Africa (1.72, 1.16-2.43). The EBF prevalence based on 7-day recall in the intervention and control clusters were 360 (77%) and 194 (23%), respectively, in Burkina Faso (1.27, 1.15-1.40); 365 (77%) and 121 (44%), respectively, in Uganda (1.38, 1.26-1.50); and 41 (15%) and 19 (7%), respectively, in South Africa (1.98, 1.36-2.86). At 24 weeks the prevalence based on 24h recall were 286 (73%) in the intervention cluster and 18 (27%) in the control cluster in Burkina Faso (1.33, 1.17-1.50); 212 (59%) and 57 (25%), respectively, in Uganda (1.31, 1.19-1.44); and 12 (5%) and 1 (2%), respectively, in South Africa (5.70, 1.33-24.26). The prevalence based on 7-day recall were 279 (70%) in the intervention cluster and 18 (27%) in the control cluster in Burkina Faso (1.51, 1.42-1.61); 203 (57%) and 41 (11%), respectively, in Uganda (1.66, 1.35-4.49); and one (7%) and one (7%), respectively, in South Africa (0.31, 0.10-0.91). Diarrhoea prevalence at age 12 weeks in the intervention and control clusters was 20 (5%) and 16 (4%), respectively, in Burkina Faso (0.57, 0.27-1.22); 39 (10%) and 32 (9%), respectively, in Uganda (1.11, 0.71-1.76); and 45 (16%) and 45 (16%), respectively, in South Africa (1.16, 0.78-1.75). The prevalence at age 24 weeks in the intervention and control clusters was 26 (7%) and 32 (8%), respectively, in Burkina Faso (0.83, 0.45-1.54); 52 (13%) and 59 (24%), respectively, in Uganda (0.82, 0.58-1.15); and 54 (19%) and 33 (9%), respectively, in South Africa (1.31, 0.89-1.93).

**Conclusions:** Low-intensity individual breastfeeding peer counselling is achievable and, although it does not affect the diarrhoea prevalence, can be used to effectively increase EBF prevalence in many sub-Saharan African settings.

**Grand Challenges Canada / Grands Défis Canada**

**Saving Brains: Unlocking Potential for Development**

**REQUEST FOR PROPOSALS ANNOUNCEMENT**

Grand Challenges Canada is pleased to announce a new initiative in its Maternal, Neonatal and Child Health grand challenge. It's called Saving Brains. Its goal is to unlock potential in children and dramatically transform lives in the developing world.

200 million children in the developing world fail to reach their full cognitive potential. In turn childhood developmental deficits result in an estimated 20% or greater loss in adult income, condemning these individuals and their communities to a relentless cycle of poverty.

"The waste of human capital is enormous," says Joseph L. Rotman, Chairman of Grand Challenges Canada.

Key poverty-related risk factors include:

- Malnutrition
- Infection
- Poor management of pregnancy and birth complications
- Lack of stimulation and nurturing

Early Human Development 86 (2010) 729–732

Contents lists available at ScienceDirect

**Early Human Development**

journal homepage: www.elsevier.com/locate/earlhumdev

**"Breast is best": The evidence**

Michael S. Kramer\*

Department of Pediatrics, McGill University Faculty of Medicine, Canada  
Department of Epidemiology, Biostatistics, and Occupational Health, McGill University Faculty of Medicine, Canada

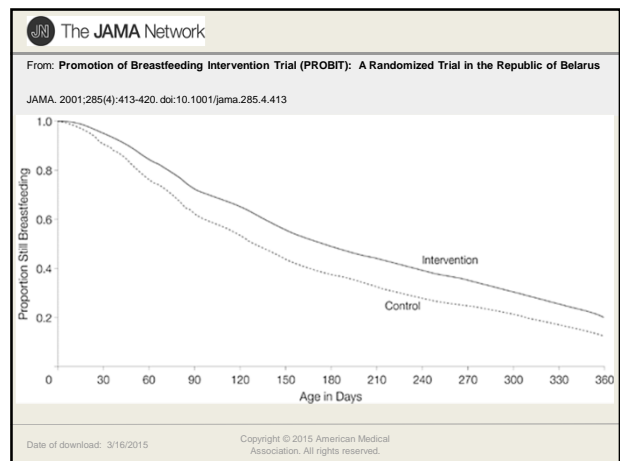
**ARTICLE INFO**

**Keywords:** Breastfeeding; Programming; Cognitive development; Obesity; Allergy; Asthma; Randomized trial

**ABSTRACT**

Although the benefits of breastfeeding in reducing morbidity and mortality from gastrointestinal and respiratory infections, sudden infant death syndrome, and (in preterm infants) necrotizing enterocolitis are well-established, long-term health effects are more controversial. The evidence is conflicting concerning the "programming" effect of breastfeeding in protecting against child obesity, hypertension, hyperlipidemia, type 2 diabetes, and atopic disease. Accelerated neurocognitive development has been associated with breastfeeding in many studies, although doubts remain about the potential for residual confounding due to cognitive and behavioural differences between mothers who breastfeed (or those who breastfeed for a longer duration or more exclusively) and those who do not. Most of this paper will summarize the methods and results of a large, cluster-randomized trial of a breastfeeding promotion intervention in the Republic of Belarus. Its experimental design and intention-to-treat analysis have yielded important findings bearing on several of these longer-term health and developmental outcomes.

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### Health and development outcomes in 6.5-y-old children breastfed exclusively for 3 or 6 mo<sup>1-3</sup>

Michael S Kramer, Lidia Matash, Natalia Bogdanovich, Frances Aboud, Bruce Mazer, Eric Fombonne, Jean-Paul Collet, Ellen Hodnett, Elena Mironova, Sergei Igumnov, Beverley Chalmers, Mourad Dahhou, and Robert W Platt

**ABSTRACT**  
**Background:** Despite the current World Health Organization recommendation that infants be exclusively breastfed for 6 mo, this practice remains unusual in both developed and developing countries.  
**Objective:** The objective was to compare health and development outcomes at age 6.5 y in children who were exclusively breastfed for 3 mo (EBF3) or for 6 mo (EBF6); in the EBF3 group, the children continued partial breastfeeding for  $\geq 6$  mo.  
 remains unusual in most settings, including both developed and developing countries (3-8).  
 In the mid-1990s, we initiated the Promotion of Breastfeeding Intervention Trial (PROBIT), a cluster-randomized trial—a breastfeeding promotion intervention modeled on the WHO/UNICEF Baby-Friendly Hospital Initiative (BFHI) (9). Although most of the publications emanating from this trial have used intention-to-treat analysis based on randomized treatment allocation, we have also published several observational analyses of t

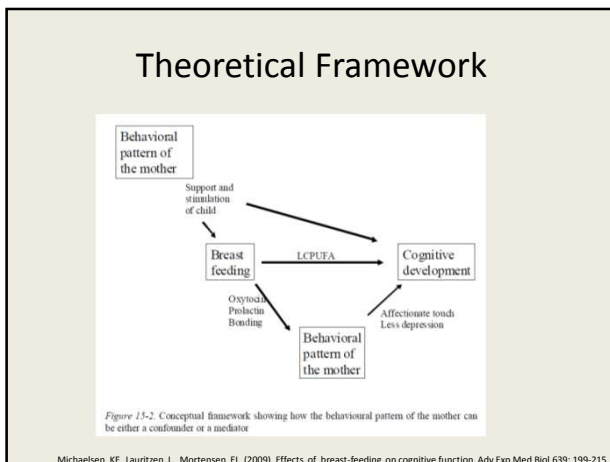
**Table 7**  
PROBIT results: mean WASI scores.

Outcome	Experimental	Control	E-C (95% CI)
Vocabulary	53.5	46.9	+4.9 (+0.4 to +9.3)
Similarities	56.6	50.7	+4.6 (+0.2 to +9.0)
Blocks	57.2	54.6	+1.9 (-1.7 to +5.5)
Matrices	52.8	50.9	+1.8 (-1.9 to +5.5)
Verbal IQ	108.7	98.7	+7.5 (+0.8 to +14.3)
Performance IQ	108.6	104.8	+2.9 (-3.3 to +9.1)
Full IQ	109.7	101.9	+5.9 (-1.0 to +12.8)

**Table 8**  
PROBIT results: mean teacher academic ratings.

Outcome	Experimental	Control	E-C (95% CI)
Reading	3.26	3.19	+0.07 (+0.004 to +0.14)
Writing	3.19	3.13	+0.08 (+0.01 to +0.15) <sup>a</sup>
Mathematics	3.23	3.20	+0.06 (-0.04 to +0.15)
Other subjects	3.30	3.27	+0.05 (-0.04 to +0.13)

<sup>a</sup> Based on full covariate-adjusted models.



### Age

- Age to obtain cognitive function:
  - Early enough not to be severely influenced by life-time factors
  - Late enough to obtain valid data
    - 5-7 year optimal?

### The organization of the project

- **Saving Brains in Uganda and Burkina Faso** re-assess children from the Promise EBF trial and their care-takers when the children are 5-7 years
  - Uganda and Burkina Faso
  - Comprehensive set of instruments
- **“SeeTheChild – mental child health in Uganda”** (RCN funded study: # 220887) have a specific focus on the most vulnerable children in Uganda identified through the study above with regard to mental child health and investigate public relevant health services for them in Uganda also applying
  - ✓ Psychiatric interviews
  - ✓ Qualitative methods

Grand Challenges Canada  
 Grands Défis Canada  
 The Research Council of Norway

### Objectives

**SeeTheChild** will in addition

2. Establish prevalence estimates for the major mental child health conditions following internationally adopted guidelines
3. Investigate treatment gaps in public health services regarding conditions found above
4. Supervise Master and PhD-students within the project