THE LANCET

BREASTFEEDING SERIES

GLOBAL LAUNCH

Washington, DC

January 29, 2016

Breastfeeding: the single most effective intervention to prevent infant deaths (*Lancet* 2003)

Child survival II

How many child deaths can we prevent this year?

*Gareth Jones, Richard W Steketee, Robert E Black, Zulfiqar A Bhutta, Saul S Morris, and the Bellagio Child Survival Study Group**

This is the second of five papers in the child survival series. The first focused on continuing high rates of child mortality (over 10 million each year) from preventable causes: diarrhoea, pneumonia, measles, malaria, HIV/AIDS, the underlying cause of undernutrition, and a small group of causes leading to neonatal deaths. We review child survival interventions feasible for delivery at high coverage in low-income settings, and classify these as level 1 (sufficient evidence of effect), level 2 (limited evidence), or level 3 (inadequate evidence). Our results show that at least one level-1 intervention is available for preventing or treating each main cause of death among children younger than 5 years, apart from birth asphyxia, for which a level-2 intervention is available. There is also limited evidence for several other interventions. However, global coverage for most interventions is below 50%. If level 1 or 2 interventions were universally available, 63% of child deaths could be prevented. These findings show that the interventions needed to achieve the millennium development goal of reducing child mortality by two-thirds by 2015 are available, but that they are not being delivered to the mothers and children who need them.

THE WORLD TODAY

What is the relevance of breastfeeding to women and children in low-, middle- and high-income countries in the 21st century?

Series

Breastfeeding 1

Breastfeeding in the 21st century: epidemiology, mechanisms, and lifelong effect

Cesar G Victora, Rajiv Bahl, Aluisio J D Barros, Giovanny V A França, Susan Horton, Julia Krasevec, Simon Murch, Mari Jeeva Sa
Nigel C Rollins, for The Lancet Breastfeeding Series Group*

The importance of breastfeeding in low-income and middle-income countries is well recognised, bu
exists about its importance in high-income countries. In low-income and middle-income countri
children younger than 6 months of age are exclusively breastfed. With few exceptions, breastfee
shorter in high-income countries than in those that are resource-poor. Our meta-analyses indicate p
child infections and malocclusion, increases in intelligence, and probable reductions in overweight
did not find associations with allergic disorders such as asthma or with blood pressure or cholester
an increase in tooth decay with longer periods of breastfeeding. For nursing women, breastfeeding
against breast cancer and it improved birth spacing, and it might also protect against ovarian ca
diabetes. The scaling up of breastfeeding to a near universal level could prevent 823 000 annual de
younger than 5 years and 20 000 annual deaths from breast cancer. Recent epidemiological and bi
from during the past decade expand on the known benefits of breastfeeding for women and childr
are rich or poor.

Series

Breastfeeding 2

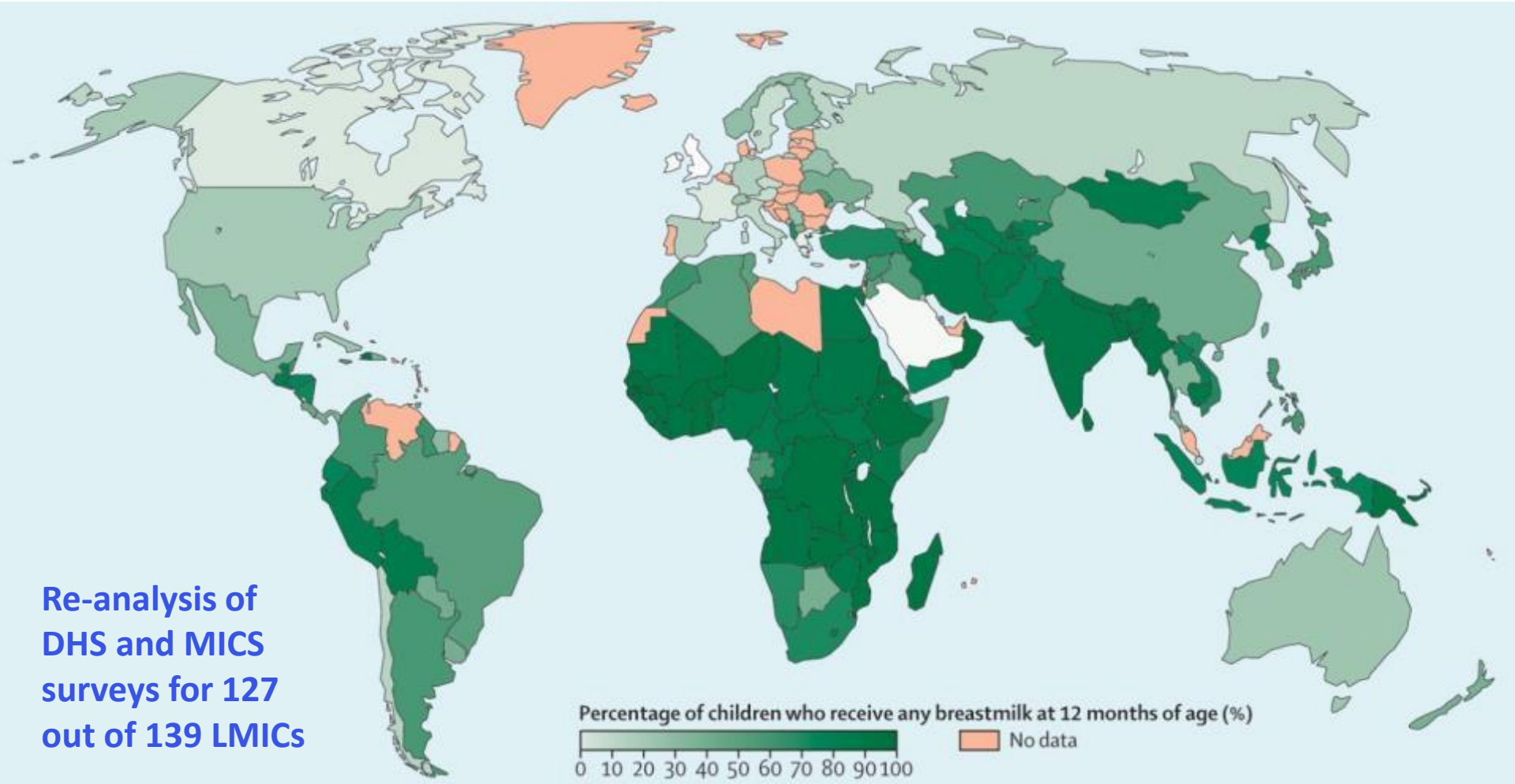
Why invest, and what it will take to improve breastfeeding practices?

Nigel C Rollins, Nita Bhandari, Nemat Hajeebhoy, Susan Horton, Chessie K Lutter, Jose C Martines, Ellen G Piwoz, Linda M Richter, Cesar G Victora, on behalf of The Lancet Breastfeeding Series Group*

Despite its established benefits, breastfeeding is no longer a norm in many communities. Multifactorial determinants of breastfeeding need supportive measures at many levels, from legal and policy directives to social attitudes and values, women's work and employment conditions, and health-care services to enable women to breastfeed. When relevant interventions are delivered adequately, breastfeeding practices are responsive and can improve rapidly. The best outcomes are achieved when interventions are implemented concurrently through several channels. The marketing of breastmilk substitutes negatively affects breastfeeding: global sales in 2014 of US$44·8 billion show the industry's large, competitive claim on infant feeding. Not breastfeeding is associated with lower intelligence and economic losses of about $302 billion annually or 0·49% of world gross national income. Breastfeeding provides short-term and long-term health and economic and environmental advantages to children, women, and society. To realise these gains, political support and financial investment are needed to protect, promote, and support breastfeeding.

Lancet 2016; 387: 491–504
This is the second in a Series of two papers about breastfeeding
*Members listed at the end of the paper
Department of Maternal, Newborn, Child and Adolescent Health (MCA) (N C Rollins MD), and Department of Noncommunicable Diseases and Mental Health (C K Lutter PhD), WHO, Geneva,

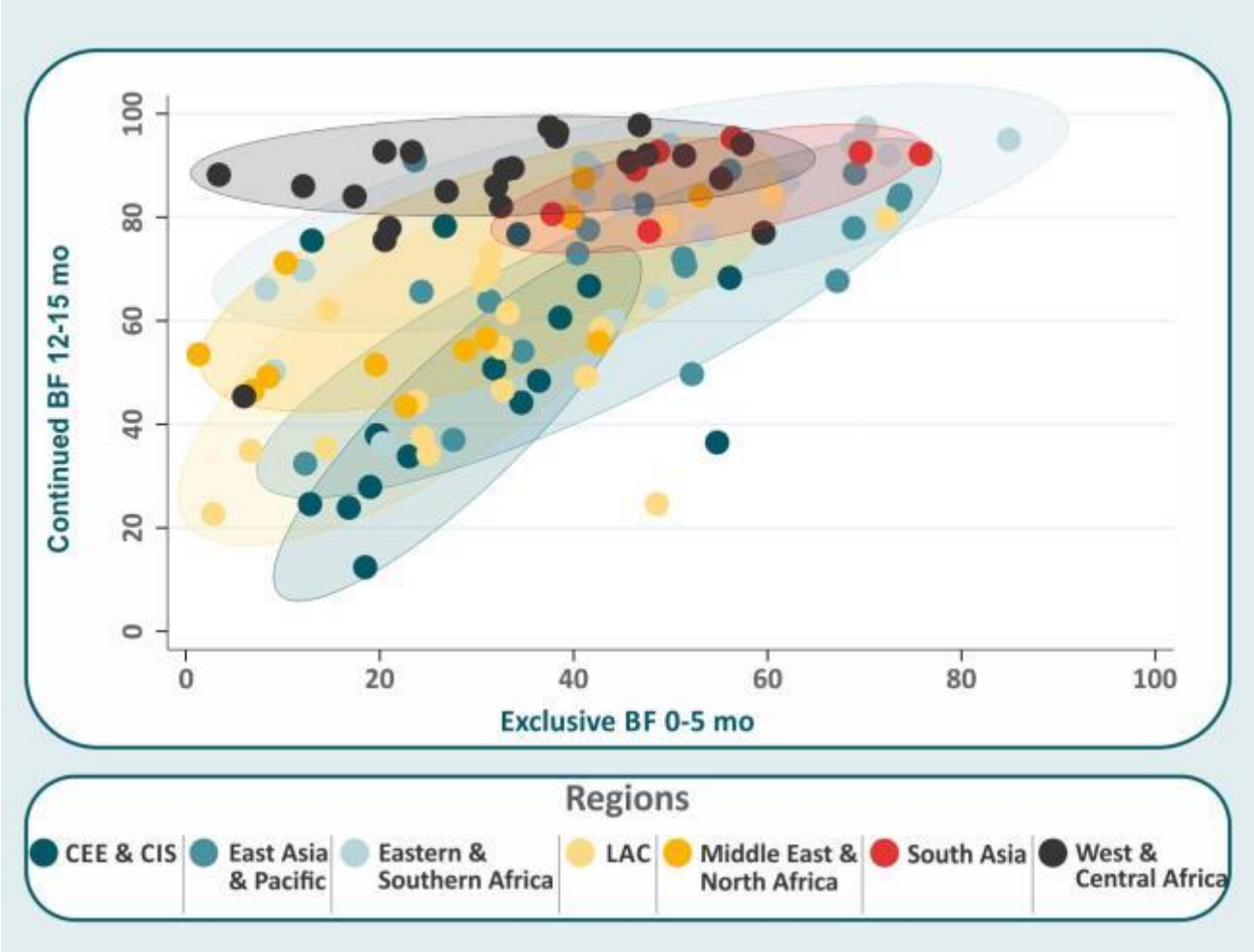
First global map of breastfeeding prevalence



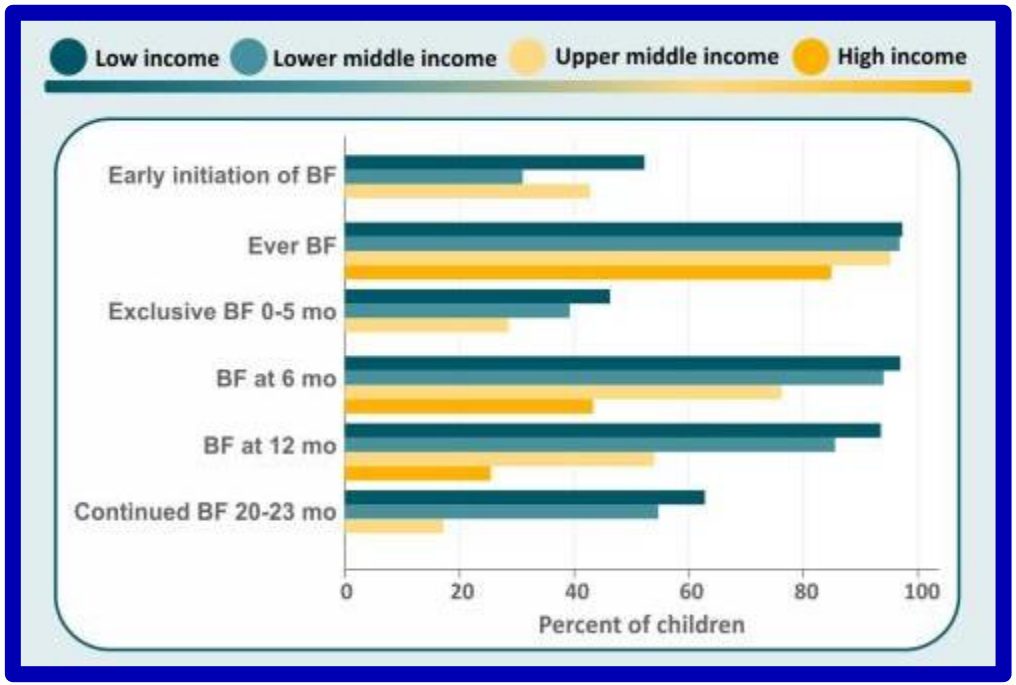
Re-analysis of DHS and MICS surveys for 127 out of 139 LMICs

Systematic review of the literature on breastfeeding prevalence from high-income countries: data on 37 out of 75 countries

Patterns of breastfeeding vary by region



Breastfeeding: one of the few positive health behaviors more prevalent in LMICs than HICs



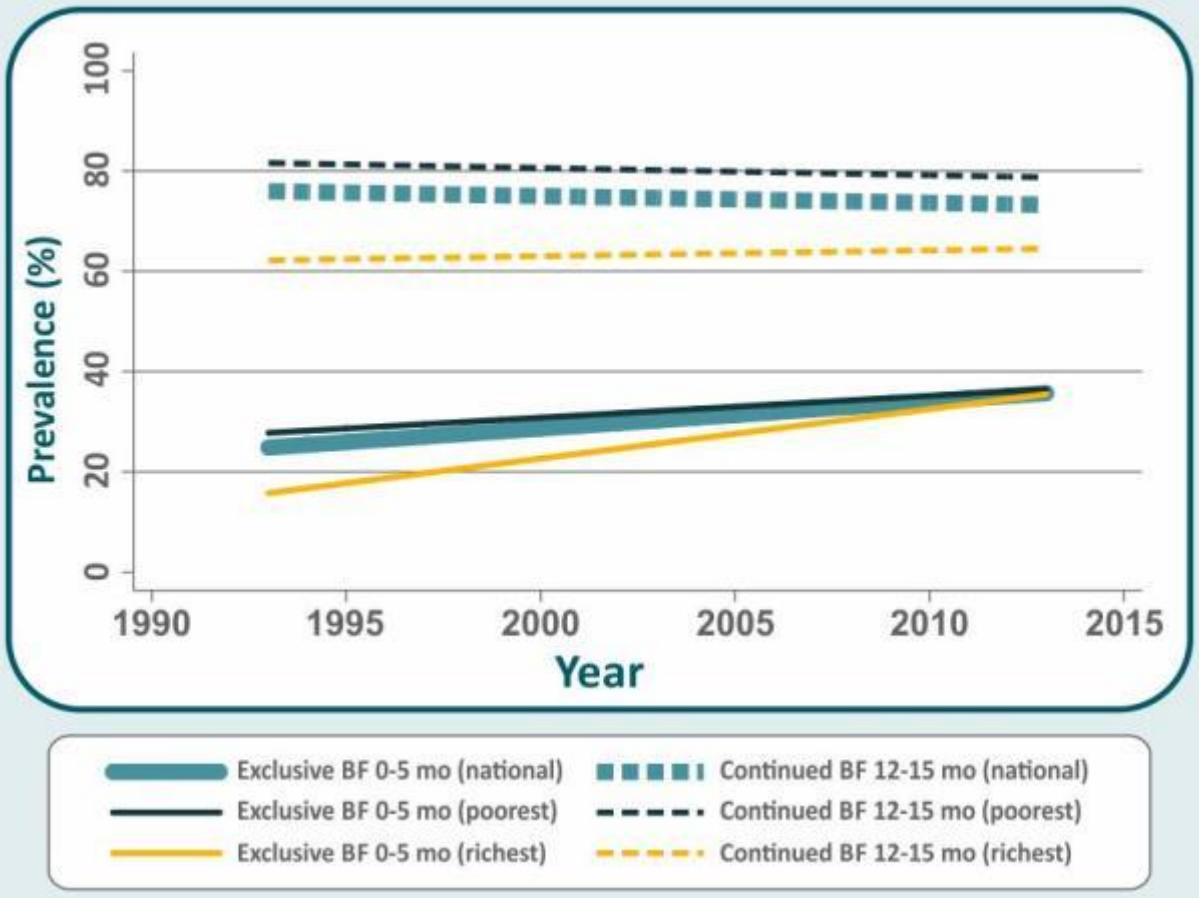
Low- and middle-income countries

- Less than 40% of infants under 6 months are exclusively breastfed
- About 1/3 of children between 6 and 24 months are not breastfed

Most high-income countries

- Fewer than 20% of children are breastfed up to 12 months (data is limited)
- More educated, wealthier women breastfeed for longer

Breastfeeding practices over time

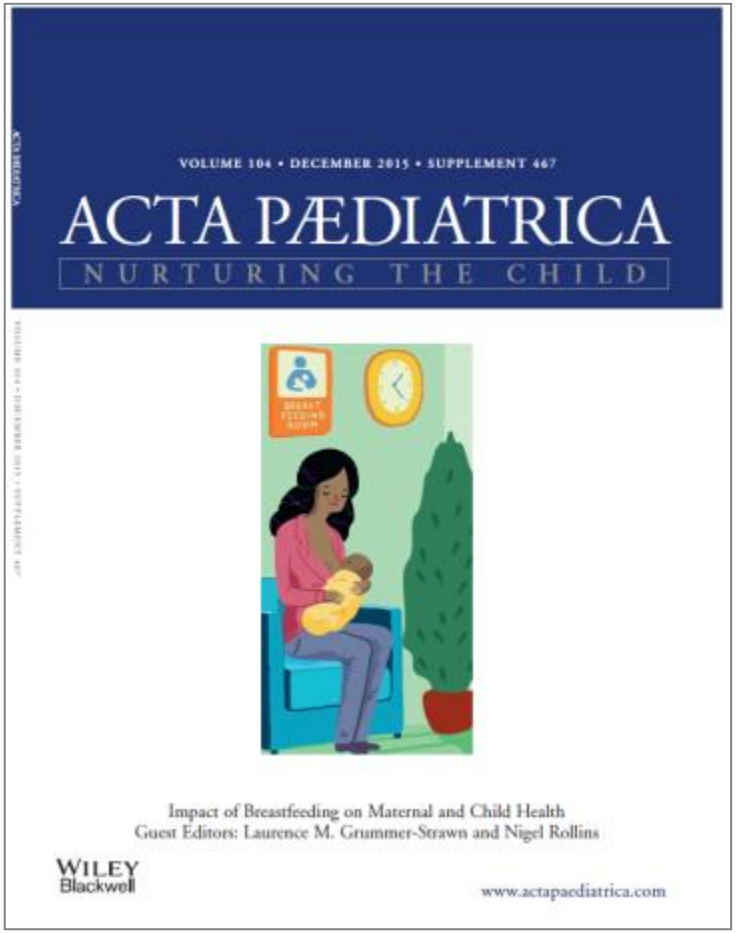


For each doubling in national GDP per capita, breastfeeding prevalence at 12 months decreases by 10 percentage points

Population-weighted averages from 217 surveys

Impact of breastfeeding on maternal and child health

- Systematic literature reviews (data from low-, middle- and high-income settings)
  - Child mortality, short and long term health outcomes
  - Breast and ovarian cancer among women
  - Interventions to improve breastfeeding practices
- Lives Saved Tool (LiST) modeled preventable child deaths



http://onlinelibrary.wiley.com/doi/10.1111/apa.2015.104.issue-S467/issuetoc

Improving breastfeeding would annually save about 820,000 children under 5 years of age

87% of them among infants less than 6 months of age

Reduce infection-related mortality (<3mo) by 88%

	Outcome	Types of comparison (breastfeeding categories)	Studies (n)	Age range of outcome	Pooled effect (95% CI)	Confounding and effect modification	Other biases	Conclusions
Effects on children, adolescents, or adults according to breastfeeding pattern								
Sankar et al (2015)*	Mortality due to infectious diseases	Exclusive versus predominant	3	<6 months	OR 0·59 (0·41–0·85)	All studies from LMICs, where confounding by SEP would probably underestimate the effect of breastfeeding. Confounder-adjusted studies showed similar effects	Studies that avoided reverse causation (breastfeeding stopped because of illness) showed similar effects. No evidence of publication bias but very few studies available	Consistent evidence of major protection. Few studies used the four breastfeeding categories in young infants, but evidence from other studies comparing any versus no breastfeeding is very consistent
Sankar et al (2015)*	Mortality due to infectious diseases	Exclusive versus partial	3	<6 months	OR 0·22 (0·14–0·34)	See above	See above	See above
Sankar et al (2015)*	Mortality due to infectious diseases	Exclusive versus none	2	<6 months	OR 0·12 (0·04–0·31)	See above	See above	See above
Sankar et al (2015)*	Mortality due to infectious diseases	Any versus none	9	6–23 months	OR 0·48 (0·38–0·60)	See above	See above	See above
Horta et al (2013)*	Diarrhoea incidence	More versus less breastfeeding (eg, exclusive vs non-exclusive; predominant vs partial; partial vs none; any breastfeeding vs no breastfeeding)	15	<5 years	RR 0·69 (0·58–0·82)	Most studies were from LMICs, where confounding would probably underestimate an effect. Confounder-adjusted studies showed similar effects. Three RCTs of breastfeeding promotion (not included in the meta-analysis) showed protection against diarrhoea morbidity (pooled OR 0·69 [0·49–0·96])	Few studies that allowed for reverse causation also showed protection. Publication bias is unlikely to explain the findings because results from large and small studies were similar	Strong evidence of major protection against diarrhoea morbidity and admissions to hospital, particularly in young infants, based on a large number of studies
Horta et al (2013)*	Diarrhoea incidence	See above	23	<6 months	RR 0·37 (0·27–0·50)	See above	See above	See above
Horta et al (2013)*	Diarrhoea incidence	See above	11	6 months to 5 years	RR 0·46 (0·28–0·78)	See above	See above	See above
Horta et al (2013)*	Admission to hospital for diarrhoea	See above	9	<5 years	RR 0·28 (0·16–0·50)	See above	See above	See above
Horta et al (2013)*	Lower respiratory infections (incidence or prevalence)	See above	16	<2 years	RR 0·68 (0·60–0·77)	Most studies were from LMICs, where confounding would probably underestimate the effect of breastfeeding. Confounder-adjusted studies showed similar effects	Studies that avoided reverse causation showed similar effects. No evidence of publication bias	Strong evidence of a reduction in severe respiratory infections in breastfed children, based on a large number of studies
Horta et al (2013)*	Admissions to hospitals for respiratory infections	See above	17	<2 years	RR 0·43 (0·33–0·55)	The only available RCT showed an RR of 0·85 (0·57–1·27), a non-significant reduction in admissions to hospital	See above	See above

(Table continues on next page)

Improving breastfeeding practices would have a profound effect on morbidity as well as mortality

Improving breastfeeding would prevent:

More than 54% of all diarrhea episodes

And 32% of all respiratory infections

(in LMICs)

Protection against hospital admissions even greater:

72% of all admissions for diarrhea

57% for respiratory infections

Breastfeeding protects health and contributes to development

Breastfeeding protects against:

- Acute otitis media (<2 yrs)
- Malocclusion
- Type 2 diabetes
- Obesity

But not against:

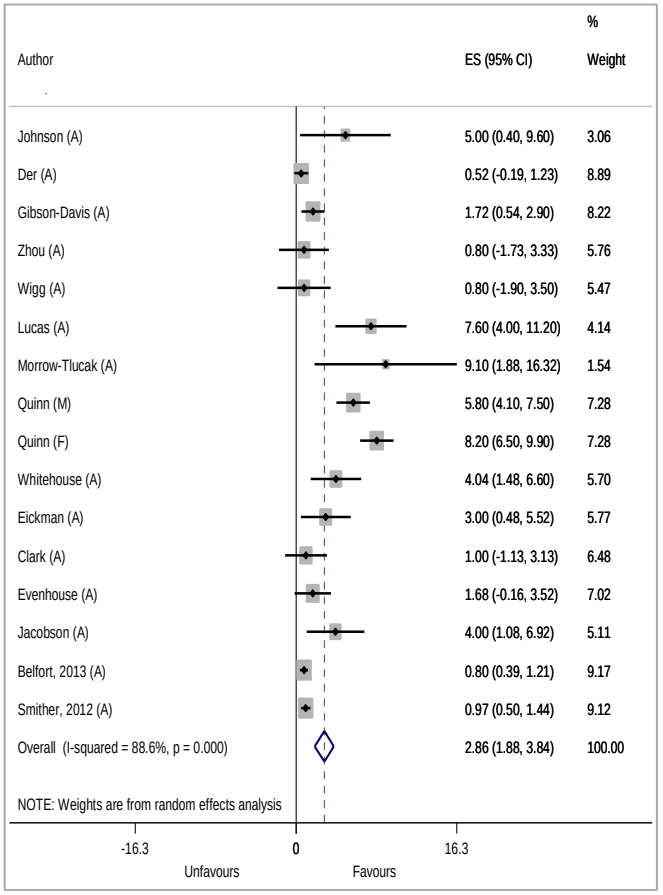
- Asthma
- Eczema
- Food allergies

No evidence for effect on:

- Blood pressure
- Serum lipids
- Growth (wt or length)

Longer breastfeeding associated with higher performance on intelligence tests

- Average of 3 IQ points, controlling for maternal IQ
- Improved academic performance (some studies)
- Increased adult earnings



Breastfeeding benefits women's health

Each year a mother breastfeeds decreases the risk of developing invasive breast cancer by 6%

Breastfeeding also reduces the risk of ovarian cancer

New impact modelling:

- Current rates of breastfeeding prevent almost 20,000 deaths from breast cancer per year
- Another 20,000 deaths could be prevented by improving breastfeeding practices further

New review confirms role of breastfeeding in birth spacing

Are these effects biologically plausible?

Could an intervention as simple and so early, have such a profound impact on health throughout life?

OCTOBER 2013

Paving the Way for Personalized Medicine

FDA's Role in a New Era of Medical Product Development

U.S. DEPARTMENT OF HEALTH AND HUMAN SERVICES
U.S. FOOD AND DRUG ADMINISTRATION

Breastfeeding – exquisitely personalized medicine at a critical moment

Individualized components of breastmilk

- Bacteria from the mother's gut microbiome
- Immune cells primed in the mother's intestine
- Carbohydrates that shape the baby's microbiome
- Small RNA's that control genes in the baby
- Microvesicles (exosomes) that control genes in the baby
- Stem cells that survive in the baby

theguardian

Breast milk protein could be used in fight against antibiotic resistance

Saturday 23 January 2016 09.39 GMT

National Physical Laboratory and UCL study reveals that lactoferrin kills bacteria, fungi and viruses

Scientists re-engineered the fragment into a virus-like capsu
cells. Photograph: Stefan Wermuth/Reuters

An antibiotic developed from human breast milk could combat certain drug-resistant bacteria, British scientists have found.

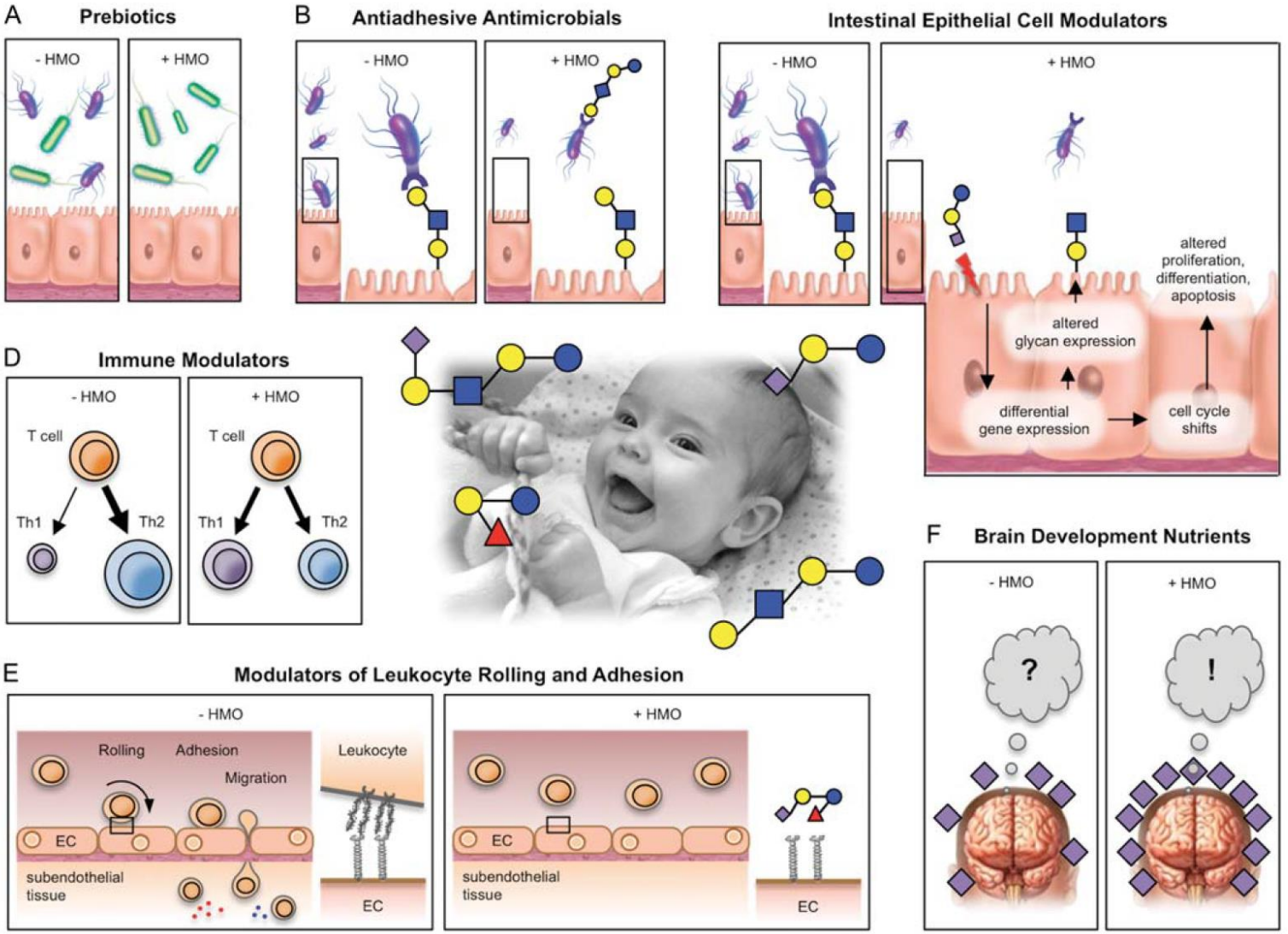
Tackling antibiotic-resistant bacteria, known as superbugs, is a priority for the government. A panel set up by David Cameron forecast that they would cost 10 million lives and £700bn a year worldwide by 2050 if the problem went unchecked.

The breakthrough, by the National Physical Laboratory (NPL) and University College London, found that the minuscule fragment, less than a nanometre in width, is responsible for giving the protein its anti-microbial properties.

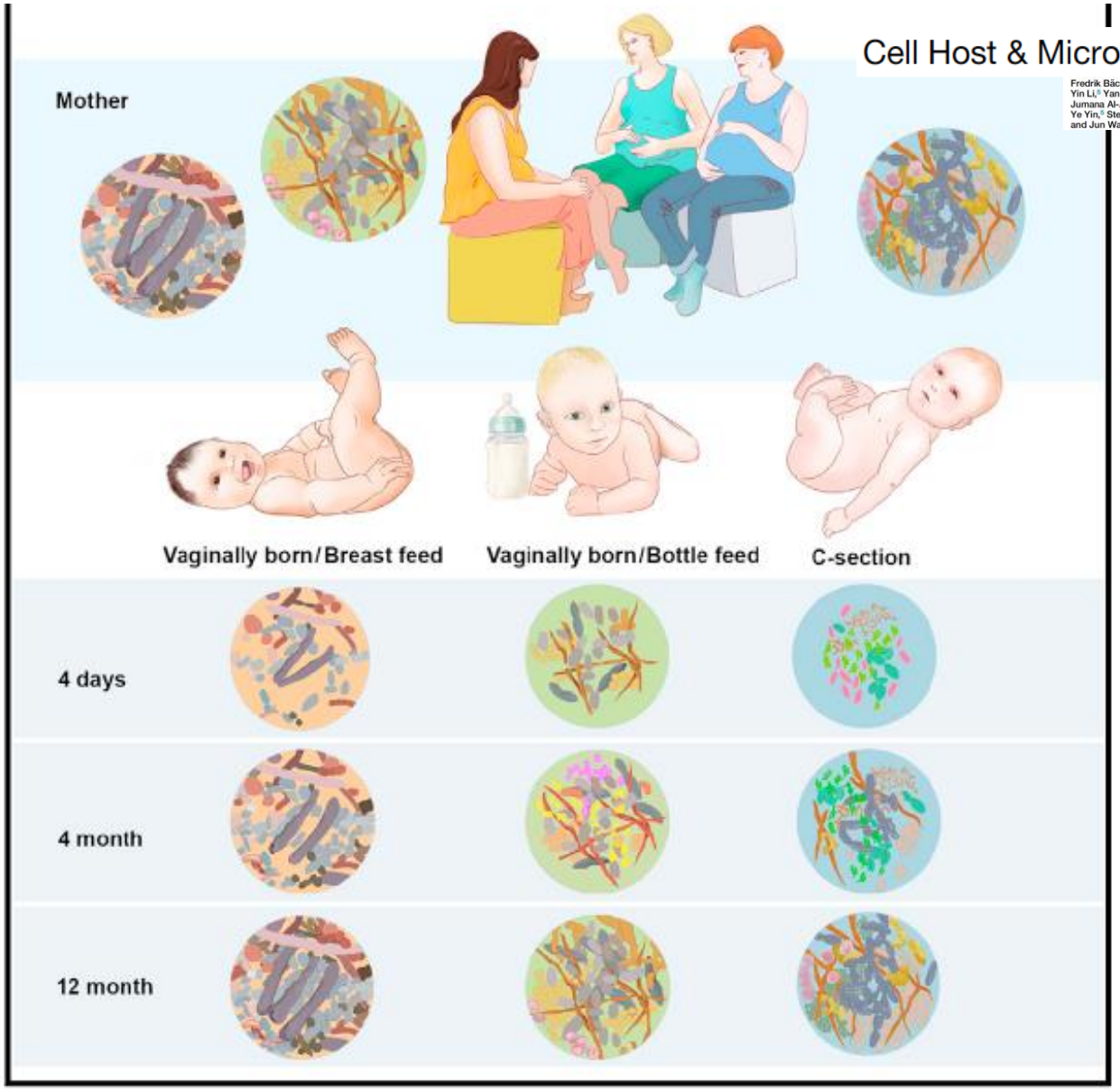
This is what makes breast milk so important in protecting infants from disease in their first months of life. The protein, called lactoferrin, effectively kills bacteria, fungi and even viruses on contact.

Human milk oligosaccharides: Every baby needs a sugar mama

Lars Bode **Glycobiology** vol. 22 no. 9 pp. 1147–1162, 2012



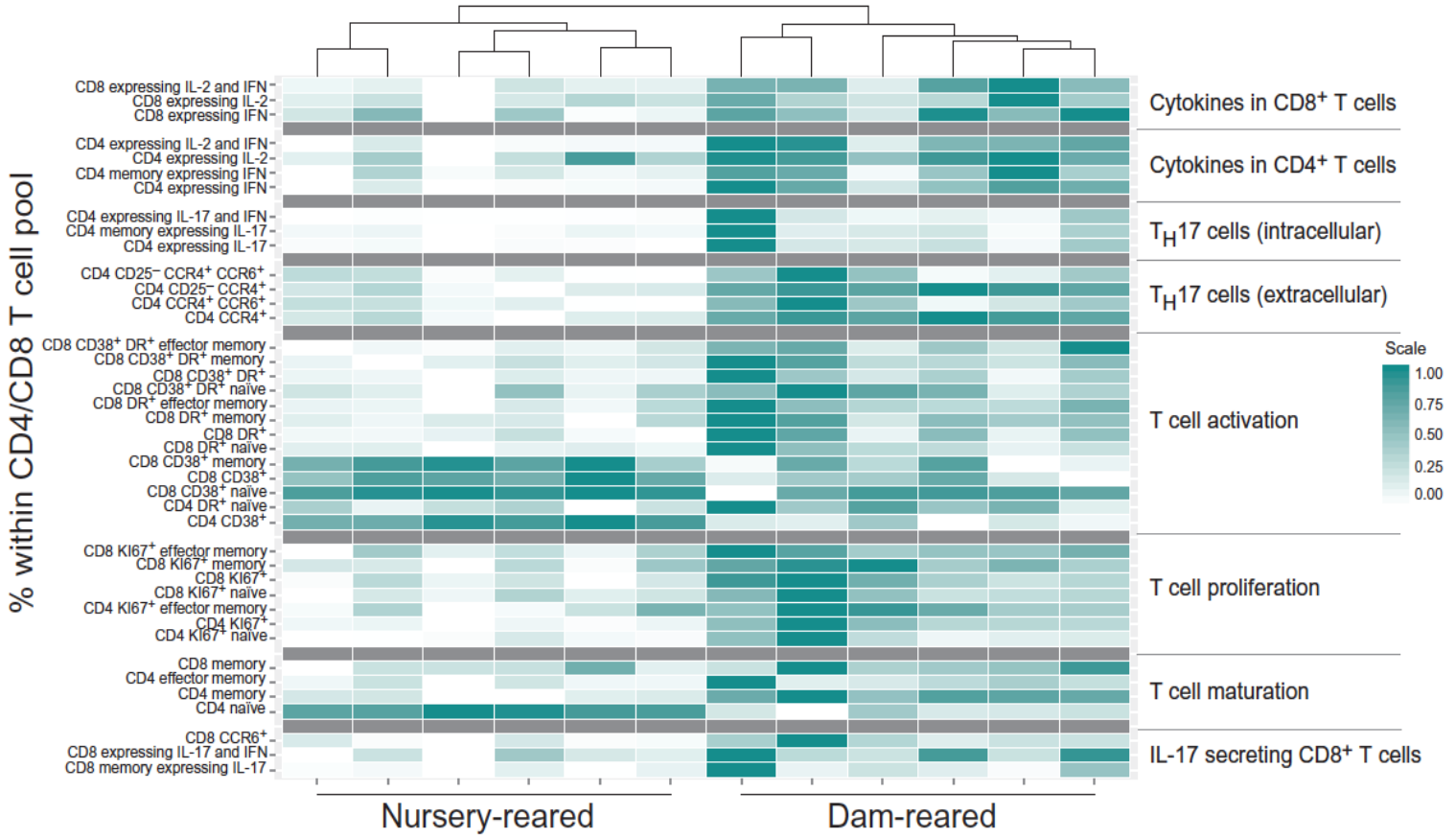
Dynamics and Stabilization of the Human Gut Microbiome during the First Year of Life



Cell Host & Microbe *17*, 690–703, May 13, 2015

Fredrik Bäckhed,[1,2,*] Josefine Roswall,[3,4] Yangqing Peng,[3] Qiang Feng,[3,6] Huijue Jia,[3] Petia Kovatcheva-Datchary,[1] Yin Li,[3] Yan Xia,[3] Hailiang Xie,[3] Huanzi Zhong,[3] Muhammad Tanweer Khan,[1] Jianfeng Zhang,[3] Junhua Li,[3] Liang Xiao,[3] Jumana Al-Aama,[6,7] Dongya Zhang,[3] Ying Shiuan Lee,[1] Dorota Kotowska,[8] Camilla Colding,[8] Valentina Tremaroli,[1] Ye Yin,[3] Stefan Bergman,[4,9] Xun Xu,[3] Lise Madsen,[6,8] Karsten Kristiansen,[3,8] Jovanna Dahlgren,[4,10,*] and Jun Wang[3,6,7,10,11,12,*]

Formula-fed and breastfed rhesus macaques have different gut microbiota and immune systems



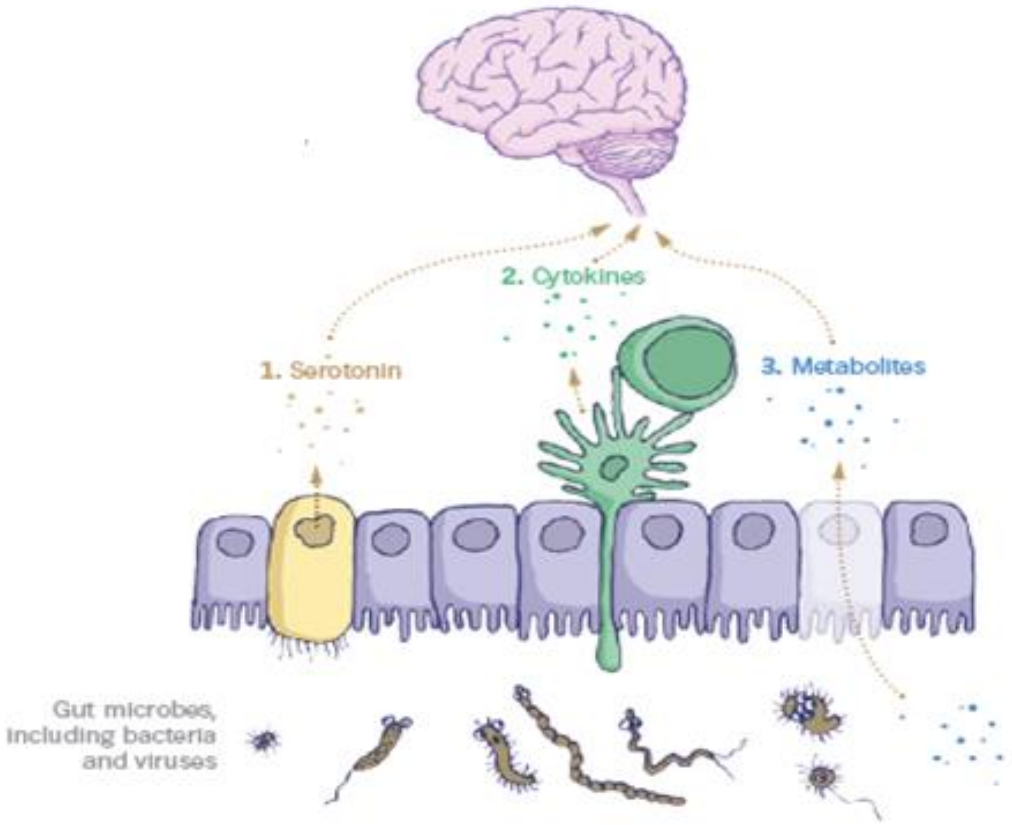
Ardeshir A, et al. *Sci Transl Med,* 2014

NATURE | VOL 526 | 15 OCTOBER 2015

BRAIN, MEET GUT

BY PETER ANDREY SMITH

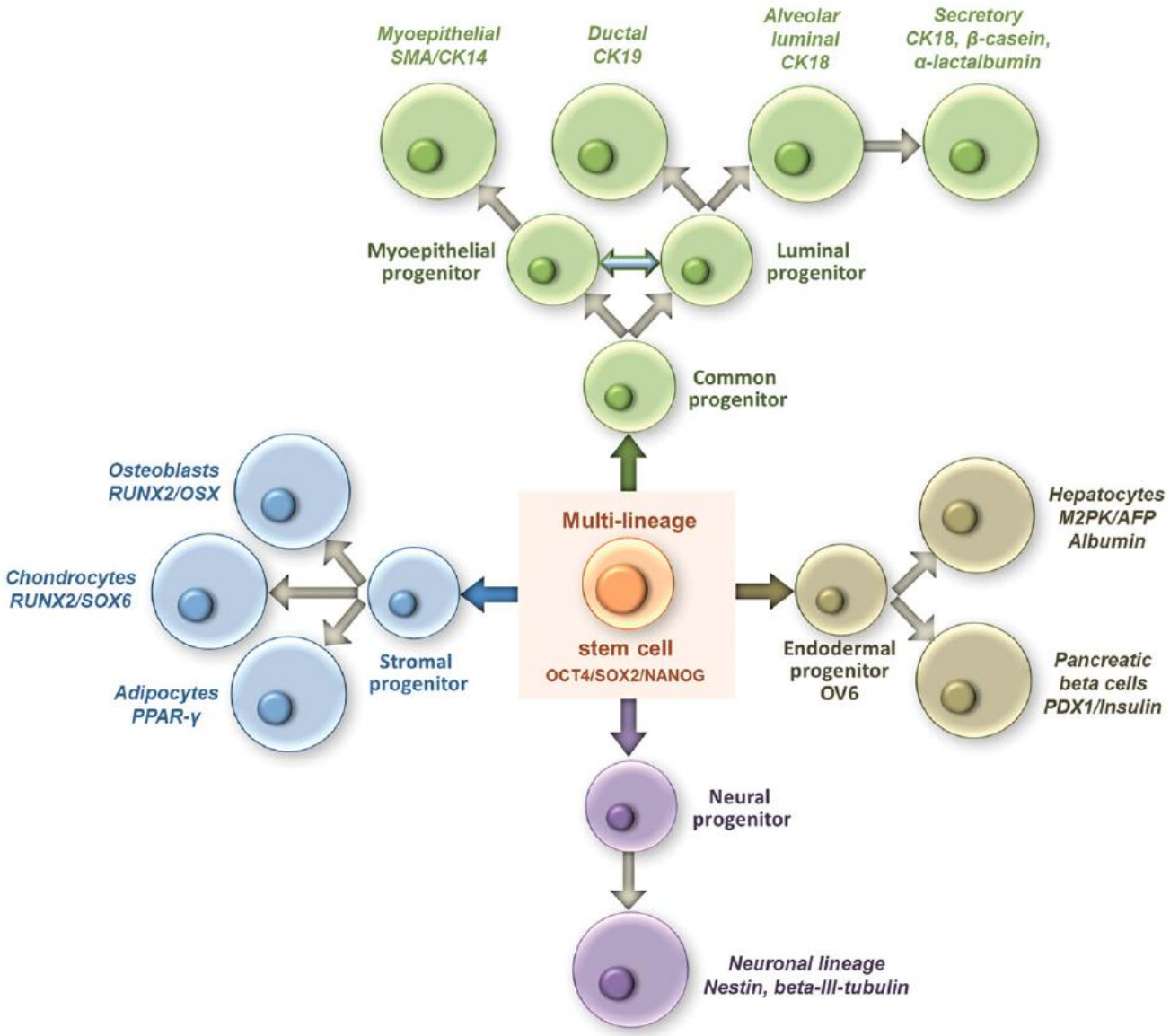
Neuroscientists are probing the connections between intestinal microbes and brain development.



Breastmilk Is a Novel Source of Stem Cells with Multilineage Differentiation Potential

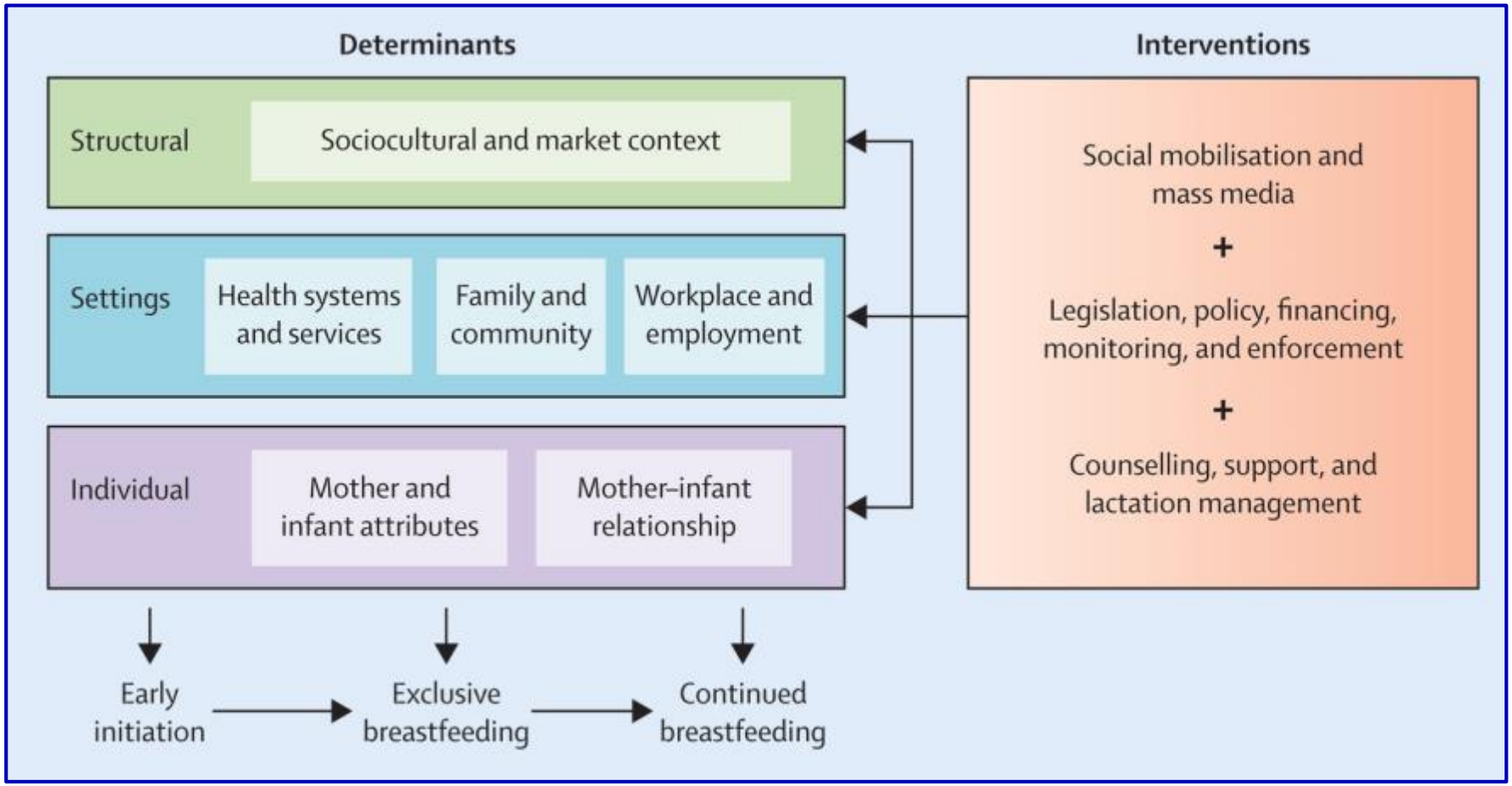
Foteini Hassiotou,[a,b] Adriana Beltran,[c] Ellen Chetwynd,[d] Alison M. Stuebe,[d] Alecia-Jane Twigger,[b] Philipp Metzger,[b,e] Naomi Trengove,[a] Ching Tat Lai,[a] Luis Filgueira,[b] Pilar Blancafort,[b,c] Peter E. Hartmann[a]

Stem Cells 2012;30:2164–2174



Despite this growing body of evidence, women worldwide still do not have the support they need to breastfeed

Building an enabling environment for breastfeeding: A conceptual model



Interventions to improve breastfeeding practices

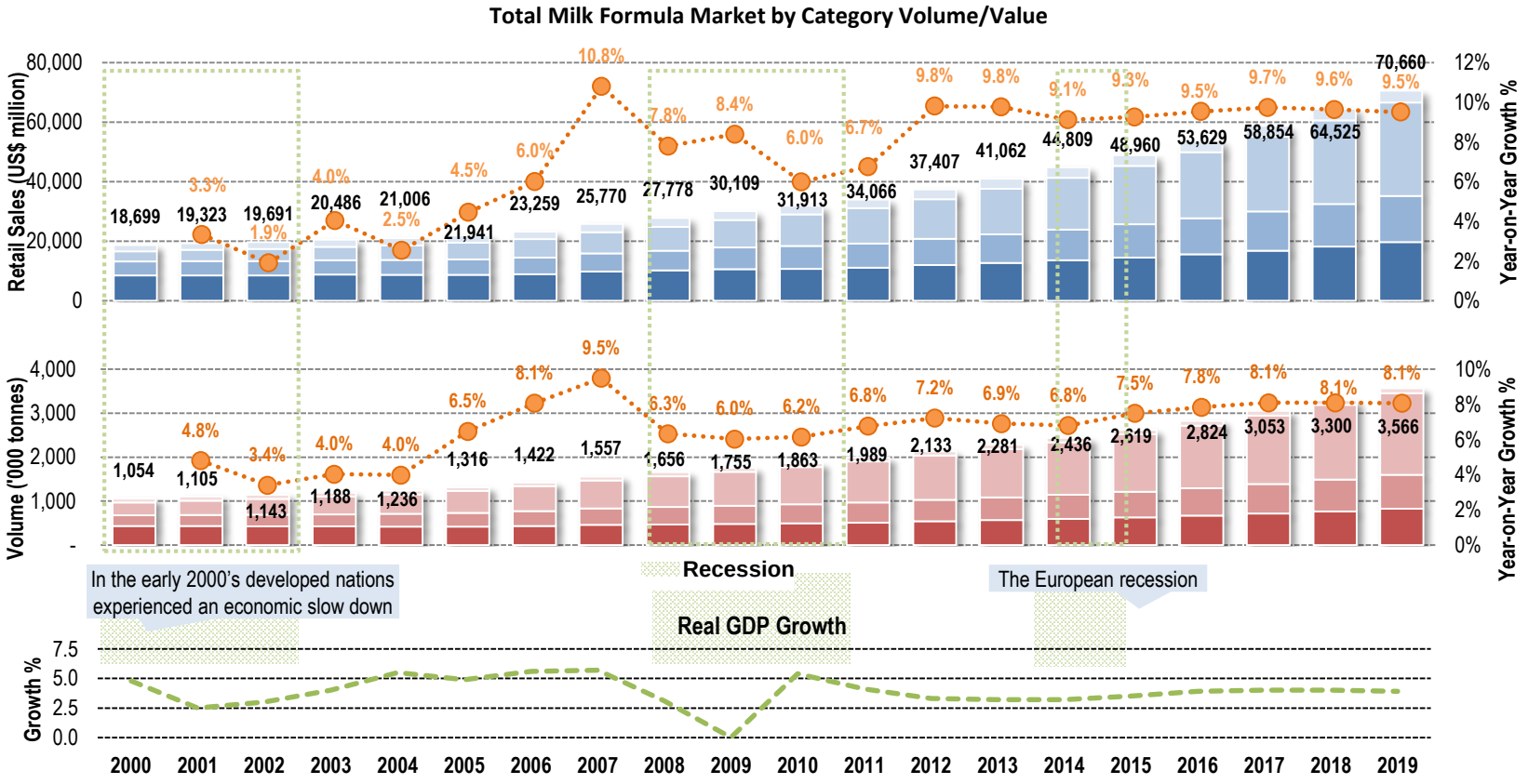
Systematic review examined the effect of interventions by setting: 20,000+ papers screened and 300 studies examined

Meta-analyses:

- **Breastfeeding practices are highly responsive to interventions delivered in health systems, communities and homes**
- **Health system and community interventions can increase exclusive breastfeeding by x2.5**
- Maternity leave and work-place interventions also beneficial (studies are few and generally limited to HICs)
- Largest effects of interventions are achieved when interventions are delivered in combination
- Mix of interventions needed may vary by setting and breastfeeding trends

The breast milk substitute (BMS) industry is large and growing

- *In 2014, global sales of all baby milk formula were about US$ 44.8 billion*
- *By 2019, the market value is projected to reach US$ 70.6 billion.*



Standard | Follow-on | Toddler | Special | Yr-on-Yr growth

The economic case for investing in breastfeeding

Economic gains:

US$302 billion/year

(0.47% of global GNI)

Due to increased productivity associated with higher intelligence

Estimated health benefits:

Reduced annual healthcare costs totaling nearly $400 million in the U.S., UK, Brazil and urban China

	Estimated percentage loss in gross national income	Estimated loss in 2012 US$
Eastern and southern Africa	0·04%	$0·1 billion
West and central Africa	0·06%	$0·3 billion
Middle East and north Africa	0·97%	$11·8 billion
South Asia	0·05%	$1·0 billion
East Asia and Pacific	0·31%	$28·1 billion
Latin America and the Caribbean	0·39%	$12·1 billion
Eastern Europe and central Asia	0·75%	$17·6 billion
Subtotal (low-income and middle-income countries)	0·39%	$70·9 billion
High-income countries	0·53%	$231·4 billion
World	0·49%*	$302·0 billion (total estimated loss)

Estimates are based on data for 96 countries (of 197 countries in the UNICEF's 2014 database).[91] For details about data and included countries, and country-level results, see appendix pp 115–16. *Global average, weighted by gross national income.

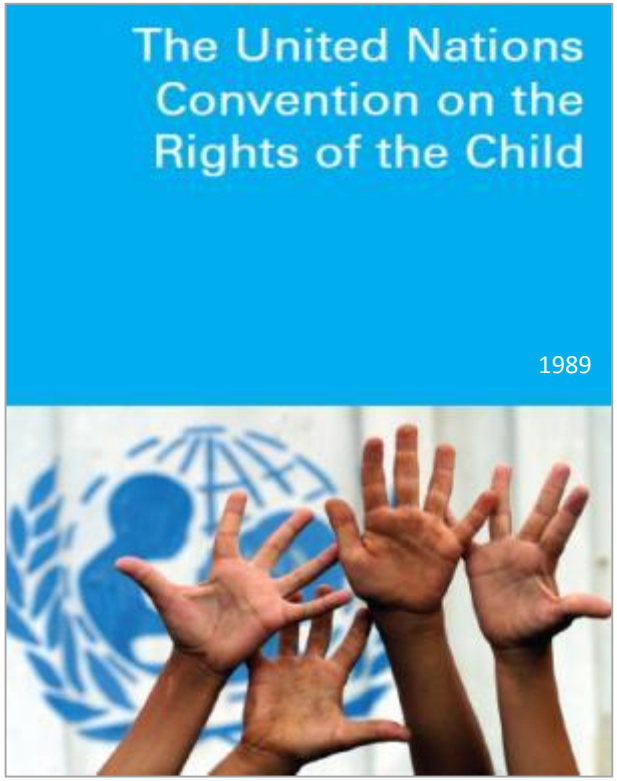
Table 2: **Estimated economic losses from cognitive deficits associated with regional infant feeding practices compared with every infant breastfeeding until at least 6 months of age.**

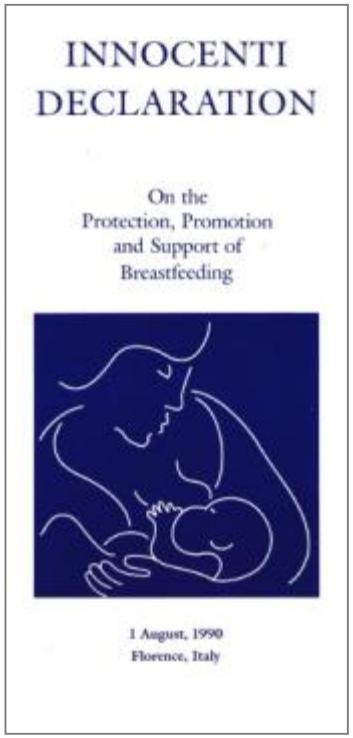
Building an enabling environment to support breastfeeding: key actions

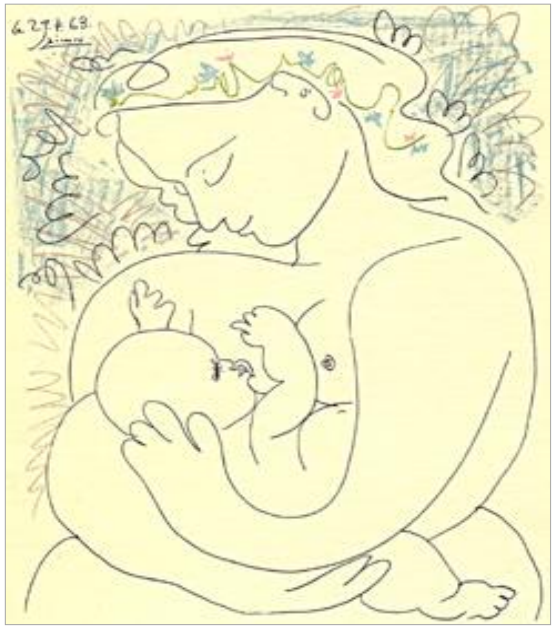
A package of actions, policies and programs to support mothers at health facilities, home and work has the greatest impact

- **Disseminate accurate information** on the value of breastfeeding
- **Foster positive social attitudes toward breastfeeding**
- **Demonstrate political will** to support breastfeeding
- **Regulate the breastmilk substitute industry** by implementing, monitoring and enforcing the Code
- **Scale up and monitor breastfeeding interventions**
- **Enact policy interventions** to ensure that maternity protection and workplace interventions are implemented

Every mother and child, no matter their location or circumstance, benefits from optimal breastfeeding







Shared responsibility for creating a supportive environment for mothers to exercise their choice

"If breastfeeding did not already exist, someone who invented it today would deserve a dual Nobel Prize in medicine and economics."

Keith Hanson,
Vice President for Human Development,
World Bank Group

Acknowledgements

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