DST-NRF Centre of Excellence in Human Development

Individual and Society

HIV and early childhood development – new frontiers

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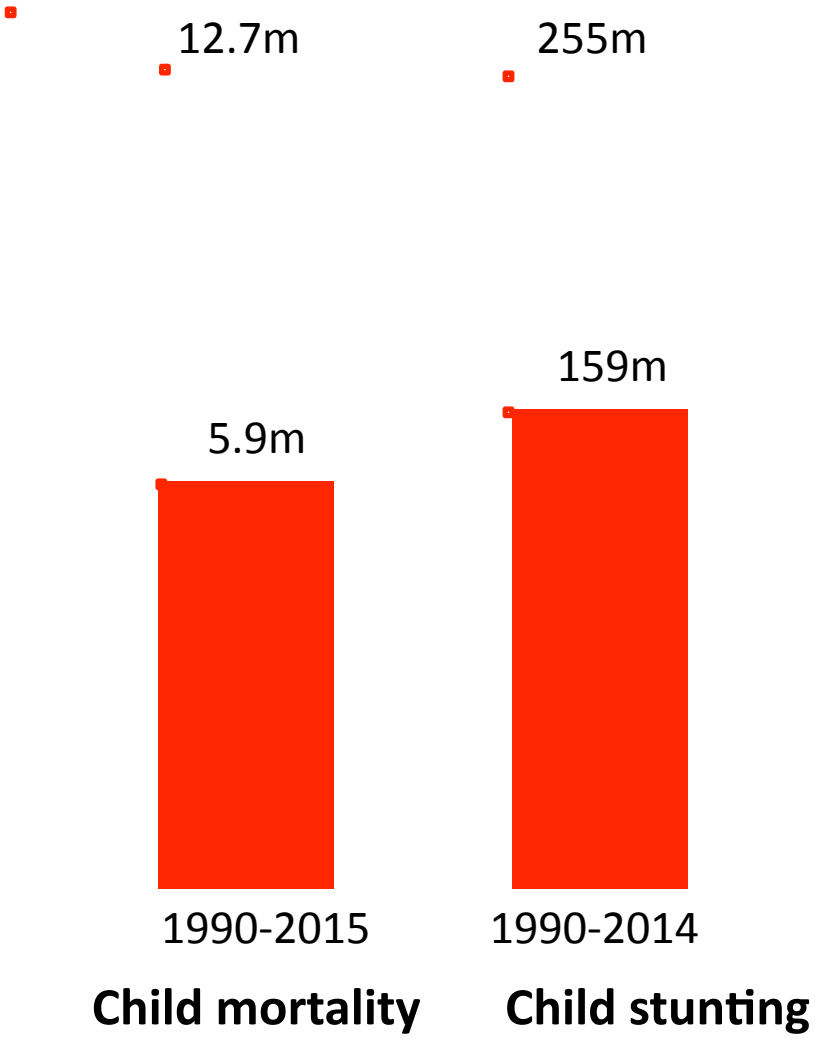
Coalition for Children Affected by AIDS

Durban, 15-16th July 2016

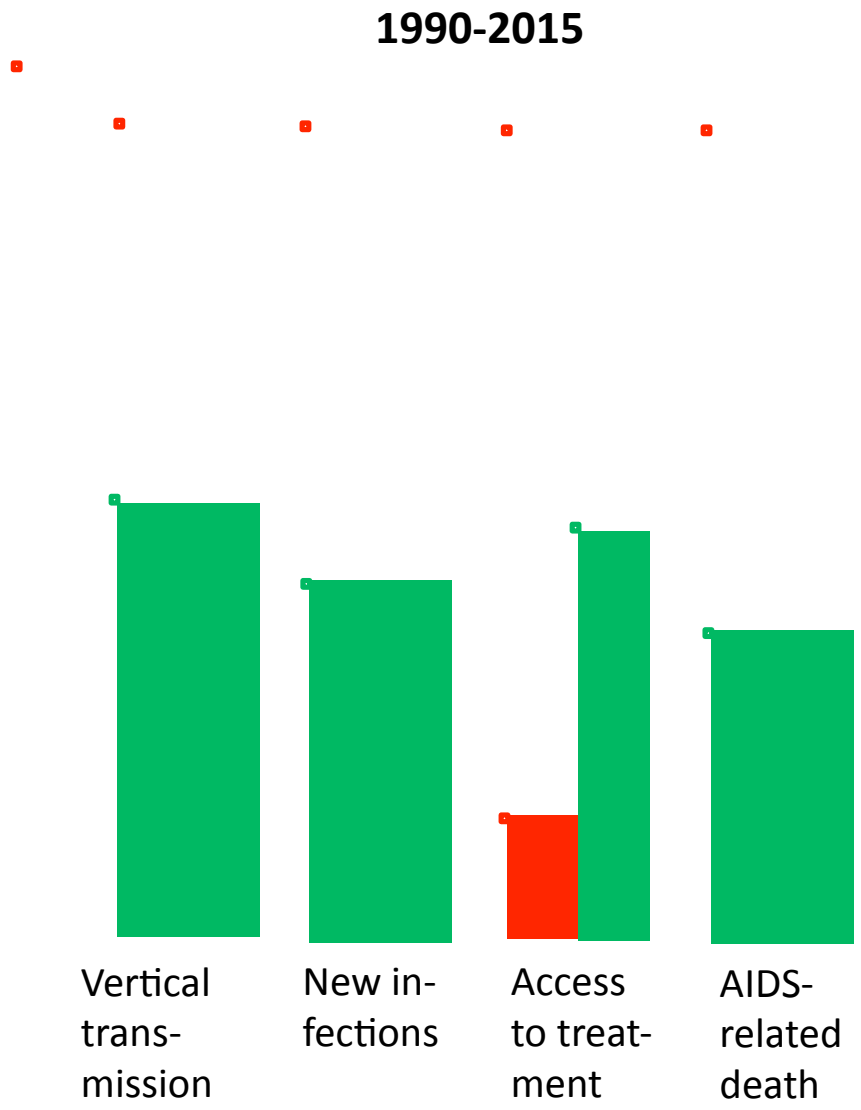
BIG SUCCESS: Child survival & growth

- Child mortality more than halved between 1990-2015 [1] (drop of 53%)
- Child stunting dropped 40% from between 1990-2014



BIG SUCCESSES: Child HIV

- Vertical transmisson halved in the 21 top priority countries (22.4% → 8.9%)
- New infections among children dropped 60% per annum in the 21 highest burden (6 countries achieved a 75% reduction)
- Child access to treatment more than doubled, from 15% (275 700) to 51% (727 000)
- AIDS-related child deaths under 5y dropped 62% since 1990 (partly driven by successes in 3 of the 21 high priority countries)[1]



Big challenges remain

Child mortality and human development

- 16,000 children under the age of 5 years continue to die each day[1]
- More than 1/3 of children in LMICs are at elevated risk of not reaching their developmental potential because their poor environments deprive them of essential nutrition, nurture and opportunities to learn[2]
- 60% of women of child-bearing age are in the labour-force – day care for young children?[3]

Big challenges remain

HIV infection

- Only half of HIV+ people on treatment
  - New infections coming down very slowly (4% S E Africa 2010-15)
  - Many parent/prospective are and will become HIV+
- Poor retention of women and children in care
  - Lack of retention/adherence - infections during b'feeding + pregnancy & delivery (4.2% + 4.7% = 8.9%)
- Lack of attention to the child post-birth
  - Infant diagnosis has stalled - 51% tested within the first two months of life, same as in 2014
- Inadequate primary prevention of new infections among women
  - Only 5% reduction between 2009 and 2015 – 4.5m new infections in 21 high priority countries[1]

These challenges are related

1. HIV and child survival

- Reductions in maternal deaths; orphaning; vertical transmission; AIDS-related child deaths contribute to increased child survival in sub-Saharan Africa[1]

2. HIV and stunted child growth

- Children infected and affected by HIV show poorer growth[2]

3. HIV and poor child development

- Children infected and affected by HIV more likely to have
  - Delayed and/or disrupted development
  - Difficulties with socio-emotional adjustment[3]

Links: HIV - early child development

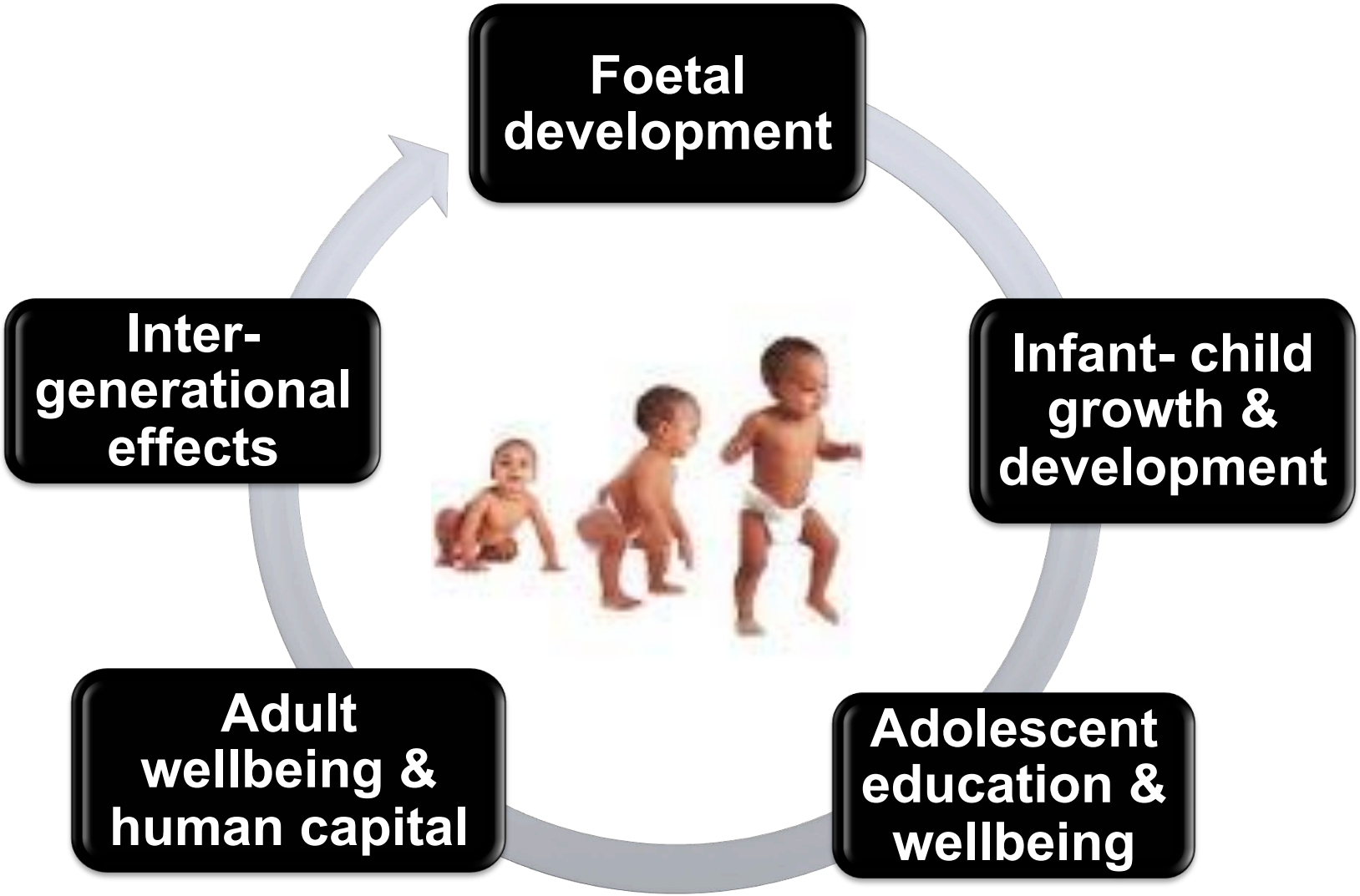
CLEAR LINKS

- Maternal HIV is a risk factor for:
  - Adverse birth outcomes: Still birth, neonatal death, preterm delivery and smallness (SGA)[1]
- Adverse birth outcomes are risk factors for:
  - Poor growth and neurodevelopmental disabilities[2]
- Especially in challenging family conditions associated with HIV[3]

EMERGING LINKS

- HIV and the significance of early child development for health and human capital across the lifecycle

Life course development & inter-generational effects



New evidence about early childhood

Re-thinking early child development as a result of scientific advances in:

- Psychological science
- Neuroscience
- Genetics, genetic adaptations
- Microbiology
- Longitudinal studies
  - Birth cohort cohorts
  - Intervention outcome studies

All tell us that early childhood – the first 1000 days of life – is a very special time in human development

Psychological science - examples

Meltzoff & Moore (1977) *Science*

- The ability of babies to recognize, imitate & learn from people from birth

Psychological science - examples

frontiers in
HUMAN NEUROSCIENCE

METHODS ARTICLE
published: 04 March 2014
doi: 10.3389/fnhum.2014.00118

Hyperscanning MEG for understanding mother–child cerebral interactions

Masayuki Hirata[1], Takashi Ikeda[1,2], Mitsuru Kikuchi[3], Tomoya Kimura[4], Hirotoshi Hiraishi[3], Yuko Yoshimura[3] and Minoru Asada[2]*

[1] Department of Neurosurgery, Osaka University Medical School, Suita, Japan
[2] Department of Adaptive Machine Systems, Graduate School of Engineering, Osaka University, Suita, Japan
[3] Research Center for Child Mental Development, Graduate School of Medical Science, Kanazawa University, Kanazawa, Japan
[4] Yokogawa Electric Corporation, Kanazawa, Japan

- The ability of babies to recognize, imitate & learn from others from birth
- The way babies' brains activate when they interact with people vs objects

Psychological science - examples

Walk (1968) *Science*

- The ability of babies to recognize, imitate & learn from others from birth
- The way their brains activate when they interact with others
- How babies learn from the emotional states of people they trust

Psychological science - examples

Smith (1968) *Advances in Neonatal Care*

- The ability of babies to recognize, imitate & learn from others from birth
- The way their brains activate when they interact with others
- How babies learn from the emotional states of others
- How love and comfort reduce infant stress and promote learning and wellbeing

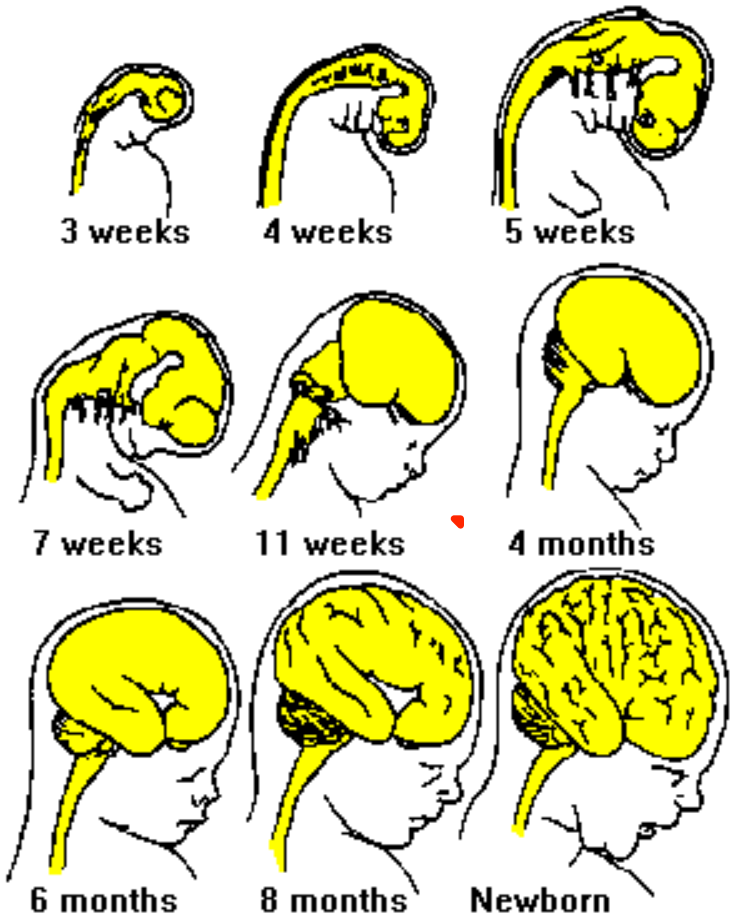
The power of parenting

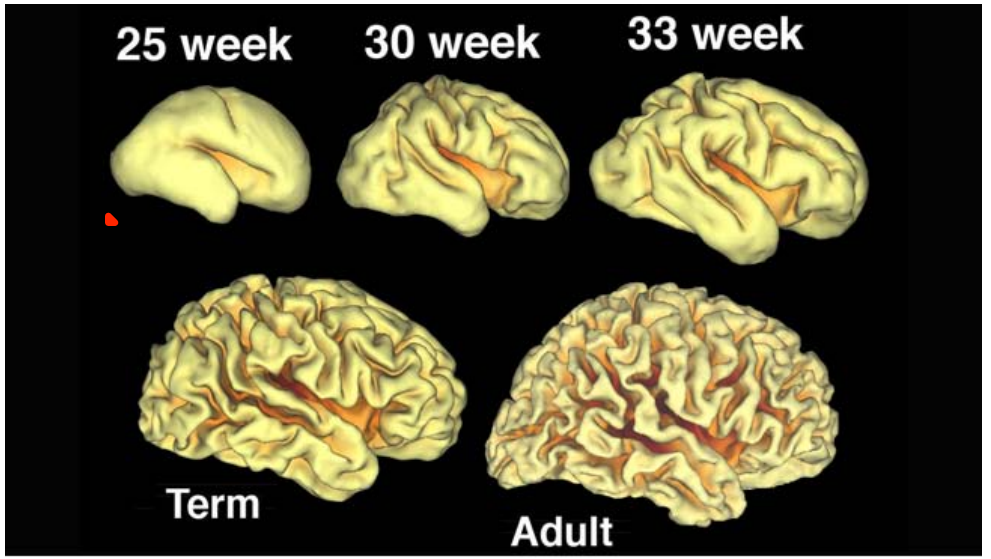
We (men & women) are all born with capacities to parent, evident in, a.o:

- Hormonal & emotional changes in pregnancy and post-natally
- Behavioural & neuropysiological sensitivity to infant cues
- Heart rate acceleration to infant cries and vocalizations
- Approach responses to the "cuteness" of baby faces
- Spontaneous "motherese" talk to babies
- Bonding & motivation

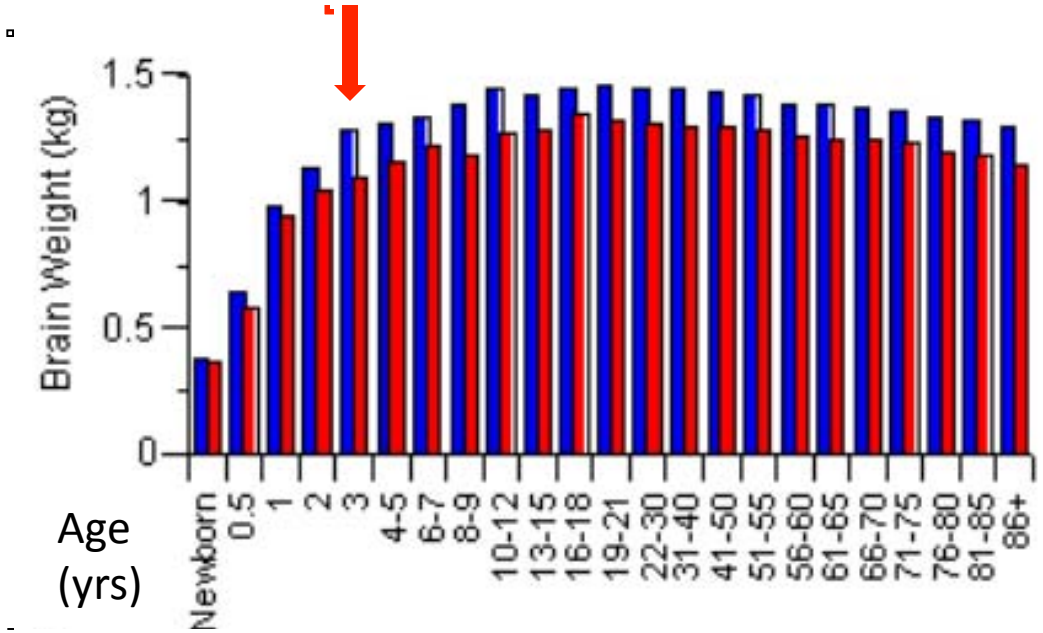
Rilling & Young (2014), *Science*

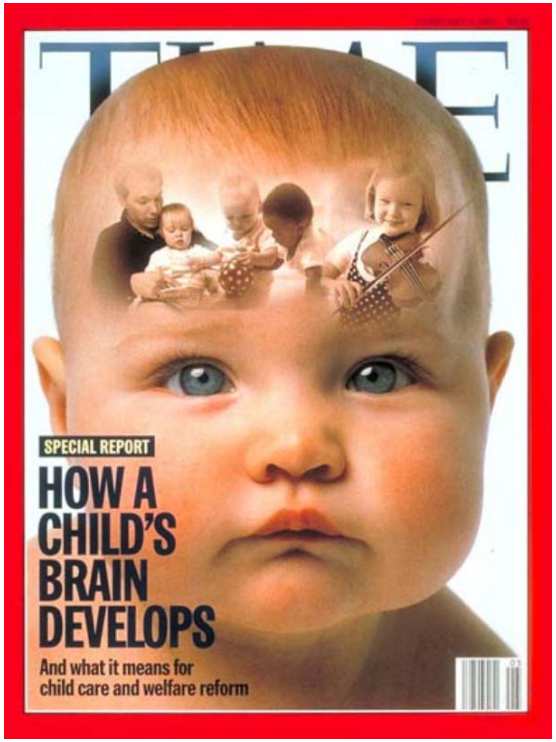
Rapid early brain development





The brain develops extremely rapidly during pregnancy and the first few years of life, learning and adapting to the specific context in which a child is born

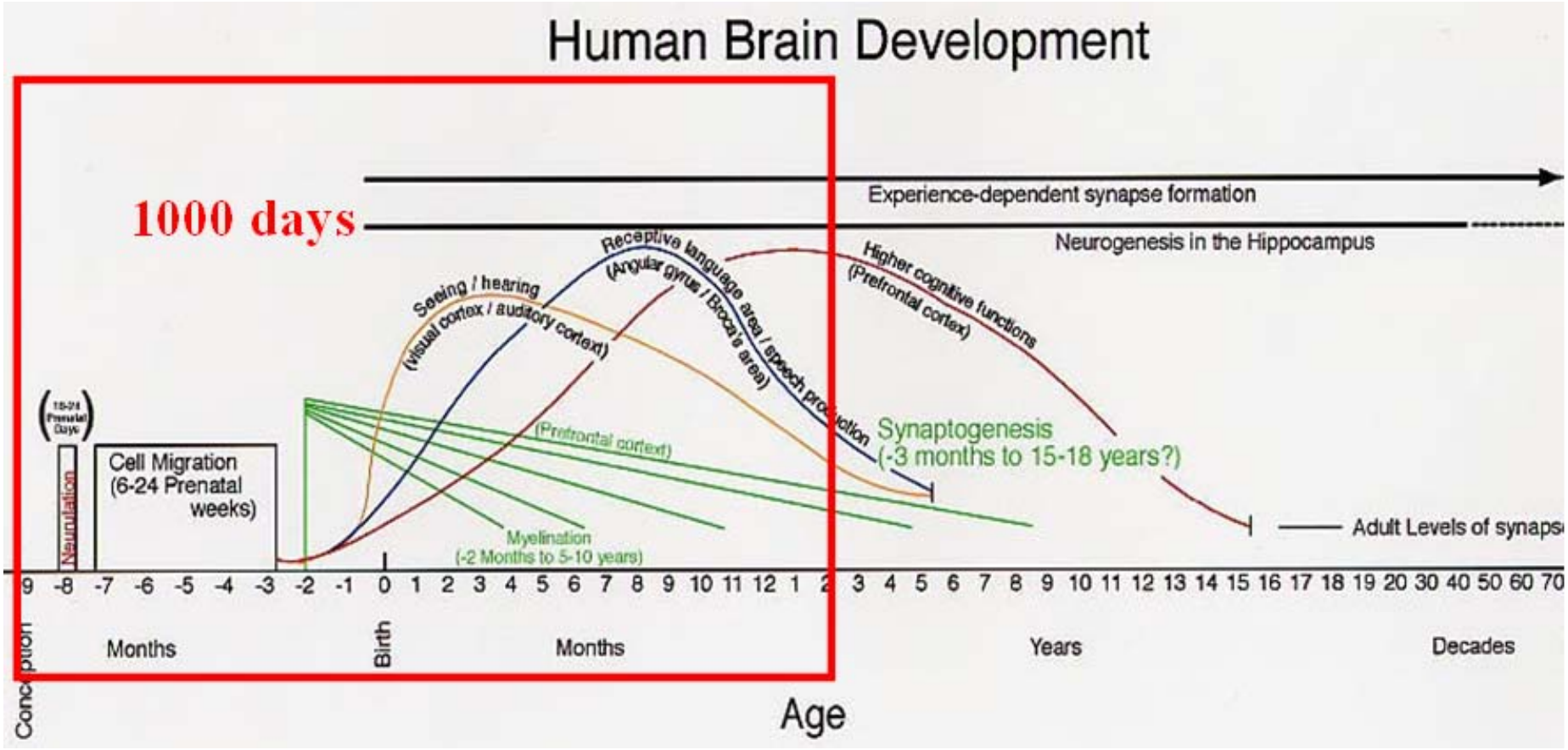




The brain grows faster during the first 3 months of life than at any other time

- Grows 1% bigger per day
- The brain gets 64% larger from birth to 3m
- From 3m groth slows down to 0.4% per day

Rapid functional development

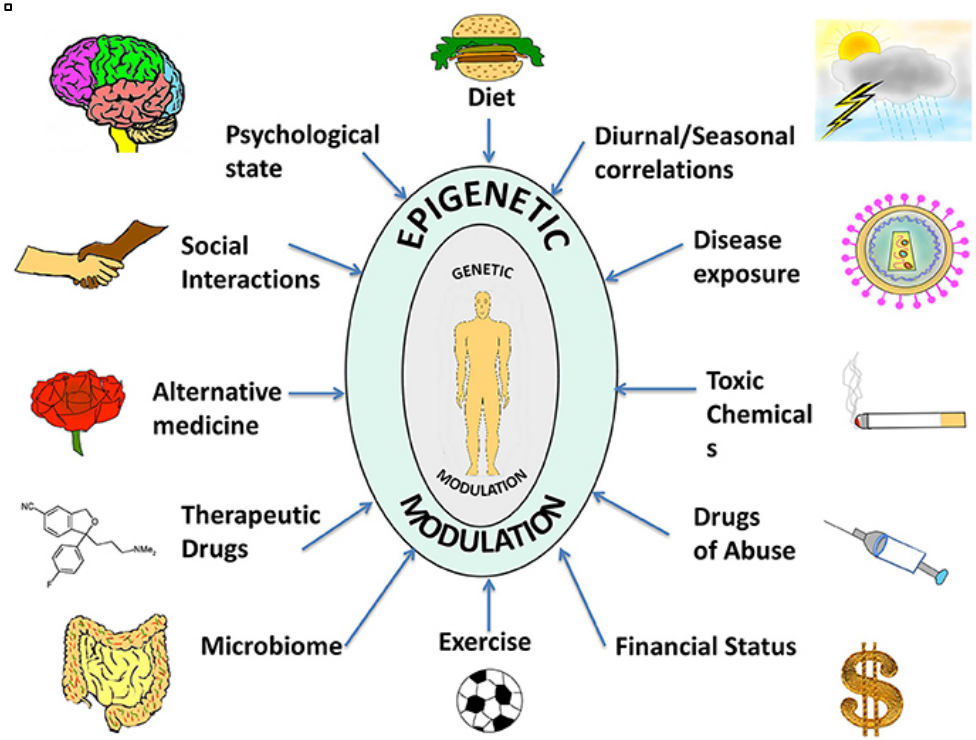


Structural features of the brain supporting sensory, language and cognitive functions are developed by 2 years of age

Thompson & Nelson, 2001, *American Psychologist*

Genetic adaptations (epigenesis)

- From conception our genes start figuring out what kind of environment we're living in
  - And how to adapt to it
- Epigenetic changes occur in response to a wide range of environmental factors



Kanherker et al 2014, Front Cell Dev Biol

Genetic adaptations - programming

- Changes result from some genetic functions being amplified or muted
- DNA methylation most dramatic during early development
- Epigenesis "primes" or "programmes" the lifelong physiological and psychological functioning of the individual

Lister (2013), *Science*

Microbiology

Johnson & Versalovic (2012), *Pediatrics*

The trillions of microbes that live with and in us:

- Are exchanged among us, especially between mother and child:
  - During pregnancy
  - Vaginal delivery
  - Immediate body contact
  - Colostrum and breastfeeding
- And significantly altered by environmental conditions

Effects on health and development

The maternal microbiome:

- Kickstarts and shapes the infant's immune system
- Maps metabolic pathways
- Affects health and wellbeing, including psychological and neuro-development

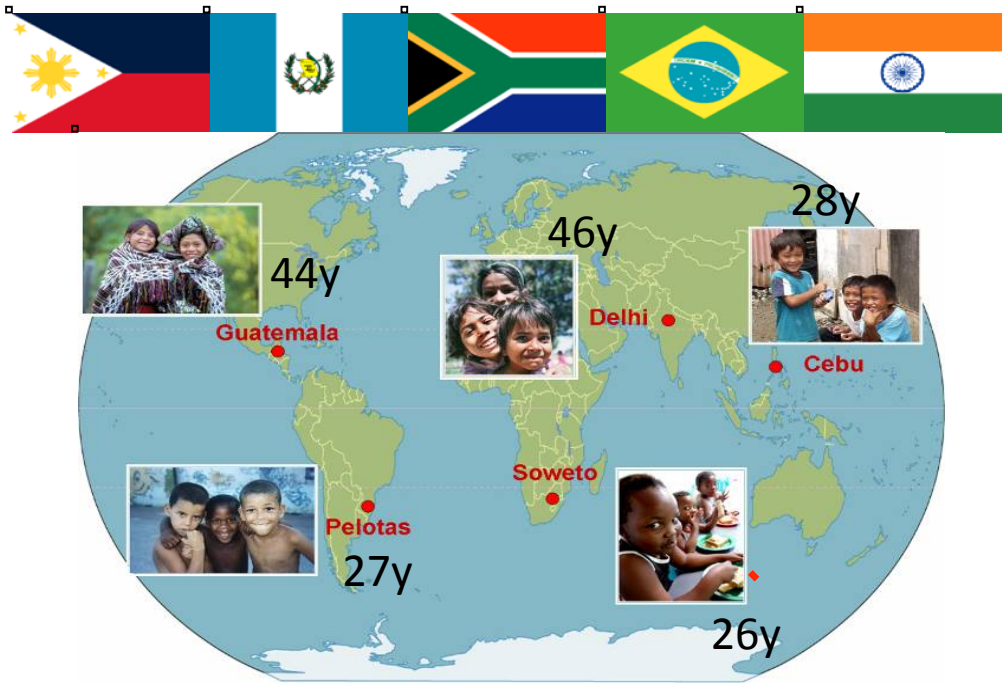
Flight (2014), *Nature Reviews Neuroscience*

Studies with long-term outcomes

- In low & middle income countries only became available fairly recently
- Birth cohort studies
- Long-term follow ups from early interventions

Birth cohort studies

Eg COHORTS (Consortium of Health-Oriented Research in Transition)



- Our study, **Birth to Twenty Plus (Bt20+)** enrolled 3 273 children before birth, with follow-up to age 26y

Martorell et al (2010), *Journal of Nutrition*;
Fall et al (2015), *Lancet Global Health*

Showing links between early growth and adult outcomes (eg height, schooling, diabetes and cardiovascular disease risk, and birthweight of the third generation)

Follow-ups from early intervention

- **Romania: Institutionalization**
  - Children fostered before 2y achieved normal IQ in **late childhood** whereas children fostered after 2y didn't
- **Guatemala: Nutrition**
  - Children given a protein supplement before but not after 2y, had a 46% increase in **adult** wages (for men)
- **Jamaica: Nutrition and stimulation**
  - Children who received supplementary nutrition and home stimulation during the first 2 years achieved 24% higher wages as **adults** than controls

The first 1000 days

Pregnancy (9mo = 270 days)

+ Year 1 (12mo = 365 days)

+ Year 2 (12mo = 365 days)

= 1000 days

A critically important developmental period takes place in the “pouch” of loving care, nurturance and protection

Link: ECD programmes → HIV

Prevent infection, support HIV+ children and families, by helping to:

- Prevent infection among children
- Diagnose infection as soon as possible
- Get children onto treatment as early as possible
- Ensure adherence
- Assist with disclosure and ensure protection
- Provide support to children and families with support

Link: HIV → early child development

HIV exposed but uninfected children

- 1.5m pregnant HIV+ women a year
- 30% of all children born in S & E Africa
- Evidence of increased developmental risks:
  - Still births
  - Prematurity and low birth weight
  - Mortality in the first 2 years, 2-3 times that of Unexposed Uninfected children (HUU)[1]
  - Poorer growth and stunting
  - ? Developmental delay, behavioural difficulties
- → Could be associated with higher risk of cognitive difficulties, poor school performance, lower earnings

Why?

- Biological factors
  - Severity of mother viral load, illness
  - Inflammation, immune suppression)[1,] other infections (CMV?)[2]
  - ARV exposure? Toxicity
  - Fetal programming
- Social factors
  - Lack of breastfeeding, compromised care (maternal death, poverty, depression, stress)
- Multifactorial

Rapidly expanding field

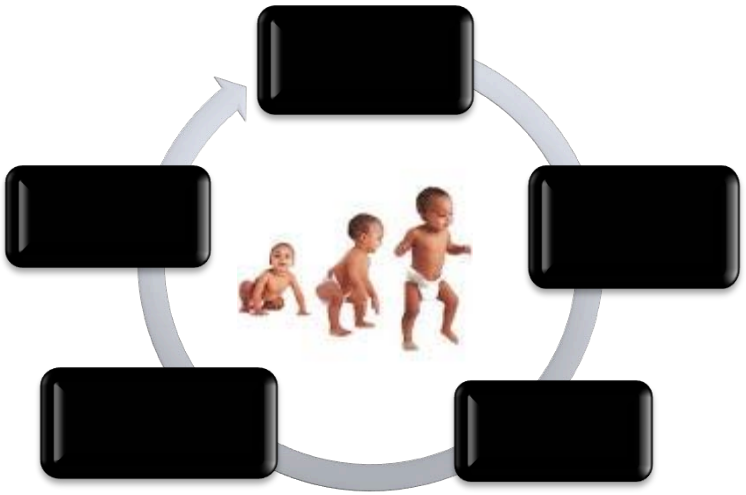
- Longstanding concerns expressed about HIV exposure on uninfected infants
- Few methodologically robust studies – pre- and post-ART, control groups (HIV unexposed children), large sample sizes, follow up
- More than 10 reviews 2015-2016
- Many and increasing numbers of studies on HEU children

HEU outcomes can be improved

- Outcomes are better amongst children:
  - Whose mothers are virally suppressed
  - Less sick
  - Breastfed and well nourished
  - Live in better socio-economic conditions
- For example, longer-term follow up studies:
  - Jahansad et al (2015) Thailand – did better on developmental tests
  - Nicolson et al (2015) Zambia – achieved better school results
- Indicate the potential for supportive interventions

“Join up” HIV interventions

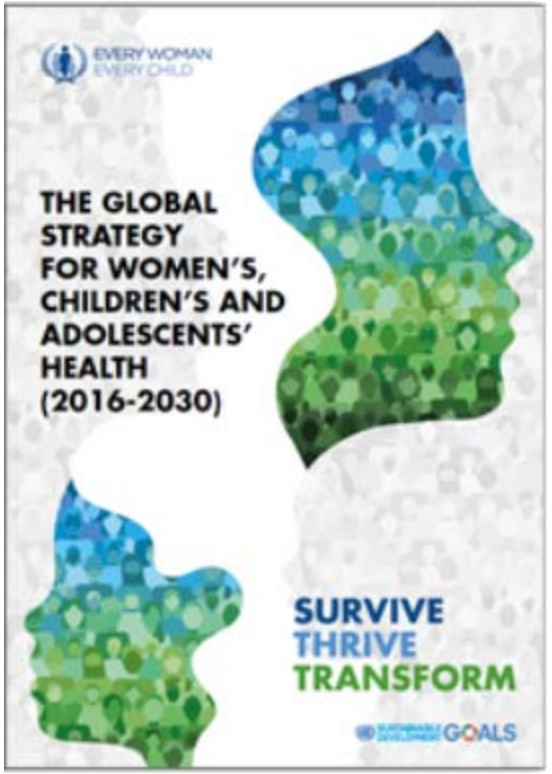
- HIV diagnosis and treatment is not only about men and women
- PMTCT is not only about preventing infection among infants
- Adolescent prevention is not only about incidence



The benefits (and harms) are joined together across the life course and through inter-generational effects

Get beyond survival …

- Global Strategy for Women, Children's and Adolescent's Health 2016-2030
  (Launched 26 September 2016)
- Secretary-General- the three main objectives:
- "First, survival, we want to end preventable deaths of women and children by 2030.
- Second, we aim to ensure every child and adolescent thrives
- Third, we commit to transforming the world in which women, children and adolescents live."



Join up PMTCT and ECD interventions

"The Sustainable Development Goals recognize that early childhood development can help drive the transformation we hope to achieve over the next 15 years"

UN Secretary-General Ban Ki-moon,
UN Headquarters
22 September 2015

ON THE FAST-TRACK TO
AN AIDS FREE GENERATION

UNAIDS, 2016, p16

Unprecedented opportunities are available. If countries use them to build on the progress made and to close remaining gaps, they could catapult towards the goal of ending the AIDS epidemic by 2030. The 2030 Agenda for Sustainable Development is a vital platform for this renewed push to eliminate HIV infections among children and protect mothers' lives—and for accelerating unifying actions to end the AIDS epidemic. The Sustainable Development Goals feature numerous opportunities for fresh, collaborative, and sustainable efforts