Breastfeeding 2

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

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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.

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This is the second in a Series of two papers about breastfeeding

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Introduction

Breastfeeding improves the survival, health, and development of all children.[1] It saves women's lives and contributes to human capital development. The benefits span populations living in high-income, middle-income, and low-income countries.[1] In the second paper in this Series, we summarise the evidence on determinants of, and interventions to improve, breastfeeding practices. We discuss the effect of the breastmilk substitute industry on breastfeeding practices, and explore the reasons why some countries have been more successful in improving breastfeeding than others. We also estimate some of the economic costs and environmental consequences of not breastfeeding.

The Innocenti Declaration: an ideal not yet realised

Breastfeeding became less common in high-income countries during the 20th century.[2] Similar patterns were also seen in better-educated, wealthier, and urban women in low-income and middle-income countries.[1,3] Breastmilk substitutes were perceived as modern and prestigious, and breastfeeding was associated with being poor and unsophisticated.[4] In August, 1990, policy makers and international agencies adopted the Innocenti Declaration,[5] which affirmed that all infants should receive "exclusive breastfeeding from birth to 4–6 months of age [WHO recommendations amended to 6 months in 2001[6]] and thereafter should continue to be breastfed". In the same year, the UN Convention on the Rights of the Child enshrined health and health care, including the advantages of breastfeeding, as a legal right of the child and the promotion of breastfeeding as a legal obligation of countries that ratified the Convention. The Convention called for states to take appropriate measures for children of working parents, and to protect the public from improper and biased information that persuades mothers to give up breastfeeding.[7] In 1991, the Baby Friendly Hospital Initiative (BFHI) was launched to scale up ten interventions in birthing facilities to protect, promote, and support successful breastfeeding (appendix p 1).[8]

Despite these initiatives being established 25 years ago, global breastfeeding rates remain far below international targets,[9] and commitment to breastfeeding, in terms of policy and investment, is in a state of fatigue.[10] For all low-income and middle-income countries with data, exclusive breastfeeding rates increased from 25% in 1993 to 37% in 2013; in the wealthiest 20% in each country, breastfeeding increased from 16% to 36%, whereas the poorest 20% followed the general trend. Continued

Key messages

- The world is still not a supportive and enabling environment for most women who want to breastfeed.
- Countries can rapidly improve breastfeeding practices by scaling up known interventions, policies, and programmes.
- Success in breastfeeding is not the sole responsibility of a woman—the promotion of breastfeeding is a collective societal responsibility.
- The breastmilk substitute industry is large and growing, and its marketing undermines efforts to improve breastfeeding.
- The health and economic costs of suboptimal breastfeeding are largely unrecognised. Investments to promote breastfeeding, in both rich and poor settings, need to be measured against the cost of not doing so.
- Political support and financial investment are needed to protect, promote, and support breastfeeding to realise its advantages to children, women, and society.

breastfeeding at 12–15 months decreased from 76% to 73% globally, driven largely by the decrease in prevalence in poor populations.[1]

Determinants of breastfeeding

We did a systematic review of available studies to identify the determinants of breastfeeding (appendix pp 2–86), and reviewed and revised previous conceptual frameworks. The conceptual model (figure 1) includes the determinants that operate at multiple levels and affect breastfeeding decisions and behaviours over time. Nearly all women are biologically capable of breastfeeding, bar very few with severely limiting medical disorders.[11] However, breastfeeding practices are affected by a wide range of historical, socioeconomic, cultural, and individual factors (figure 1).

Social and cultural attitudes and market factors shape the structural context for breastfeeding.[12] Breastfeeding is often portrayed as the ideal for babies, demonstrating maternal devotion. However, in some settings women who want to breastfeed in public experience negative reactions.[13,14] Some employers and fellow employees report being uncomfortable with women breastfeeding at work.

In health systems, health-care providers influence and support feeding decisions at key moments before and after birth and later, when challenges occur, to maintain exclusive and continued breastfeeding.[15] Nevertheless, substantial gaps in knowledge and skills to support breastfeeding are reported at all levels of health-care staff.[16,17]

High-risk pregnancies,[18] assisted delivery and long hospital stays,[19] maternal illness,[20] and preterm, ill, or low-birthweight newborn babies,[21] can result in breastfeeding starting later, as can hospital practices such as mother–infant separation,[22] prelacteal supplementation, and free samples of breastmilk substitutes.[23] Within families, the practices and experience of female relatives affect the incidence and duration of breastfeeding.[24,25] In many traditional societies, colostrum is viewed as harmful and discarded,[26] and prelacteal feeds can delay breastfeeding for several days.[27] The attitudes and preferences of fathers can also affect breastfeeding: women whose partners support breastfeeding breastfeed for longer.[28,29]

Women's work is a leading motive for not breastfeeding or early weaning. Its effect is multi-dimensional, including fatigue, practicality, and intensity.[30] The increasing numbers of women in the workforce draw attention to the importance of work-time breaks and on-site rooms for breastfeeding and the provision of maternity leave.[31,32] Most studies report negative effects of work on breastfeeding;[33–35] women planning to return to work after childbirth are less likely to begin or continue breastfeeding.[36,37] Short maternity leave (<6 weeks) leads to a four-times increase in the odds of either not establishing or early cessation of breastfeeding.[38]

At the personal level, breastfeeding intentions are generally established by the third trimester.[39] Subjective norms and benefits of breastfeeding are the most frequently cited reasons for intending to breastfeed. Intention is strongly predictive of initiation[40] and of duration,[41] provided the context is supportive.[42]

Individual factors, including advice and practices that undermine maternal confidence and self-efficacy, negatively affect breastfeeding.[43,44] Poor breastfeeding positioning and latching[45] as well as inadequate support, especially in the first weeks after birth, and anticipation of breastfeeding difficulties are common reasons for abandoning breastfeeding. Mothers who do not successfully breastfeed are less likely to attempt breastfeeding in subsequent pregnancies.[46] Infant crying or fussiness, perceived hunger, and the inability to settle her infant[47,48] often cause a mother to assume that she has insufficient milk and to introduce breastmilk substitutes.[49]

Individual-level factors, including smoking,[50,51] overweight and obesity,[52] and depression,[53] are important determinants because of the large number of women affected.[54,55] In the past 20 years, the HIV epidemic has significantly affected policy and programmatic recommendations, community and family attitudes, and health-care worker confidence in breastfeeding, all of which have detrimentally affected individual feeding practices (appendix pp 87–88).[56–62]

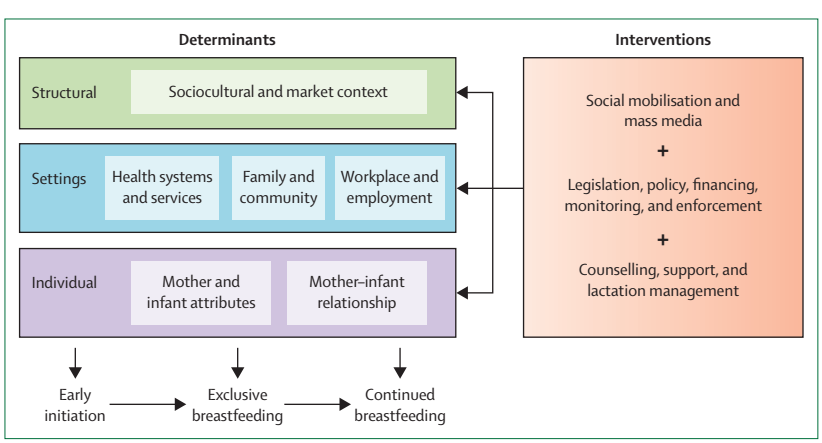

Figure 1: **The components of an enabling environment for breastfeeding—a conceptual model**
The structural level refers to the social factors that affect the whole population. For determinants, these factors include social trends, advertising, media, and products available in stores; interventions at the structural level include legislation, policy, and media and social mobilisation to change social attitudes and practices. These factors are distal and unidirectional. The population is uniformly exposed to them, but they are not uniformly interpreted. Pregnant women and women with young children are affected in more direct and personalised ways than are women with no children and men and community members. This effect occurs through various interactions, attitudes, practices, and information in the three main settings, which are, in turn, affected by the social, cultural, and market context. At the most intimate level, women's breastfeeding behaviour is influenced by personal attributes such as her age, weight, education, and confidence, and by attributes of her baby such as sex, wellbeing, and temperament. Breastfeeding is a behaviour that entails a relationship between mother and baby. Moment-by-moment interactions between them, including whether the baby is thought to be satisfied and content, are the result of the mother's internalisation of the influences at the level of structural determinants and settings.

Interventions to improve breastfeeding practices

Many aforementioned determinants of breastfeeding are amenable to interventions to protect, promote, or support improved breastfeeding.[63] We examined the effects of interventions according to settings identified in the

conceptual model: health systems and services, family and community, and workplace and employment. We also reviewed available data for policies to address structural factors that create an enabling environment for breastfeeding. We did a systematic review and meta-analysis[64] of interventions delivered in these settings according to the conceptual model. We also examined combined interventions—ie, those delivered concurrently in more than one setting. We assessed four outcomes: breastfeeding initiation within 1 h of birth, exclusive breastfeeding up to 6 months, continued breastfeeding from 12 months to 23 months, and any breastfeeding up to 6 months of age (see appendix pp 89–96 for further information about our methods and findings).

Health systems

For our meta-analyses we considered several interventions included in the BFHI: individual counselling or group education, immediate breastfeeding support at delivery, and lactation management. These interventions increased exclusive breastfeeding by 49% (95% CI 33–68) and any breastfeeding by 66% (34–107; table 1).

An earlier meta-analysis reported a negative association between caesarean sections and early breastfeeding but no effect at 6 months.[19] Our findings suggest that in the presence of adequate support, a caesarean section is not necessarily a barrier to timely breastfeeding initiation (risk ratio [RR] 0·95 [95% CI 0·84–1·07]) or to exclusive breastfeeding (1·08 [0·82–1·41]; data not shown).

Family and community

We did a meta-analysis of interventions providing antenatal and postnatal support to mothers, fathers, and other family members at home, including community health workers and peer-to-peer counsellors: counselling by a nurse, trained lactation counsellor, or other health provider, including post-discharge telephone calls combined with home visits. Fathers were targeted individually, and in group counselling sessions. Home and family-based interventions were effective at improving exclusive (RR 1·48 [95% CI 1·32–1·66]), continued (1·26 [1·05–1·50]), and any (1·16 [1·07–1·25]) breastfeeding, and tended to improve early initiation (1·74 [0·97–3·12]). Interventions that provided antenatal and postnatal counselling were more effective than were those targeting one period only, whereas interventions targeting fathers gave mixed results.

Community-based interventions, including group counselling or education and social mobilisation, with or without mass media, were similarly effective, increasing timely breastfeeding initiation by 86% (95% CI 33–159) and exclusive breastfeeding by 20% (3–39). We identified no studies that examined the effect of community-level interventions on continued breastfeeding. Findings from the one study we identified on the effect of mass or social media on breastfeeding suggested that it has a major effect on early initiation of breastfeeding (RR 5·33 [2·33–12·19]). Social media needs additional study in view of its wide and effective use to market breastmilk substitutes and other products.[65]

The workplace, maternity protection, and nursing breaks for working mothers

Although nearly all countries have maternity protection legislation, only 98 (53%) of 185 countries meet the International Labour Organization's 14-week minimal standard and only 42 (23%) meet or exceed the recommendation of 18 weeks' leave;[32] large informal work sectors further compound these inadequacies. Consequently, hundreds of millions of working women have no or inadequate maternity protection, the overwhelming majority (80%) of whom live in Africa and Asia. The few data available suggest that maternity leave policies are effective at increasing exclusive breastfeeding (RR 1·52 [1·03–2·23]). Breastfeeding can be continued after a return to work in settings where maternity leave[37] or child care is available and where breastfeeding or the expressing of breastmilk is supported.[66]

The reduction of barriers for working mothers to breastfeed by providing lactation rooms and nursing breaks are low-cost interventions that can reduce absenteeism and improve workforce performance, commitment, and retention.[32] An analysis of national policies in 182 countries showed that breastfeeding breaks with pay were guaranteed in 130 countries (71%), unpaid breaks were offered in seven countries (4%), and 45 countries (25%) had no policy. In multivariate models, paid-break guarantees for at least 6 months were associated with an 8·9% point increase in exclusive breastfeeding.[67] Findings from a study in the USA showed that lactation rooms and breaks to express breastmilk increased breastfeeding at 6 months by 25% (95% CI 9–43).[68]

Other enabling policies and interventions

Most studies reviewed explored the effects of direct interventions, rather than the role of policies and enabling interventions on breastfeeding outcomes. Enabling interventions operate by removing structural and societal barriers that interfere with women's ability to breastfeed optimally. Examples include maternity and workplace policies or regulations to restrict marketing of breastmilk substitutes; health insurance or other financing mechanisms for lactation support; and baby-friendly hospital certification.

Data about the effect of policies are rarely reported. However, a study from 14 countries with baseline exclusive breastfeeding rates lower than 30% showed that rates had a 1% point increase per year in countries that scored highly on a composite indicator rating implementation of pro-breastfeeding policies and programmes. By contrast, little change (0·2% point

	Early initiation of breastfeeding (within 1 h of birth)	Exclusive breastfeeding for 0–5 months	Continued breastfeeding for 12–23 months	Any breastfeeding up to 6 months
Health systems and services				
Overall	29 studies: RR 1·11 (1·06–1·16)	51 studies: RR 1·46 (1·37–1·56)	Eight studies: RR 1·18 (1·03–1·35)	47 studies: RR 1·40 (1·30–1·52)
Baby-friendly support	Ten studies: RR 1·20 (1·11–1·28)	15 studies: RR 1·49 (1·33–1·68)	Three studies: RR 1·26 (0·96–1·64)	13 studies: RR 1·66 (1·34–2·07)
Counselling* or education	Ten studies: RR 1·12 (1·05–1·19)	28 studies: RR 1·66 (1·43–1·92)	Five studies: RR 1·15 (0·99–1·35)	24 studies RR 1·47 (1·29–1·68)
Special training of health staff	Three studies: RR 1·09 (1·01–1·18)	Five studies: RR 1·36 (1·14–1·63)	No studies	Five studies RR 1·33 (1·07–1·67)
Family and community				
Home and family	Five studies: RR 1·74 (0·97–3·12)	43 studies: RR 1·48 (1·32–1·66)	Two studies: RR 1·26 (1·05–1·50)	36 studies: RR 1·16 (1·07–1·25)
Counselling* or education	Five studies: RR 1·74 (0·97–3·12)	38 studies: RR 1·58 (1·39–1·80)	One study: HR 1·22 (1·01–1·47)	33 studies: RR 1·17 (1·08–1·27)
Family or social support	No studies	Five studies: RR 0·95 (0·87–1·02)	One study: RR 1·69 (0·95–2·99)	Three studies: RR 1·02 (0·86–1·22)
Community	Five studies: RR 1·86 (1·33–2·59)	Six studies: RR 1·20 (1·03–1·39); one study: OR 1·10 (0·60–1·80)	No studies	No studies
Group counselling* or education	Four studies: RR 1·65 (1·38–1·97)	One study: RR 1·61 (0·95–2·71); one study: OR 1·10 (0·60–1·80)	No studies	No studies
Integrated mass media, counselling, and community mobilisation approach	One study: RR 5·33 (2·33–12·19)	Five studies: RR 1·17 (1·0–1·36)	No studies	No studies
Work environment				
Work environment	No studies	Four studies: RR 1·28 (0·98–1·69)	One study: RR 3·33 (1·43–10·0)	Four studies: RR 1·31 (1·10–1·56)
Maternal leave policy	No studies	Two studies: RR 1·52 (1·03–2·23)	No studies	One study: RR 0·99 (0·8–1·29)
Workplace support	No studies	Two studies: RR 1·08 (0·74–1·60)	No studies	One study: RR 1·25 (1·09–1·43)
Employment status	No studies	No studies	One study: RR 3·33 (1·43–10·0)	Two studies: RR 1·49 (1·12–1·98)
Combination of settings				
Combination of settings	Ten studies RR 1·57 (1·24–1·97)	26 studies RR 1·79 (1·45–2·21)	Seven studies RR 1·97 (1·74–2·24)	30 studies RR 1·30 (1·06–1·61)
Health systems and services and home and family	Six studies: RR 1·36 (1·07–1·73)	16 studies: RR 1·63 (1·27–2·10)	Six studies: RR 1·34 (1·01–1·81)	21 studies: RR 1·23 (1·08–1·40); two studies: OR 2·08 (1·32–3·28)
Home and family and community	Three studies: RR 1·85 (1·08–3·17)	Three studies: RR 1·42 (1·21–1·66)	No studies	Three studies: RR 1·00 (0·89–1·12)
Health systems and services and community	One study: RR 2·09 (1·64–2·67)	Seven studies: RR 2·52 (1·39–4·59)	One study: RR 10·2 (7·66–13·74)	Six studies: RR 1·74 (0·84–3·39)

Data are risk ratio (RR; 95% CI) or odds ratio (OR; 95% CI). All estimates of effect and methods are provided in Sinha and colleagues.[64] *Antenatal counselling focused on infant feeding decision making and preparation for breastfeeding; periodic postnatal home and family encounters focused on establishing exclusive breastfeeding, managing problems and challenges, and continued breastfeeding.

Table 1: **Effects of interventions on breastfeeding outcome measures, by setting**

change per year) was recorded in countries with low composite scores.[69] Such data emphasise that societies also need to protect women's personal decisions, and policies are a means of empowering women to breastfeed while conveying social value to breastfeeding as a norm.

In summary, our meta-analyses indicate that breastfeeding practices are highly responsive to interventions delivered in health systems, communities, and homes. Maternity leave and workplace interventions are also beneficial, although studies are few and are generally limited to high-income settings. The largest

effects of interventions on breastfeeding outcomes are achieved when interventions are delivered in combination. For example, combined health systems and community interventions increase exclusive breastfeeding by 2·5 times (table 1).

The International Code of Marketing of Breastmilk Substitutes

Compelling accounts of inappropriate and unethical marketing of breastmilk substitutes and of many infants becoming malnourished or dying from contaminated or diluted breastmilk substitutes[70] were followed by the adoption of the International Code of Marketing of Breastmilk Substitutes at the 34th World Health Assembly in 1981. The Code implicitly recognised that health workers, women, and families are susceptible to direct and indirect marketing strategies. It consists of 11 articles which, along with subsequent resolutions from the World Health Assembly, outline the responsibilities of governments, health-care systems, and workers, and of the companies that market or manufacture breastmilk substitutes. The Code represents the collective will of the member states of the UN and so carries substantial political and moral weight. However, it depends on national legislation, monitoring, and enforcement for its effectiveness. Violations of the Code remain prevalent[71] and show that without enforceable legislation and investment to support monitoring, it will have limited effect (appendix p 97).

Contextual factors on breastfeeding trends

Findings from case studies complement quantitative data by showing how synergies created through a mixture of interventions can improve breastfeeding. We discuss three pairs of countries (representing about a quarter of all children younger than 4 years worldwide) that are similar in economic development but differ in breastfeeding trends to explore why breastfeeding prevalence has increased, stagnated, or declined with time (panels 1 and 2). In addition to having large populations, these countries reflect the world's largest regions and comprise different mixes of public and private health care. Bangladesh is a low-income country and Nigeria is a lower middle-income country, Brazil and China are upper middle-income countries, and the UK and the USA are high-income countries (see appendix p 98 for breastfeeding practices and trends in each country).

These case studies show that breastfeeding can increase when countries implement and coordinate two or more actions. In Bangladesh, the focus was on comprehensive health-worker training, strategic use of data, and mass media. Brazil also focused on health-worker training while at the same time made hospitals baby friendly and strengthened maternity protection and the implementation of the Code. In the USA, there were policy changes and strategic collection and use of data. Strong civil society engagement and participation was a common element across all three of these countries, whereas it was weak in the countries that had static or declining breastfeeding rates.

The effect of industry

Knowledge of the breastmilk substitute market and marketing practices are essential for understanding the competing environment in which efforts to protect, promote, and support breastfeeding operate. Market research was commissioned for this Series from Euromonitor International (specific methods, definitions, and results are in appendix pp 99–114; market research terminology to describe baby milk formula are used— standard: for infants <6 months; follow-on: for infants 7–12 months; toddler: 13 months onward; special: for specific medical conditions; and "all baby milk formula": all of these together).

The retail value of the baby milk formula industry is growing. Unlike other commodities, baby milk formula seems to be resilient to market downturns. In 2014, global sales of all baby milk formula were about US$44·8 billion—by 2019, the market value is projected to reach $70·6 billion (figure 2). In 2009, when the growth of real gross domestic product turned negative globally, baby milk formula sales still grew by 8% annually in constant value terms (figure 2).

Marketing by the infant feeding industry and the availability of formula, including the distribution of free samples,[77–79] increase rates of bottle-feeding.[80,81] Formula advertisements portray formula milk to be as good as or better than breastmilk, or present it as a lifestyle choice rather than a decision with health and economic consequences.[82] Mothers report that media is an important source of information, and findings from studies in several countries associate recollection of formula advertisements with decreased breastfeeding.[83,84] Marketing messages can also convey that breastfeeding is difficult and that breastmilk substitutes help to settle fussy babies.[85] Findings from a 2008 population-based study in the USA showed that 67% of mothers had received free milk formula samples, and that such gifts were associated with shorter breastfeeding duration.[86] Industries selling breastmilk substitutes and related products often sponsor health professional associations[87,88]—for which comprehensive funding data are scarce—which might introduce conflicts of interest in their support of breastfeeding.

Per-child consumption of all types of formula (total retail volumes divided by the population of children aged 0–36 months, corrected for population growth) is highest in western Europe and Australasia, followed by North America. However, projected growth from 2014 to 2019 in these regions is only about 1%. Although present consumption is lower in other regions, the corresponding increase in the Middle East and Africa is expected to be more than 7% and in the Asia Pacific it is expected to be more than 11%.

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Panel 1: Case studies from low-income and middle-income countries

Bangladesh and Nigeria

Bangladesh has overall higher breastfeeding rates than Nigeria. In the past 6–8 years, exclusive breastfeeding has increased in both countries, although the percentage-point increase in Bangladesh is double that of Nigeria (13% *vs* 6%; appendix p 98). In Bangladesh, comprehensive health-worker training, community mobilisation, and media campaigns that reached much of the population probably explain a large part of this difference since both countries have adopted the International Code of Marketing of Breastmilk Substitutes (although weakly implemented) and both have a low potential reach of the Baby Friendly Hospital Initiative (about two-thirds of births occur at home). Bangladesh has benefited from strategic technical expertise from the Alive and Thrive Initiative, UNICEF, and civil society, which focused on reaching scale, addressing known barriers, the use of evidence, the alignment of diverse groups into common or harmonised messages, and advocacy to policy makers.[72] Maternity leave in Bangladesh is 6 months (compared with only 16 weeks in Nigeria), which, although it affects few women in view of their low participation in the formal labour market, signals a high degree of political commitment to breastfeeding in the country.

Actions to support breastfeeding in Nigeria, while ongoing, are challenged by the fragmented health-care system and less comprehensive and intensive approach compared with Bangladesh. The Code was last updated in 2005 and enforcement has been weak. Compared with Bangladesh, health-worker training has not been as comprehensive, a media campaign has not been implemented, and the strategic use of advocacy for policy change has been absent. Implementation of the Baby Friendly Hospital Initiative has slowed because of a shortage of funding. In Nigeria, the retail value of the milk formula market in 2019 is projected to reach US$42·8 million, or 0·06% of the global market (the 58th largest consumer worldwide; appendix p 111), and coupled with the shortage of comprehensive health-worker training, media campaigns, and advocacy, might explain to some extent why the increases in exclusive breastfeeding have been quite low (appendix p 98; comparable data for the breastmilk substitute market are not available for Bangladesh).

Brazil and China

Brazil and China have vastly different breastfeeding histories: between 1996 and 2006, any breastfeeding at 12 months in Brazil had a point increase of 15%, whereas between 2003 and 2008, a 5% point decrease occurred in China (figure 2). In Brazil, breastfeeding duration increased from 2·5 months in 1974–75 (one of the shortest in any low-income or middle-income country) to 14 months by 2006–07.[73] Brazil exemplifies a country in which policies and programmes addressing all three levels of the conceptual framework (individual, settings, and structural) have been implemented simultaneously.[74] The Code, enacted shortly after adoption by the World Health Assembly, has been updated three times and is rigorously monitored for compliance. Paid leave is available to mothers (24 weeks) and fathers (3 days). A systematic process for certification and recertification of hospitals as "Baby Friendly" to maintain quality standards has been instituted and health-worker training has been extensive. An innovative network of human-milk banks in more than 200 hospitals has established the use of human milk and breastfeeding as a valued and normative practice. Visible government leadership and investment and active civil society participation underpin Brazil's breastfeeding achievements. Nonetheless, it is the tenth largest market for baby milk formula, and is projected to reach $951 million by 2019.

Breastfeeding promotion in China faces unique challenges because of the country's enormous population and large number of maternity facilities (about 600 000). Although China enacted Code legislation in 1995, it has not been updated to take into account new marketing tactics, and implementation and enforcement are weak or non-existent. Independent monitoring in 2012 showed that 40% of new mothers reported receiving at least one free formula sample.[75] Of these, 60% reported being provided the sample by staff of breastmilk-substitute companies and 37% reported being offered the sample by health workers. Although the Baby Friendly Hospital Initiative is actively implemented by the Ministry of Health, no public information is available about the number of hospitals certified because there is no centralised process for the monitoring and reporting of implementation. Furthermore, authorities can only assess few facilities per year, with certification almost entirely based on self-assessment. Maternity leave is only 14 weeks, and in 2010 China had the highest female labour participation rate of high-income and middle-income countries studied (67% *vs* 60% for Brazil).[32] It is also the largest market for baby milk formula, valued at $17 783 million in 2014 and is projected to more than double by 2019. Lack of a well-coordinated government programme, active civil society participation, and a lower level of maternity protection than that of Brazil combined with aggressive unchecked marketing of breastmilk substitutes, might explain the decreases in breastfeeding in China.

As expected, per-person annual expenditure (total retail sales divided by the population of children aged 0–36 months, corrected for population growth) is greater in high-income countries ($2528) than it is in high middle-income countries ($209) and low-income and middle-income countries ($151; appendix pp 106–114). In high-income markets, sales of standard milk formula (for infants aged <6 months) are static or decreasing because of market maturity, decreasing birth rates, and legislation on advertising and sales. The enormous difference in market sales between high-income and middle-income countries is due to large and increasing sales of follow-on and toddler milks: these products are often not covered under national Code-related laws and regulations. In middle-income countries, year-on-year total sales until 2019 are expected to grow by 8%, mainly due to standard

Panel 2: Breastfeeding in the USA and the UK

Rates of breastfeeding, although low, are increasing in both countries, with the USA achieving greater gains (appendix p 98). In the USA, although it has no Code legislation and maternity leave of 12 weeks is unpaid, other efforts to support breastfeeding have greatly expanded and were further galvanised by the Surgeon General's Call to Action to Support Breastfeeding in 2011.[76] Breastfeeding targets and actions to improve breastfeeding, such as peer and professional support and implementation of the Baby Friendly Hospital Initiative, are reported by the US Centers for Disease Control and Prevention in a yearly Breastfeeding Report Card, thus helping to create accountability. Breastfeeding in public is protected through legislation in nearly all states, and a civil society coalition, comprising nearly 50 groups and institutions, plans and coordinates actions. Historic 2012 national health-care legislation included mandatory insurance coverage for lactation counselling and breastmilk pumps as well as requirements for employers to provide space and time for breastmilk expression. A government programme covering more than half of newborn babies—one which provides free milk formula—was reformed to enhance incentives for women to breastfeed. A robust set of policy changes along with active civil society engagement could explain why, despite being the second largest market for milk formula, the USA is one of only two countries where growth is projected to be negative.

By contrast with the USA, the UK provides a full year of paid maternity leave. Additionally, in the UK a far larger proportion of maternity services (estimated at about 40%) and public health nursing services than in the USA have "Baby Friendly" accreditation. Code legislation exists but it is not comprehensive and is poorly enforced despite continual, independent monitoring and reporting. Although many active non-governmental organisations exist, a coalition similar to that in the USA does not presently exist in the UK. Much like in the USA, the UK has legislation protecting breastfeeding in public, although it is not well publicised. Rates of improvements in breastfeeding are larger in Scotland, Wales, and Northern Ireland, where local government has been proactive in implementing comprehensive policies and programmes. However, when the data are combined, the larger population of England compared with the other countries in the UK dilutes improvements elsewhere in the UK where attention to breastfeeding has led women to take advantage of the maternity benefits and favourable hospital conditions (a high proportion of hospitals are Baby Friendly Hospital Initiative accredited). In the UK, the milk formula market is the eleventh largest in the world and growing, with sales projected to reach US$907 million in 2019.

formula sales. In high-income countries, it is follow-on and toddler milks that will drive the estimated future 15·2% growth. Similar data are not available for low-income countries. France and the USA are the only two major economies where the market growth rate is expected to turn negative (–2·5% in France and –0·3%, in the USA): the decreases are the result of legislation, public awareness campaigns, and actions by civil society in support of breastfeeding.

Brazil exemplifies how vulnerable breastfeeding practices can be during economic transitions. Even though breastfeeding is deeply valued, and government and civil society have invested in its support, per-baby consumption of breastmilk substitutes is projected to increase by 6·8% between 2014 and 2019, making Brazil's one of the highest growth rates in the world (appendix pp 106–114). This increase is probably due to increased purchasing power and replacement of locally available animal milk by breastmilk substitutes, rather than a decrease in breastfeeding rates.

Data for marketing budgets for breastmilk substitutes were not available, but these budgets are assumed to be large. The trajectories of retail sales indicate that marketing strategies are effective, which emphasises the importance of comprehensive national laws and regulations to curb inappropriate marketing practices with adequate monitoring and meaningful penalties to protect breastfeeding.

The economic argument for investment in breastfeeding

Improved breastfeeding practices would prevent 823 000 annual deaths in children younger than 5 years of age and 20 000 annual deaths in women caused by breast cancer.[1] Breastfeeding also reduces morbidity and improves the educational potential of children and probably their earnings as adults.[1]

We will now discuss the economic value of breastfeeding, using new data for relative risks from a series of systematic reviews (the first paper in this Series).[1] We first provide global estimates of the economic magnitude of the cognitive benefits associated with breastfeeding, and then of reduced direct treatment costs associated with lower child morbidity in four countries. We have taken a conservative approach by restricting our analysis to children—ie, by excluding women's cancers and not estimating the economic value of non-treatment-related savings, such as time and travel-related savings for caregivers and patients.

The economic cost of lower cognition

We modelled the economic benefits of improved cognition based on estimates from a 2015 meta-analysis,[89] the findings of which showed that longer breastfeeding duration was associated with a 2·6 point (95% CI 1·25–3·98) increase in intelligence quotient (IQ) score, which is equivalent to 0·17 standard deviations (SDs) in

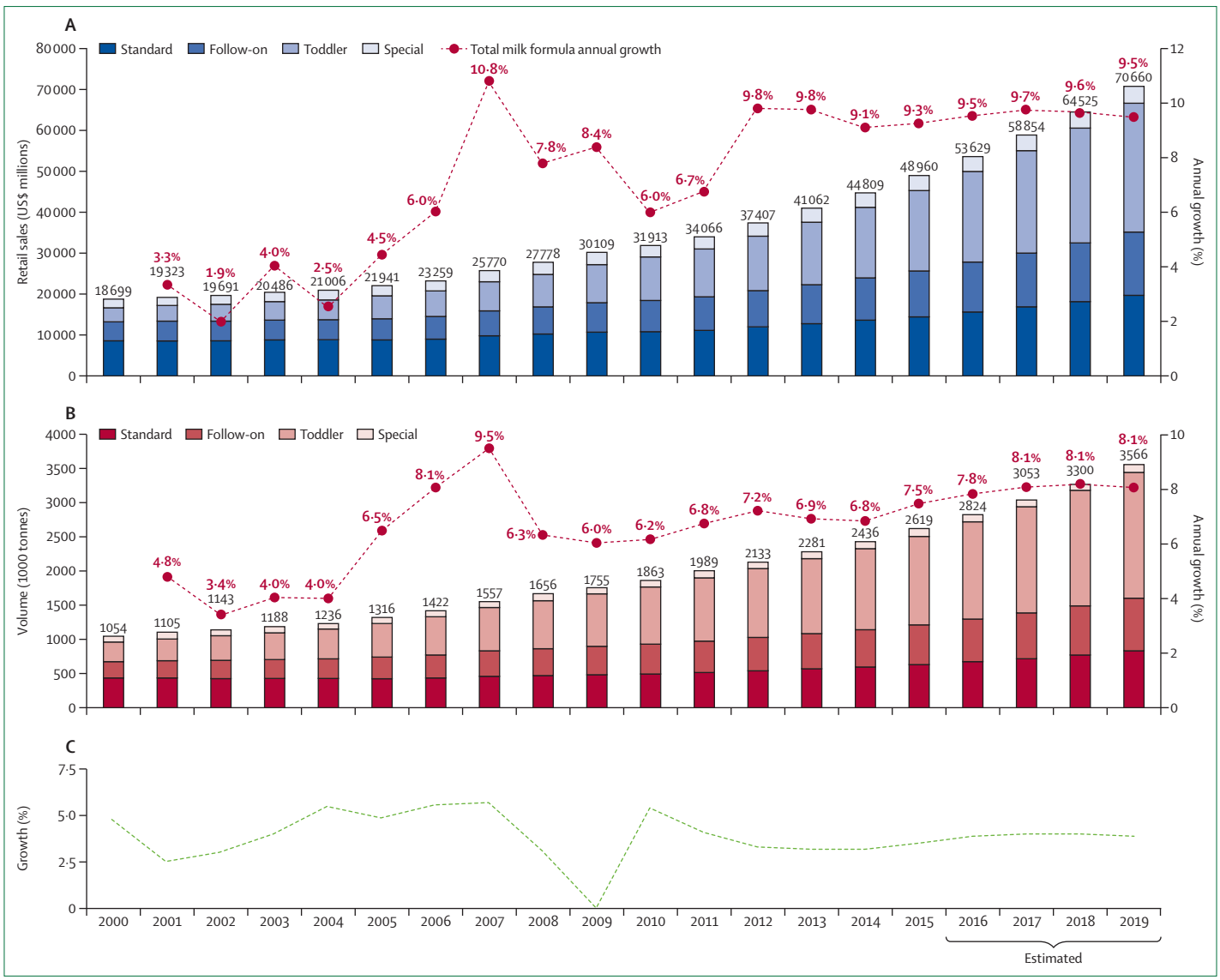

Figure 2: **The total baby milk formula market by value (A) and volumes (B) and growth in real gross domestic product (C) from 2000 to 2014 and estimated growth from 2015 to 2019**
Price sensitivity was more evident in high-income countries as milk formula growth rates decreased, whereas most emerging markets saw income growth despite the global economic recession. Emerging market consumers in effect drove the purchase in milk formula. Data for these graphs were provided by Euromonitor International (2015).

cognitive score. The investigators reported a dose effect in that greater benefits are achieved with longer durations of breastfeeding. However, because of data limitations we can only model the effect of extending breastfeeding to 6 months or longer. On the basis of a detailed survey of published studies, Hanushek and Wössmann estimated that one SD increase in cognitive scores (ie, 15 IQ points) is associated with a 12% increase in hourly earnings in high-income countries and a 16% increase in low-income and middle-income countries.[90] We assumed that labour income is about half of total national income (as estimated by the World Bank World Development Indicators), and that cognitive improvements affect only this half of national income.

We use the effect size for breastfeeding on IQ, to estimate the global loss of gross national income (GNI) associated with present levels of any breastfeeding at 6 months, as compared with all children receiving any breastfeeding up to 6 months of age. We chose "all" children receiving any breastfeeding at 6 months for comparison, because 40 of the 103 countries for which we had data already exceed 90%, and six countries exceed 99%.

Table 2 summarises our estimates, for which we used a prevalence-based method (see appendix pp 115–116 for methods and additional data related to cognition economic analyses). The losses amount to $302 billion annually, or 0·49% of world GNI. Losses in low-income and middle-income countries account for $70·9 billion,

or 0·39% of their GNI, whereas the losses for high-income countries are $231·4 billion, or 0·53% of their GNI. Five countries (Belgium, France, Greece, Saudi Arabia, and the United Arab Emirates) lose more than 0·75% of GNI. These estimates are similar in magnitude to GNI losses attributed to iron-deficiency anaemia, previously calculated for five low-income or lower middle-income countries.[92]

The economic cost of childhood morbidity

To show the potential effects of reduced morbidity on health-care costs, we estimated the treatment costs of five common infectious diseases in childhood in four countries (for the USA, we also include another four childhood diseases); we report what the respective treatment costs would be if exclusive and continued breastfeeding had a point increase of 10% from current levels or if 90% coverage was achieved. Meta-analyses reviewed in the first paper in this Series[1] indicate that substantial protective effects of breastfeeding on otitis media, diarrhoea, necrotising enterocolitis, and pneumonia exist. For a fifth disorder, bronchiolitis, we used the same relative risk as we did for pneumonia (similar to relative risks reported elsewhere for reduced bronchiolitis in breastfed infants[93,94]). Breastfeeding probably protects against other disorders, which, for three of the four countries, are not included—eg, obesity, diabetes mellitus, sudden infant death syndrome, and malocclusion. Our estimates are therefore conservative.

We provide these estimates for the UK, the USA, Brazil, and China. National treatment costs for the UK and the USA come from two studies.[95,96] In the UK study, the investigators estimated the effect on treatment costs if breastfeeding prevalence increased to 45%.[95] In the USA study, another four childhood disorders (asthma, leukaemia, type 1 diabetes, and childhood obesity) were included in the original calculations and are also included in our analyses. For Brazil, we used data from a national database on expenditures for admissions to hospital made available by the Ministry of Health. The China analysis uses unpublished data provided by the China National Health Development Research Centre for October, 2013, to September, 2014. These data were used to estimate treatment costs for the 53% of China's population (appendix pp 117–20) living in urban areas;[97] no information is available for those in rural areas (see appendix pp 117–120 for additional details of this analysis). The required data were not available for Bangladesh and Nigeria.

A 10% point increase in exclusive breastfeeding up to 6 months or continued breastfeeding up to 1 year or 2 years (depending on country and disorder) would translate into reduced treatment costs of childhood disorders of at least $312 million in the USA, $7·8 million in the UK, $30 million in urban China, and $1·8 million in Brazil (all values in 2012 US$). Alternatively, improved breastfeeding from present levels to 90% for USA, China, and Brazil, and to 45% for the UK (45% coverage for the UK, based on design, data available, and definitions used in the original study[95]) would reduce treatment costs by at least $2·45 billion in the USA, $29·5 million in the UK, $223·6 million in urban China, and $6·0 million in Brazil (all values in 2012 US$; appendix p 120). The estimates for Brazil are less comparable because data for treatment expenditures were available only at federal level and not at state level and were therefore less generalisable than were those of other countries.

	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**

The environmental costs of not breastfeeding

Although not yet quantifiable in monetary terms, environmental costs are also associated with not breastfeeding. Breastmilk is a "natural, renewable food" that is environmentally safe and produced and delivered to the consumer without pollution, unnecessary packaging, or waste.[98] By contrast, breastmilk substitutes leave an ecological footprint and need energy to manufacture, materials for packaging, fuel for transport distribution, and water, fuel, and cleaning agents for daily preparation and use,[99] and numerous pollutants are generated across this pathway.[100] More than 4000 L of water are estimated to be needed along the production pathway to produce just 1 kg of breastmilk-substitute powder.[101] In the USA, 550 million cans, 86 000 tons of metal, and 364 000 tons of paper, annually used to package the product, end up in landfills.[102] Breastfeeding and human milk's contribution to environmental sustainability and food security year-round should be considered in climate-smart development goals at national and global levels.

Investment levels and trends in breastfeeding support

We were not able to ascertain national or overseas aid budgets for the protection or support of breastfeeding but the little data available show a global decrease.

Historically, the United States Agency for International Development (USAID) has been a major supporter of breastfeeding programmes. One analysis showed that their funding for breastfeeding promotion increased from $8·3 million in 1989 to $16·6 million in 1999, and subsequently decreased to $13·3 million in 2003 and $2·3 million in 2005.[10] In 2008, 79% of breastfeeding coordinators in 15 Latin American countries reported a decrease in funding for breastfeeding promotion between 2000 and 2008 compared with funding levels in the 1990s.[10] In 2013, the US Women, Infant and Children Program (WIC), which covers more than half of all US infants, spent $210 million on breastfeeding promotion and peer counselling and an additional $110·4 million on an enhanced food package as an incentive for breastfeeding women, which contrasts sharply with the 2010 expenditure of $926·6 million on infant formula.[103]

Discussion

Our Series shows that breastfeeding contributes to a world that is healthier, better educated, more equitable, and more environmentally sustainable. But the relevance of breastfeeding is questioned across society. Women are drawn to substitutes for breastmilk and doubt their own ability to breastfeed. They, their families, and health professionals are not fully convinced by the benefits of breastfeeding: breastfeeding in public can generate embarrassment and has even been prohibited whereas bottle-feeding causes little reaction; the Code is not legislated, enforced, or monitored in all countries, and the breastmilk substitute industry attempts to circumvent the Code to protect sales.

Although breastfeeding is cited as a reason for women leaving the job market (appendix pp 9–10), the evidence shows that the reverse—women remaining in work and at school and using breastmilk substitutes or stopping breastfeeding—is more common. Too few women are appropriately supported through adequate maternity and workplace entitlements to be able to work or attend school and still breastfeed; either they are not provided or the women are working in the informal economy and are not eligible.

We did not estimate the cost of scaling up interventions to promote and support breastfeeding, nor did we quantify the global net gain or loss associated with the promotion of breastfeeding. Our data show that the patterns and drivers of suboptimal breastfeeding vary by setting. Therefore, the mixture of interventions and investments needed to implement them, including the cost of maternity entitlement, are likely to differ greatly between settings. Without more robust data, reliable estimates of the costs and benefits of the actions needed to support optimal breastfeeding are difficult to calculate. Estimated costs vary widely: one study estimated that it will cost $653 million annually to scale up counselling interventions in 34 countries,[104] and another study estimated that it will cost $17·5 billion globally for a larger set of interventions.[105] This latter estimate is driven by the recurring costs of maternity entitlements for poor women: to attribute all these cost to the promotion of breastfeeding would be inappropriate because the same investment would have many benefits beyond breastfeeding. From our analyses, the economic consequences of cognitive losses and the conservative estimates of reduced treatment costs suggest that the economic benefits for countries of promoting breastfeeding are likely to be substantial. Nevertheless, research into the costs of breastfeeding-enabling policies and programmes relative to their full range of benefits, including maternity entitlements, is urgently needed.

Sustainability and development are imperatives and crucial considerations for our world that is undergoing demographic and social change. In low-income and middle-income countries, the improvement of breastfeeding will contribute to the unfinished agenda of preventable infant and child deaths. In both high-income and low-income countries, improvements in breastfeeding will improve human capital and help to prevent non-communicable diseases in women and children[1,89,106] that today account for more deaths than does undernutrition. Low-income and middle-income countries are at a crossroads of deciding whether to act to avoid the downward trends in breastfeeding practices that have been noted in high-income countries in the past century. High-income countries need to attribute value again to the benefits of breastfeeding for children and women beyond protection from diseases of poverty.

The review of the evidence and country case studies show that successful protection, promotion, and support of breastfeeding need measures at many levels, from legal and policy directives to social attitudes and norms, women's work and employment conditions, and health and services to support women and their families to breastfeed optimally. So how would policy makers and programme managers approach the challenge? We propose six action points.

The first is to disseminate the evidence. The promotion of breastfeeding starts with robust dissemination of evidence for its fundamental role, for both rich and poor societies. Scientists, policy makers, programme managers, health workers, and communities too often do not recognise the value of breastfeeding as a powerful intervention for health and development that benefits children and women alike.

The second action point is to foster positive societal attitudes towards breastfeeding. Negative societal attitudes—as shown by inadequate maternity leave, lack of opportunity to breastfeed or express milk at the workplace, and restrictions on breastfeeding in public—are all too common. Breastfeeding is generally thought to be an individual's decision and the sole responsibility of a woman to succeed, ignoring the role of society in its support and protection. Establishment of a high value of

breastfeeding within society needs, as stated in the Innocenti Declaration, "the reinforcement of a 'breastfeeding culture' and its vigorous defence against incursions of a 'bottle-feeding culture'".[5] In an age of expert social marketing and communication innovations, redressing the misperceptions of breastfeeding should be possible.

Third is to show political will. Politicians need to demonstrate they appreciate that breastfeeding promotion saves lives and money. The promotion of breastfeeding is entirely different from the scaling up of commodity-based interventions, such as vaccines or drugs, which are appealing because their implementation is easier to measure, and commercial pressures are in their favour rather than against. Breastfeeding should be mainstreamed into preventive programmes for non-communicable diseases for both children and women, as well as for the prevention of morbidity and mortality from infections of early childhood. The economic gains provided by breastfeeding through increased intelligence, reduced health-care costs, and the benefits of breastfeeding to the environment should be fully appreciated and evaluated when funding for the promotion and protection of breastfeeding is assessed.

Fourth is to regulate the breastmilk-substitute industry. Breastmilk substitutes are a multi-billion-dollar industry, the marketing of which undermines breastfeeding as the best feeding practice in early life. No new interventions are needed—the Code is an effective mechanism for action. However, much greater political commitment is needed to enact and enforce the relevant, comprehensive legislation and national investment to ensure implementation and accountability. Without these commitments, agreed principles of responsible marketing will continue to be violated. As such, breastfeeding is an important way for governments to fulfil their obligations to ensure "to the maximum extent possible the survival and development of the child" (International Convention on the Rights of the Child).[7]

The fifth action point is to scale up and monitor breastfeeding interventions and trends in breastfeeding practices. Our review shows that it is possible to substantially improve breastfeeding practices with use of tested interventions. We show that interventions to support women in their homes and communities and through health services are effective. Interventions should be tailored in response to patterns of suboptimal breastfeeding in each given setting. Interventions should be delivered at scale to benefit all mothers and children, and feeding patterns should be monitored regularly to provide feedback to implementers. Periodic population-wide assessments will enable the monitoring of important breastfeeding trends.

The sixth and final action point is for political institutions to exercise their authority and remove structural and societal barriers that hinder women's ability to breastfeed. Democratic governments are entrusted to protect and promote wellbeing in the communities that elect them—this includes breastfeeding. Countries that have ratified the Convention of the Rights of the Child are also accountable for specific actions to protect children and promote their health. Legislation and accountability mechanisms should ensure that maternity protection and workplace interventions that support breastfeeding are implemented (although these will not reach women who are self-employed or in informal employment, such as street vending, domestic work, or agriculture) and that all maternity health services comply with the Code and the BFHI.

All 194 member states of the World Health Assembly have agreed on breastfeeding targets for 2025. In the first paper in this Series, we showed that these targets are realistic and could even be exceeded. Breastfeeding is not explicitly mentioned in the Sustainable Development Goals, but our Series shows that improvements in breastfeeding would help achieve the targets for health, food security, education, equity, development, and the environment. Without commitment and active investment by governments, donors, and civil society, the promotion, protection, and support for breastfeeding will remain inadequate and the outcome will be major losses and costs that will be borne by generations to come.

Contributors

All authors contributed to the design, writing, and revision of the final version of the report.

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References

1 Victora CG, Aluísio J D Barros AJD, França GVA, et al. Breastfeeding in the 21st century: epidemiology, mechanisms, and lifelong effect. *Lancet* 2016; **387:** 475–90.

2 WHO. Contemporary patterns of breast-feeding. Report of the WHO Collaborative Study on Breast-feeding. Geneva: World Health Organization, 1981.

3 Grummer-Strawn LM. The effect of changes in population characteristics on breastfeeding trends in fifteen developing countries. *Int J Epidemiol* 1996; **25:** 94–102.

4 Meldrum B. Psychological factors in breast feeding versus bottle feeding in the Third World. *Bull Br Psychol Soc* 1982; **35:** 229–31.

5 UNICEF. Innocenti Declaration on the Protection, Promotion and Support of Breastfeeding. 1990. http://www.unicef.org/programme/breastfeeding/innocenti.htm (accessed Nov 26, 2015).

6 WHO. The optimal duration of exclusive breastfeeding. Report of an expert consultation. Geneva: World Health Organization. March 28–30, 2001. http://apps.who.int/iris/bitstream/10665/67219/1/WHO_NHD_01.09.pdf (accessed Nov 26, 2015).

7 United Nations Office of the High Commissioner on the Rights of the Child. Conventions on the Rights of the Child. 1989. http://www.ohchr.org/EN/ProfessionalInterest/Pages/CRC.aspx (accessed Nov 26, 2015).

8 World Health Organization. Baby-Friendly Hospital Initiative. Revised, updated and expanded for integrated care. 2009. http://www.who.int/nutrition/topics/bfhi/en (accessed Nov 26, 2015).

9 International Food Policy Research Institute. Global Nutrition Report 2015: actions and accountability to advance nutrition and sustainable development. Washington, DC: International Food Policy Research Institute. 2015. http://www.ifpri.org/publication/synopsis-global-nutrition-report-2015 (accessed Nov 26, 2015).

10 Lutter CK, Chaparro CM, Grummer-Strawn L, Victora CG. Backsliding on a key health investment in Latin America and the Caribbean: the case of breastfeeding promotion. *Am J Public Health* 2011; **101:** 2130–36.

11 World Health Organization. Acceptable medical reasons for use of breast-milk substitutes. 2009. http://www.who.int/maternal_child_adolescent/documents/WHO_FCH_CAH_09.01/en (accessed Nov 26, 2015).

12 Cattaneo A. Academy of breastfeeding medicine founder's lecture 2011: inequalities and inequities in breastfeeding: an international perspective. *Breastfeed Med* 2012; **7:** 3–9.

13 Acker M. Breast is best…but not everywhere: ambivalent sexism and attitudes toward private and public breastfeeding. *Sex Roles* 2009; **61:** 476–90.

14 Hannan A, Li R, Benton-Davis S, Grummer-Strawn L. Regional variation in public opinion about breastfeeding in the United States. *J Hum Lact* 2005; **21:** 284–88.

15 Labbok M, Taylor E. Achieving exclusive breastfeeding in the United States: findings and recommendations. Washington, DC: United States Breastfeeding Committee, 2008. http://www.usbreastfeeding.org/d/do/482 (accessed Nov 26, 2015).

16 McAllister H, Bradshaw S, Ross-Adjie G. A study of in-hospital midwifery practices that affect breastfeeding outcomes. *Breastfeed Rev* 2009; **17:** 11–15.

17 Leviniene G, Petrauskiene A, Tamuleviciene E, Kudzyte J, Labanauskas L. The evaluation of knowledge and activities of primary health care professionals in promoting breast-feeding. *Medicina* 2009; **45:** 238–47.

18 Kozhimannil KB, Jou J, Attanasio LB, Joarnt LK, McGovern P. Medically complex pregnancies and early breastfeeding behaviors: a retrospective analysis. *PLoS One* 2014; **9:** e104820.

19 Prior E, Santhakumaran S, Gale C, Philipps LH, Modi N, Hyde MJ. Breastfeeding after cesarean delivery: a systematic review and meta-analysis of world literature. *Am J Clin Nutr* 2012; **95:** 1113–35.

20 Simmons D, Conroy C, Thompson CF. In-hospital breast feeding rates among women with gestational diabetes and pregestational type 2 diabetes in South Auckland. *Diabet Med* 2005; **22:** 177–81.

21 Adair LS, Popkin BM. Low birth weight reduces the likelihood of breast-feeding among Filipino infants. *J Nutr* 1996; **126:** 103–12.

22 Righard L, Alade MO. Effect of delivery room routines on success of first breast-feed. *Lancet* 1990; **336:** 1105–07.

23 Thurston A, Bolin JH, Chezem JC. Infant formula samples: perinatal sources and breast-feeding outcomes at 1 month postpartum. *J Perinat Neonatal Nurs* 2013; **27:** 353–58.

24 Fuller JJ, White AA. The effects of support networks on the choice of infant feeding method. *J Am Diet Assoc* 1998; **98** (suppl)**:** A61.

25 Meyerink RO, Marquis GS. Breastfeeding initiation and duration among low-income women in Alabama: the importance of personal and familial experiences in making infant-feeding choices. *J Hum Lact* 2002; **18:** 38–45.

26 Bandyopadhyay M. Impact of ritual pollution on lactation and breastfeeding practices in rural West Bengal, India. *Int Breastfeed J* 2009; **4:** 2.

27 Ojofeitimi EO, Olaogun AA, Osokoya AA, Owolabi SP. Infant feeding practices in a deprived environment: a concern for early introduction of water and glucose D water to neonates. *Nutr Health* 1999; **13:** 11–21.

28 Bar-Yam NB, Darby L. Fathers and breastfeeding: a review of the literature. *J Hum Lact* 1997; **13:** 45–50.

29 Gibson-Davis CM, Brooks-Gunn J. The association of couples' relationship status and quality with breastfeeding initiation. *J Marriage Fam* 2007; **69:** 1107–17.

30 Roe B, Whittington LA, Fein SB, Teisl MF. Is there competition between breast-feeding and maternal employment? *Demography* 1999; **36:** 157–71.

31 Visness CM, Kennedy KI. Maternal employment and breast-feeding: findings from the 1988 National Maternal and Infant Health Survey. *Am J Public Health* 1997; **87:** 945–50.

32 International Labor Organization. Maternity and paternity at work: Law and practice across the world. Geneva: International Labor Organization, 2014.

33 Dearden KA, Quan N, Do M, et al. Work outside the home is the primary barrier to exclusive breastfeeding in rural Viet Nam: insights from mothers who exclusively breastfed and worked. *Food Nutr Bull* 2002; **23** (suppl)**:** 101–08.

34 Ong G, Yap M, Li FL, Choo TB. Impact of working status on breastfeeding in Singapore: evidence from the National Breastfeeding Survey 2001. *Eur J Public Health* 2005; **15:** 424–30.

35 Ogbuanu C, Glover S, Probst J, Liu J, Hussey J. The effect of maternity leave length and time of return to work on breastfeeding. *Pediatrics* 2011; **127:** e1414–27.

36 Mirkovic KR, Perrine CG, Scanlon KS, Grummer-Strawn LM. In the United States, a mother's plans for infant feeding are associated with her plans for employment. *J Hum Lact* 2014; **30:** 292–97.

37 Hawkins SS, Griffiths LJ, Dezateux C, Law C, and the Millennium Cohort Study Child Health Group. The impact of maternal employment on breast-feeding duration in the UK Millennium Cohort Study. *Public Health Nutr* 2007; **10:** 891–96.

38 Guendelman S, Kosa JL, Pearl M, Graham S, Goodman J, Kharrazi M. Juggling work and breastfeeding: effects of maternity leave and occupational characteristics. *Pediatrics* 2009; **123:** e38–46.

39 Stein A, Cooper PJ, Day A, Bond A. Social and psychiatric factors associated with the intention to breastfeed. *J Reprod Infant Psychol* 1987; **5:** 165–71.

40 Lawton R, Ashley L, Dawson S, Waiblinger D, Conner M. Employing an extended Theory of Planned Behaviour to predict breastfeeding intention, initiation, and maintenance in White British and South-Asian mothers living in Bradford. *Br J Health Psychol* 2012; **17:** 854–71.

41 DiGirolamo A, Thompson N, Martorell R, Fein S, Grummer-Strawn L. Intention or experience? Predictors of continued breastfeeding. *Health Educ Behav* 2005; **32:** 208–26.

42 Kervin BE, Kemp L, Pulver LJ. Types and timing of breastfeeding support and its impact on mothers' behaviours. *J Paediatr Child Health* 2010; **46:** 85–91.

43 Avery A, Zimmermann K, Underwood PW, Magnus JH. Confident commitment is a key factor for sustained breastfeeding. *Birth* 2009; **36:** 141–48.

44 Brown CRL, Dodds L, Legge A, Bryanton J, Semenic S. Factors influencing the reasons why mothers stop breastfeeding. *Can J Public Health* 2014; **105:** e179–85.

45 Odom EC, Li R, Scanlon KS, Perrine CG, Grummer-Strawn L. Reasons for earlier than desired cessation of breastfeeding. *Pediatrics* 2013; **131:** e726–32.

46 Da Vanzo J, Starbird E, Leibowitz A. Do women's breastfeeding experiences with their first-borns affect whether they breastfeed their subsequent children? *Soc Biol* 1990; **37:** 223–32.

47 Howard CR, Lanphear N, Lanphear BP, Eberly S, Lawrence RA. Parental responses to infant crying and colic: the effect on breastfeeding duration. *Breastfeed Med* 2006; **1:** 146–55.

48 Wasser H, Bentley M, Borja J, et al. Infants perceived as "fussy" are more likely to receive complementary foods before 4 months. *Pediatrics* 2011; **127:** 229–37.

49 McCann MF, Bender DE. Perceived insufficient milk as a barrier to optimal infant feeding: examples from Bolivia. *J Biosoc Sci* 2006; **38:** 341–64.

50 Leung GM, Ho LM, Lam TH. Maternal, paternal and environmental tobacco smoking and breast feeding. *Paediatr Perinat Epidemiol* 2002; **16:** 236–45.

51 Liu J, Rosenberg KD, Sandoval AP. Breastfeeding duration and perinatal cigarette smoking in a population-based cohort. *Am J Public Health* 2006; **96:** 309–14.

52 Turcksin R, Bel S, Galjaard S, Devlieger R. Maternal obesity and breastfeeding intention, initiation, intensity and duration: a systematic review. *Matern Child Nutr* 2014; **10:** 166–83.

53 Dennis C-L, McQueen K. Does maternal postpartum depressive symptomatology influence infant feeding outcomes? *Acta Paediatr* 2007; **96:** 590–94.

54 Kiernan K, Pickett KE. Marital status disparities in maternal smoking during pregnancy, breastfeeding and maternal depression. *Soc Sci Med* 2006; **63:** 335–46.

55 Wojcicki JM. Maternal pre-pregnancy body mass index and initiation and duration of breastfeeding: a review of the literature. *J Womens Health (Larchmt)* 2011; **20:** 341–47.

56 Rollins N, Coovadia HM. Breastfeeding and HIV transmission in the developing world: past, present, future. *Curr Opin HIV AIDS* 2013; **8:** 467–73.

57 Coovadia HM, Rollins NC, Bland RM, et al. Mother-to-child transmission of HIV-1 infection during exclusive breastfeeding in the first 6 months of life: an intervention cohort study. *Lancet* 2007; **369:** 1107–16.

58 Arpadi S, Fawzy A, Aldrovandi GM, et al. Growth faltering due to breastfeeding cessation in uninfected children born to HIV-infected mothers in Zambia. *Am J Clin Nutr* 2009; **90:** 344–53.

59 Thiry L, Sprecher-Goldberger S, Jonckheer T, et al. Isolation of AIDS virus from cell-free breast milk of three healthy virus carriers. *Lancet* 1985; **2:** 891–92.

60 World Health Organization. Guidelines on HIV and Infant Feeding. 2010. Principles and recommendations for infant feeding in the context of HIV and a summary of evidence. http://www.who.int/maternal_child_adolescent/topics/child/nutrition/hivif/en/ (accessed Nov 26, 2015).

61 Shapiro RL, Hughes MD, Ogwu A, et al. Antiretroviral regimens in pregnancy and breast-feeding in Botswana. *N Engl J Med* 2010; **362:** 2282–94.

62 World Health Organization. Antiretroviral drugs for treating pregnant women and preventing HIV infection in infants. Recommendations for a public health approach. http://www.who.int/hiv/pub/arv/adult2010/en (accessed Nov 26, 2015).

63 Haroon S, Das JK, Salam RA, Imdad A, Bhutta ZA. Breastfeeding promotion interventions and breastfeeding practices: a systematic review. *BMC Public Health* 2013; **13** (suppl 3): S20.

64 Sinha B, Chowdhury R, Sankar MJ, et al. Interventions to improve breastfeeding outcomes: systematic review and meta analysis. *Acta Paediatr* 2015; **104:** 114–34.

65 Abrahams SW. Milk and social media: online communities and the International Code of Marketing of Breast-milk Substitutes. *J Hum Lact* 2012; **28:** 400–06.

66 Kelly YJ, Watt RG. Breast-feeding initiation and exclusive duration at 6 months by social class—results from the Millennium Cohort Study. *Public Health Nutr* 2005; **8:** 417–21.

67 Heymann J, Raub A, Earle A. Breastfeeding policy: a globally comparative analysis. *Bull World Health Organ* 2013; **91:** 398–406.

68 Dabritz HA, Hinton BG, Babb J. Evaluation of lactation support in the workplace or school environment on 6-month breastfeeding outcomes in Yolo County, California. *J Hum Lact* 2009; **25:** 182–93.

69 Lutter CK, Morrow AL. Protection, promotion, and support and global trends in breastfeeding. *Adv Nutr* 2013; **4:** 213–19.

70 Muller M. The baby killer. A War on Want investigation into the promotion and sale of powdered baby milks in the Third World. London: War on Want, 1974. http://www.waronwant.org/past-campaigns/baby-milk (accessed March 10, 2015).

71 Save the Children Pakistan Programme and Gallup Pakistan. Breastfeeding. A road map to promotion and protection. 2013. https://www.savethechildren.net/sites/default/files/BF%20Report%20-%20EO.pdf (accessed Nov 26, 2015).

72 Baker J, Sanghvi T, Hajeebhoy N, Martin L, Lapping K. Using an evidence-based approach to design large-scale programs to improve infant and young child feeding. *Food Nutr Bull* 2013; **34** (suppl): S146–55.

73 Victora CG, Aquino EM, do Carmo Leal M, Monteiro CA, Barros FC, Szwarcwald CL. Maternal and child health in Brazil: progress and challenges. *Lancet* 2011; **377:** 1863–76.

74 Perez-Escamilla R, Curry L, Minhas D, Taylor L, Bradley E. Scaling up of breastfeeding promotion programs in low- and middle-income countries: the "breastfeeding gear" model. *Adv Nutr* 2012; **3:** 790–800.

75 Save the Children UK. Superfood for babies. http://www.savethechildren.org.uk/sites/default/files/images/Superfood_for_Babies_UK_version.pdf (accessed Nov 26, 2015).

76 U.S. Department of Health and Human Services. The Surgeon General's Call to Action to Support Breastfeeding. Washington, DC: US Department of Health and Human Services, Office of the Surgeon General, 2011. http://www.surgeongeneral.gov/library/calls/breastfeeding/calltoactiontosupportbreastfeeding.pdf (accessed Nov 26, 2015).

77 Feldman-Winter L, Grossman X, Palaniappan A, et al. Removal of industry-sponsored formula sample packs from the hospital: does it make a difference. *J Hum Lact* 2012; **28:** 380–88.

78 Adair LS, Popkin BM, Guilkey DK. The duration of breast-feeding: how is it affected by biological, sociodemographic, health sector, and food industry factors? *Demography* 1993; **30:** 63–80.

79 Sheehan D, Bridle B, Hillier T, et al. Breastfeeding outcomes of women following uncomplicated birth in Hamilton-Wentworth. *Can J Public Health* 1999; **90:** 408–11.

80 Yee CF, Chin R. Parental perception and attitudes on infant feeding practices and baby milk formula in East Malaysia. *Int J Consum Stud* 2007; **31:** 363–70.

81 AlFaleh KM. Perception and knowledge of breast feeding among females in Saudi Arabia. *J Taibah Univ Med Sci* 2014; **9:** 139–42.

82 Piwoz EG, Huffman SL. The impact of marketing of breast-milk substitutes on WHO—recommended breastfeeding practices. *Food Nutr Bull* 2015; published online Aug 27. DOI:10.1177/0379572115602174.

83 Suleiman A. A study of marketing and its effect on infant feeding practices. *Med J Malaysia* 2001; **56:** 319–23.

84 Phoutthakeo P, Otsuka K, Ito C, Sayamoungkhoun P, Kounnavong S, Jimba M. Cross-border promotion of formula milk in Lao People's Democratic Republic. *J Paediatr Child Health* 2014; **50:** 51–56.

85 Parry K, Taylor E, Hall-Dardess P, Walker M, Labbok M. Understanding women's interpretations of infant formula advertising. *Birth* 2013; **40:** 115–24.

86 Rosenberg KD, Eastham CA, Kasehagen LJ, Sandoval AP. Marketing infant formula through hospitals: the impact of commercial hospital discharge packs on breastfeeding. *Am J Public Health* 2008; **98:** 290–95.

87 Allers KS. Does the A.A.P. logo belong on formula gift bags? http://parenting.blogs.nytimes.com/2013/12/19/does-the-a-a-p-logo-belong-on-formula-gift-bags/?_r=0 (accessed Dec 8, 2015).

88 American Academy of Pediatrics. Home page and Professional Education pages. http://www.meadjohnson.com/pediatrics/us-en/professional-education/aap-pediatric-care-online (accessed March 31, 2015).

89 Horta BL, de Mola CL, Victora CG. Breastfeeding and intelligence: systematic review and meta-analysis. *Acta Paediatr Suppl* 2015; **104:** 14–19.

90 Hanushek EA, Woessmann L. The role of cognitive skills in economic development. *J Econ Lit* 2008; **46:** 607–68.

91 UNICEF. The state of the world's children 2014: in numbers. http://www.unicef.org/sowc2014/numbers/documents/english/EN-FINAL%20Table%202.pdf (accessed Dec 8, 2016).

92 Horton S, Ross J. The economics of iron deficiency. *Food Policy* 2003; **28:** 51–75.

93 Carbonell-Estrany X, Figueras-Aloy J, Law BJ, and the Infección Respiratoria Infantil por Virus Respiratorio Sincitial Study Group, and the Pediatric Investigators Collaborative Network on Infections in Canada Study Group. Identifying risk factors for severe respiratory syncytial virus among infants born after 33 through 35 completed weeks of gestation: different methodologies yield consistent findings. *Pediatr Infect Dis J* 2004; **23** (suppl)**:** S193–201.

94 Dornelles CT, Piva JP, Marostica PJ. Nutritional status, breastfeeding, and evolution of Infants with acute viral bronchiolitis. *J Health Popul Nutr* 2007; **25:** 336–43.

95 UNICEF. Preventing disease and saving resources: the potential contribution of increasing breastfeeding rates in the UK. www.unicef.org.uk/Documents/Baby_Friendly/Research/Preventing_disease_saving_resources.pdf (accessed Nov 26, 2015).

96 Bartick M, Reinhold A. The burden of suboptimal breastfeeding in the United States: a pediatric cost analysis. *Pediatrics* 2010; **125:** e1048–56.

97 The World Bank. World development indicators. Nov 12, 2015. http://data.worldbank.org/data-catalog/world-development-indicators (accessed Nov 24, 2015).

98 Francis S, Mulford C. The milk of human kindness: a global fact sheet on the economic value of breastfeeding. London: Crossroads Books, 2002.

99 Coutsoudis A, Coovadia HM, Wilfert CM. HIV, infant feeding and more perils for poor people: new WHO guidelines encourage review of formula milk policies. *Bull World Health Organ* 2008; **86:** 210–14.

100 Correa W. Ecomall. Breastfeeding and the environment. 2014. http://www.ecomall.com/greenshopping/mbr.htm (accessed Nov 26, 2015).

101 Linnecar A, Gupta A, Dadhich J, Bidla N. Formula for disaster: weighing the impact of formula feeding vs breastfeeding on environment. BPNI/IBFAN Asia, 2014. http://ibfan.org/docs/FormulaForDisaster.pdf (accessed Nov 26, 2015).

102 US Department of Health and Human Services. Executive summary: the surgeon general's call to action to support breastfeeding. http://www.surgeongeneral.gov/library/calls/breastfeeding (accessed Nov 24, 2015).

103 US Department of Agriculture Food and Nutrition Service, Office of Policy Support. WIC Food Cost Report. Aug 13, 2013. http://www.fns.usda.gov/wic-food-package-cost-report-fiscal-year-2010 (accessed Nov 26, 2015).

104 Bhutta ZA, Das JK, Rizvi A, et al, and the Lancet Nutrition Interventions Review Group, and the Maternal and Child Nutrition Study Group. Evidence-based interventions for improvement of maternal and child nutrition: what can be done and at what cost? *Lancet* 2013; **382:** 452–77.

105 Holla-Bhar R, Iellamo A, Gupta A, Smith JP, Dadhich JP. Investing in breastfeeding—the world breastfeeding costing initiative. *Int Breastfeed J* 2015; **10:** 8.

106 Horta BL, de Mola CL, Victora CG. Long-term consequences of breastfeeding on cholesterol, obesity, systolic blood pressure, and type 2 diabetes: systematic review and meta-analysis. *Acta Paediatr Suppl* 2015; **104:** 30–37.