

Breastfeeding in the Modern World

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Key Messages

- There is overwhelming evidence that breastfeeding benefits both babies and mothers especially in low-income settings.
- National and international efforts to remove existing barriers to breastfeeding, and proven community-based and family interventions, could substantially reduce deaths among children and mothers and improve wealth by enhancing IQ and school attainment.

Keywords

Breastfeeding · Exclusive breastfeeding · Initiation of breastfeeding · Barriers to breastfeeding · Benefits of breastfeeding

Abstract

Background: Social changes in the 20th century resulted in substantial reductions in the prevalence of breastfeeding in many countries but especially in those with high and increasing wealth. Concerns about this decline prompted widespread research to quantify the benefits of breastfeeding and the mechanisms by which it exerts protective effects for mothers and children. Pro-breastfeeding advocacy resulted in the WHO International Code of Marketing of Breastmilk Substitutes in 1981 and the Innocenti Declaration on Breastfeeding in 1990, which, together with numerous other initiatives, have helped to turn the tide. **Summary:** A tranche of recent meta-analyses of dozens of individual studies provide

very strong evidence that breastfeeding has substantial benefits to babies, infants, and young children. The benefits and strengths of association vary according to the background environmental and hygiene conditions in different settings. In low-income settings, the chief measurable benefits for the child are in respect of reductions in diarrhea and respiratory infections, and in mortality. In high-income settings, breastfeeding protects against otitis media, likely protects against type 2 diabetes and overweight and obesity, and possibly protects against type 1 diabetes. It likely improves IQ by 2–3 percentage points. In mothers, breastfeeding reduces a mother's likelihood of breast and ovarian cancers. Feeding these data into the Lives Saved Tool suggests that these benefits could prevent 823,000 deaths in children and 22,000 among women.

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Introduction

Breastfeeding – aptly termed “an ancient art and a modern miracle” – has multiple proven benefits for babies, their mothers, and their societies and should thus be cherished, promoted, and protected. The rapid social and economic changes affecting our world can have diverse effects on breastfeeding practices. As low-income countries advance, traditional values, including breastfeeding, are under pressure. On the other hand, in many high-income countries, an appreciation of the enormous benefits of breastfeeding has driven a more

enlightened approach to issues such as maternity leave and regulation of the inappropriate promotion of milk formulas, which are gradually helping to increase the prevalence of breastfeeding, albeit from a low base.

In 2016, *The Lancet* published two coordinated papers drawing together the latest evidence based upon a series of newly commissioned meta-analyses and market research [1, 2]. The current review is based heavily upon these excellent papers augmented by additional more recent analyses.

The Latest Evidence on the Benefits of Breastfeeding

There are numerous comprehensive reviews available, which summarize the benefits of breastfeeding and the mechanisms by which these are achieved (e.g., [3]). They describe an array of increasingly understood complex pathways by which breastmilk has evolved to optimize child survival in eons past. These remarkable mechanisms are worthy of study, but the keenest observer may also question whether breastmilk is still optimized for child development now that babies are so much less vulnerable to early infections. A key example of how breastmilk might not now be optimal is in respect of its iron content [4, 5], a matter of active research by our research group. Over evolutionary time, it appears that iron levels in milk were maintained very low in order to avoid promoting pathogen growth. Modern medicine now considers these levels to be potentially constraining brain and cognitive development, and many countries recommend early iron supplementation in breastfed babies, especially those born prematurely or at low birthweight. Notwithstanding these nuances, breastfeeding remains a powerful force for good health across that world.

Breastfeeding Reduces Morbidity and Mortality Rates in Young Children

There is overwhelming evidence that breastfeeding protects against death in low-income settings. Twenty-eight meta-analyses have addressed this issue. Methodologies vary according to the available definitions of breastfeeding in the source papers (e.g., ever vs. never breastfed, short vs. long breastfeeding), but despite these limitations, there is a very strong consensus that breastfeeding reduces mortality by between 4- and 10-fold in low-income settings [1, 6, 7].

Separate meta-analyses suggest that breastfeeding can additionally reduce child deaths in the low mortality settings of high-income countries. For instance, meta-analysis of 6 studies suggests a 36% reduction in sudden infant death syndrome among ever breastfed babies and meta-analysis of 4 studies shows a reduction of 58% in necrotizing enterocolitis [8].

The evidence for morbidity is even stronger. Meta-analysis of 66 studies, most of which were in low-income settings, shows a very clear protection against diarrhea and respiratory infections, with estimated reductions of about a half for diarrhea and a third for respiratory infections [9]. Protection by breastfeeding against more severe forms of each of these (judged by the need for hospitalizations) is estimated to be even stronger: 75% for diarrhea and 57% for respiratory infections [9]. All of these effects are strongest in younger children.

In high-income settings, there is evidence of protection against otitis media in children younger than 2 years, but not in older children [10]. Evidence for protection against food allergies, eczema, and allergic rhinitis is unconvincing, and a marginal protection against asthma (9%) disappears when the analysis is constrained to studies with more rigorous control of confounding [11].

In young children, breastfeeding is found to protect against dental caries in an analysis of 49 studies [12]. However, longer breastfeeding (for over 12 months) and nocturnal breastfeeding are associated with a 2- to 3-fold increase in dental caries in older children (>12 months).

Growth Outcomes

A meta-analysis of 17 studies (which includes 15 randomized trials of breastfeeding promotion, most conducted in middle-income countries) shows no difference in growth outcomes except for a very marginal possible reduction in BMI [13].

Later Obesity

Evidence of the effects of breastfeeding on the risk of overweight and obesity is equivocal, though the latest meta-analysis of observational studies suggests a 13% reduction [13].

Later Noncommunicable Disease Risks

Meta-analysis of 11 available studies suggests that breastfeeding could provide a 32% reduction in type 2 diabetes, but when restricted to the only 3 studies deemed to be of high quality, this drops to 24% and is nonsignificant with high heterogeneity [14]. There is a possible protection against type 1 diabetes when 6

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studies were combined [14] but no apparent impact on blood pressure or cholesterol levels (analysis ranged from 38 to 46 studies). Breastfeeding shows an aggregate protection of 19% against childhood leukemia in an analysis of 18 studies [15].

Intelligence

It is notoriously difficult to adjust for confounding in studies of breastfeeding and intelligence (brighter mothers are more likely to breastfeed their children) and to eliminate possible residual confounding. Nonetheless, most analyses suggest a 2–3% point improvement in a range of measures of IQ after best efforts to adjust for home environment and parental IQ [1, 16–18], and numerous studies suggest improvements in attained years of schooling [1].

Breastfeeding Has Health Advantages for the Mother

Birthspacing

Numerous studies over many decades show that breastfeeding creates a period of lactational amenorrhea that aids with birthspacing [1, 15, 19, 20], an effect that is mediated by prolactin and is regulated by a mother's energy balance [21] in a manner such that undernourished mothers are best protected from an inappropriately short birth interval that would harm the mother herself and her children.

Breast and Ovarian Cancers

Extensive and well-powered meta-analyses show that ever versus never breastfeeding and longer versus shorter breastfeeding have a measurable protective effect against breast [19, 22] and ovarian [19] cancers. When restricted to the best controlled studies, longer versus shorter breastfeeding is associated with a 7% reduction in breast cancer and an 18% reduction in risk of ovarian cancer [19].

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Cardiovascular Disease

A very recent meta-analysis of 8 studies involving almost 1.2 m parous women reveals the following reductions in cardiovascular outcomes among women who had ever breastfed compared to those who had never breastfed: 11% for cardiovascular disease (CVD), 14% for coronary heart disease, 12%

for stroke, and 17% for fatal CVD [23]. However, in individual studies adjusted for socioeconomic status and, in some studies, additional variables, there remains the possibility that these associations arise from residual confounding whereby certain behavioral traits may have parallel effects on likelihood of breastfeeding and later likelihood of CVD.

Osteoporosis

Bone is used as a reserve to help supply calcium in breastmilk and breastfeeding is thus associated with some dynamic changes in bone mineral density [24, 25], but meta-analysis of the 4 available studies found no association between breastfeeding and subsequent osteoporosis [19].

Type 2 Diabetes

Meta-analysis of 6 cohort studies indicates a 32% reduction in the likelihood of developing type 2 diabetes [26].

Postpartum Weight Change

Although fat tends to be accrued in pregnancy especially in gynoid regions and there is solid biochemical evidence that this is an evolved mechanism to subsidize the energy needs of subsequent lactation [27], patterns of weight change postpartum are very variable and weight loss is by no means inevitable. Overall, the evidence that breastfeeding influences postpartum weight change in any consistent direction is inconclusive [28]. However, an analysis of data from 740,000 British women showed that each additional 6 months of lifetime breastfeeding was associated with a 1% lower BMI [29].

Maternal Depression

There is an inverse association between breastfeeding and maternal depression, but the direction of causality is uncertain and it seems most likely that the least depressed women would be more likely to successfully breastfeed [30].

Latest Recommendations on Breastfeeding by Mothers with HIV or COVID-19

HIV

Provision of lifelong antiretroviral therapy and/or prophylaxis should be the mainstay of the care of mothers living with HIV. Whether or not this is provided, the latest WHO advice (updated in February 2019) is as follows: "Mothers known to be HIV-infected (and whose infants are HIV uninfected or of unknown HIV status) should exclusively breastfeed their infants for the first 6 months of life, introducing appropriate complementary foods thereafter, and continue breast feeding. Mothers living with HIV should breastfeed for at least 12 months and may continue breastfeeding for up to 24 months or longer (similar to the general population)" [31].

Recommendations differ in many countries. For instance, the US CDC and the American Academy of Pediatrics recommend against breastfeeding by HIV-infected mothers [32].

COVID-19

WHO recommends that “mothers with suspected or confirmed COVID-19 should be encouraged to initiate or continue to breastfeed. Mothers should be counselled that the benefits of breastfeeding substantially outweigh the potential risks for transmission” [33]. In contrast to their position on HIV, the US CDC provide advice on precautions for breastfeeding with COVID rather than making an explicit recommendation and currently do not advise against breastfeeding with COVID [34]. The US Centers for Disease Control’s latest advice is that breastfeeding mothers can safely receive the Pfizer or Moderna vaccines, though whether this provides any protection to their baby is still unknown.

Estimates of Lives Saved and Saveable by Breastfeeding

Using the Lives Saved Tool [35], Victora et al. [1] estimated that if breastfeeding was scaled up to be almost universal in 2015, it would have saved 823,000 lives in 75 high mortality LMICs. They estimated a reduction in deaths from breast cancer of 20,000 per year if current breastfeeding rates in high-income countries were raised toward the global average compared to a modeled scenario with no breastfeeding. They estimated that increasing breastfeeding rates at 1 year in high-income settings and at 2 years in LMICs could potentially save a further 22,000 lives.

Recent Trends in Breastfeeding Worldwide

Indicators Used to Assess Breastfeeding Prevalence and Trends

Meaningful comparisons of breastfeeding rates across nations and across time would ideally be based on standardized definitions (see Box 1) and standardized protocols for assessing prevalence against such measures.

Box 1

Survey indicators on breastfeeding practices

Early initiation of breastfeeding

The proportion of babies born within the last 24 h who were put to the breast within 1 h.

Exclusive breastfeeding under 6 months

The proportion of infants 0–5 months who are fed exclusively with breastmilk.

Continued breastfeeding at 1 year

The proportion of children aged 12–15 months who receive breastmilk.

From: World Health Organization [36]

Unfortunately, surveys often use alternative definitions, and few surveys from high-income countries report on these standardized indicators; hence, proxy estimates often have to be constructed to permit comparisons [1]. Notwithstanding these limitations, Victora et al. [1] estimated global trends in breastfeeding and their results are cited here.

Breastfeeding Rates across the World

Figure 1 shows the global prevalence of breastfeeding at 1 year and demonstrates encouragingly high rates in most of Africa and south Asia. Figure 2 consolidates the data by national wealth categories and presents additional indicators. In low- and lower-middle income countries, the proportions of babies ever breastfed and still breastfeeding at 6 months are very impressive, exceeding 90% on average. Levels of exclusive breastfeeding 0–5 months are about 50% in the lowest-income countries, decline with increasing wealth, and are unavailable for the highest-income countries. Thus, breastfeeding is one of the few health indicators that show better statistics for low-income countries. Figure 3, also reproduced from Victora et al. [1], shows the association between the proportions of babies exclusively breastfed at 0–5 months and the proportion still breastfeeding at 1 year. In most regions, there is an unsurprising correlation between the two indicators, but in West Africa, there are countries with very low exclusive breastfeeding rates yet very high levels of babies still breastfed at 12 months.

Victora et al. [1] also extracted data from longitudinal breastfeeding surveys in LMICs and concluded that there was a general increase (from 25% in 1993 to 36% in 2013) with a proportionately higher increase among the richest quintile among such populations, but from a lower base such that by 2013 breastfeeding rates were very similar across wealth quintiles in LMICs. Rates of breastfeeding at 1 year dropped slightly (from 76 to 73%) but remained at an impressive level.

Facilitators and Barriers to Breastfeeding

Cultural Attitudes and Family Support

Cultural attitudes have an over-whelming influence on breastfeeding practices as is easily apparent when comparing the very high rates of breastfeeding in “traditional” societies compared to the much lower rates in most “modern” societies (see Box 2 for a brief description of breastfeeding in The Gambia). Fortunately, in many of these modern societies, thanks to the efforts of numerous advocacy groups, there is a growing appreciation and understanding of the value of breastfeeding and in most countries prevalence rates are rising, albeit slowly.

In the modern setting, cultural attitudes are heavily influenced by peer influences especially through social media (see Fig. 4 for a conceptual model summarizing the influences [2]). Family attitudes and support, or lack of, are also crucial in set-

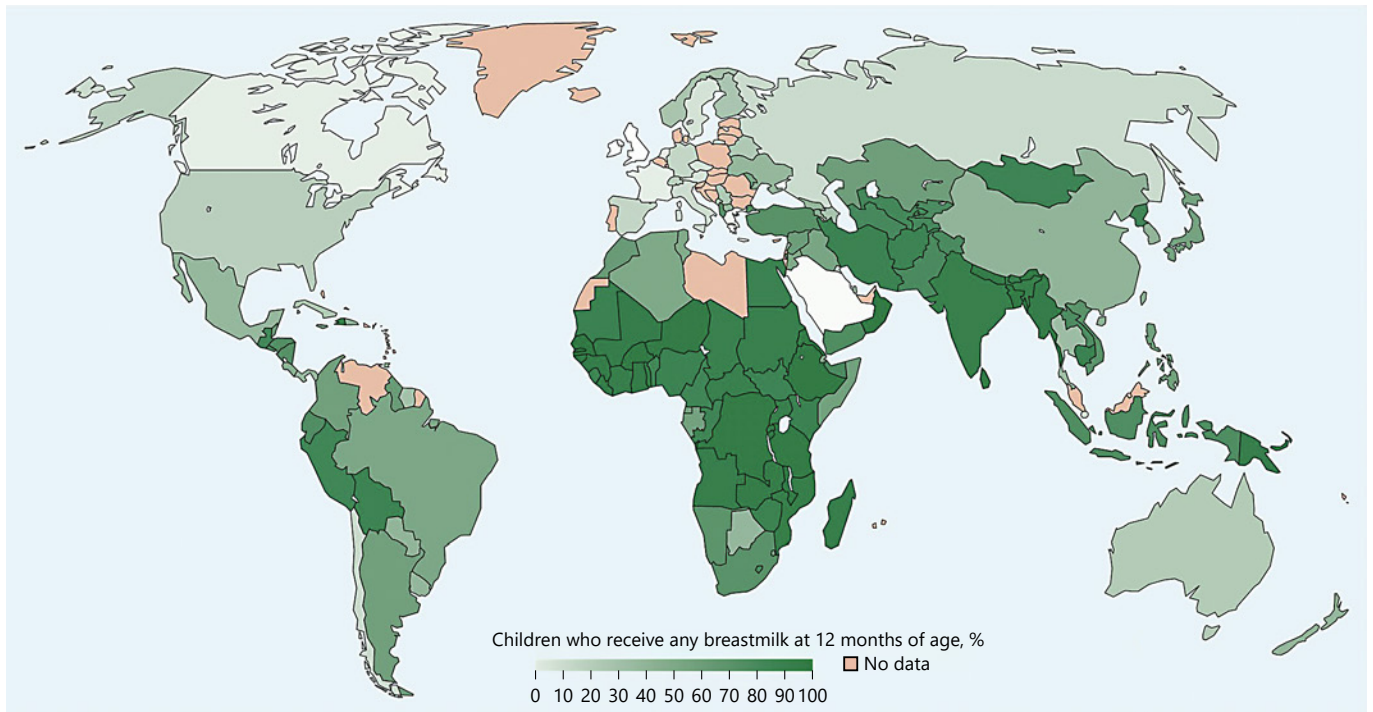


Fig. 1. Global distribution of breastfeeding at 12 months. Data from 153 countries between 1995 and 2013. Reprinted from Victora et al. [1], pp 475–490, Copyright 2016, with permission from Elsevier.

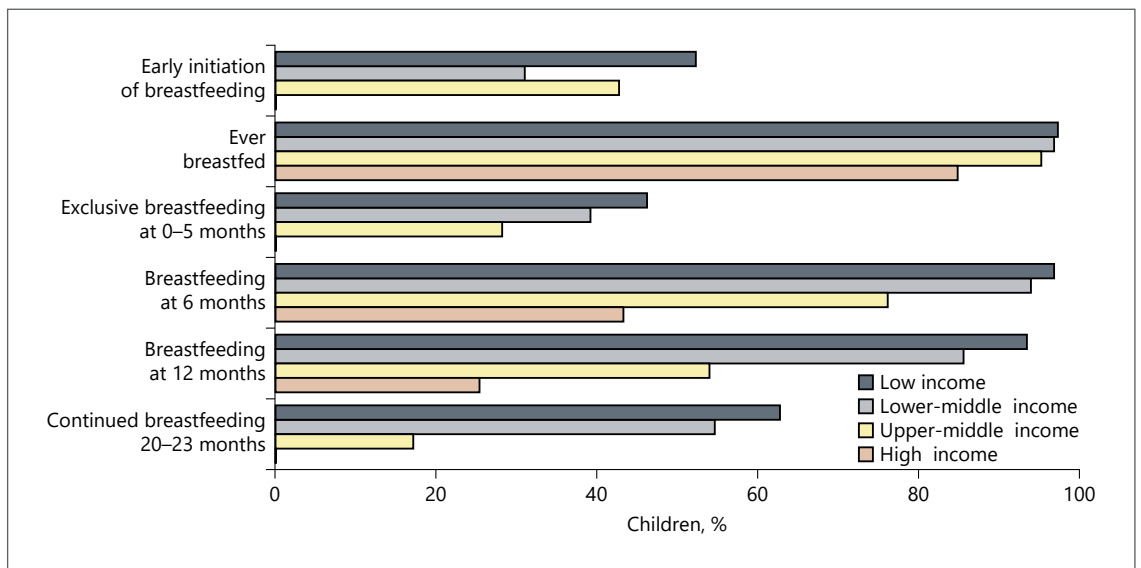


Fig. 2. Breastfeeding indicators by country income group in 2010. Data are from national surveys that used standard indicators, and were weighted by national populations of children under 2 years. Data for up to 153 countries. Reprinted from Victora et al. [1], pp 475–490, Copyright 2016, with permission from Elsevier.

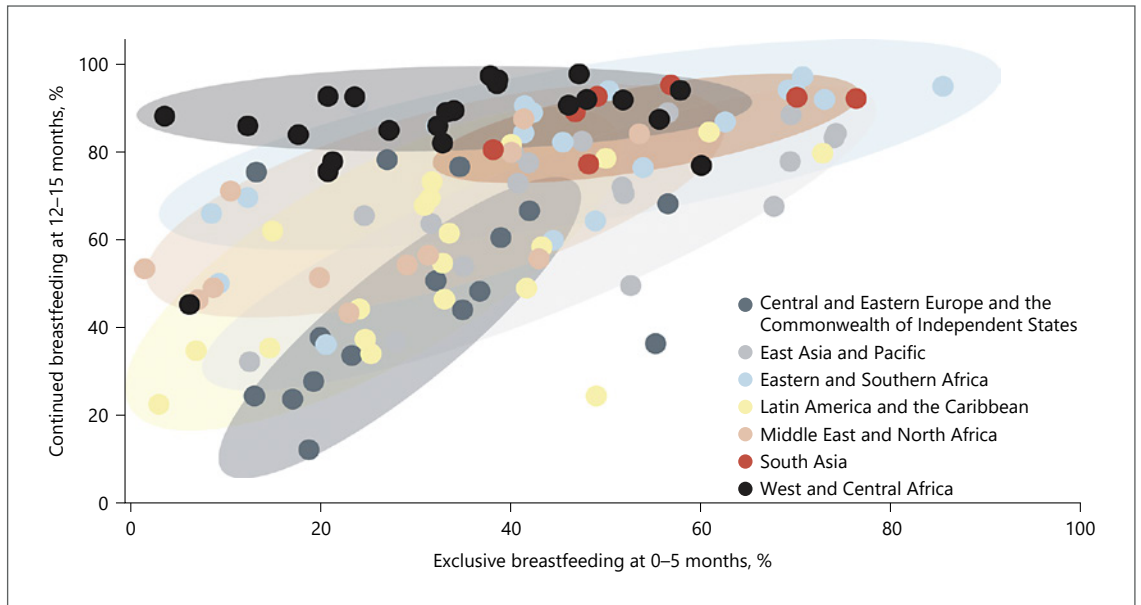


Fig. 3. The relation between exclusive breastfeeding at 0–5 months and continued breastfeeding at 12–15 months, by region. Datapoints are countries (values from the most recent survey from 117 countries, 2000–13) and are colored according to their region. The shaded ellipses include at least 80% of the points in each region. Reprinted from Victora et al. [1], pp 475–490, Copyright 2016, with permission from Elsevier.

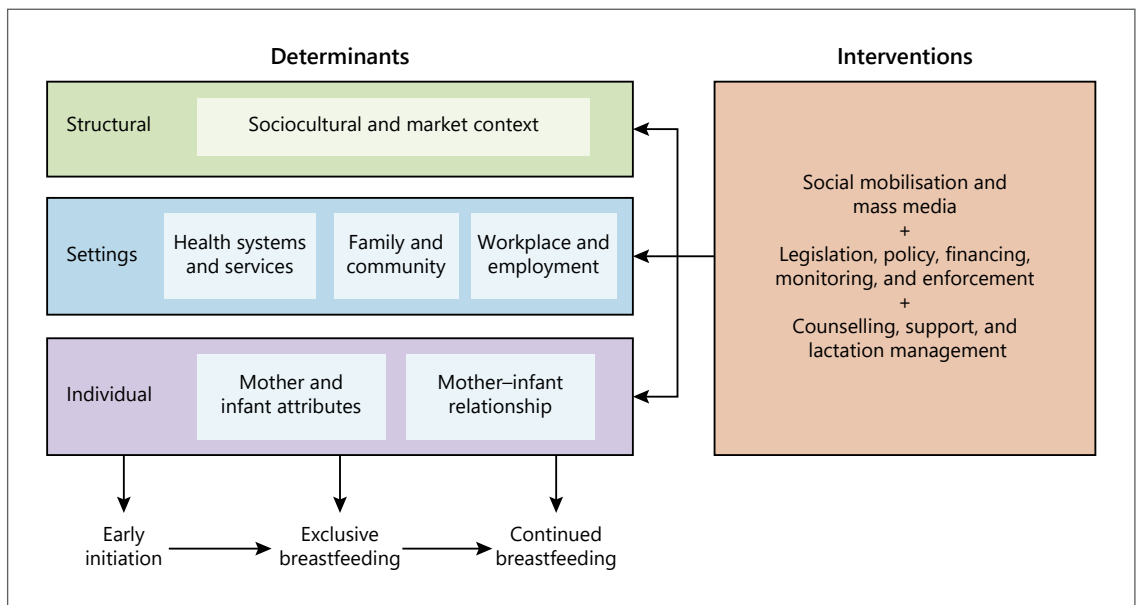


Fig. 4. The components of an enabling environment for breastfeeding – a conceptual model. Reprinted from Rollins et al. [2], pp 491–504, Copyright 2016, with permission from Elsevier. A full explanation of the model can be found in the original article.

ting a parent’s attitudes and aspirations. Positive experiences by a female relative are associated with greater success at breastfeeding [37, 38]. The attitudes of fathers are also key;

women with supportive partners are more likely to successfully breastfeed and for longer [39, 40]. For a first-time mother living in a society where breastfeeding rates are low, it can

be very challenging to commit to breastfeeding and to establish it successfully. Many online and face-to-face resources are available in most settings, but family support remains key.

Interventions to Promote Breastfeeding

Based on a meta-analysis of four studies, Rollins et al. [2] report that several elements of the Baby Friendly Hospital Initiative (BFHI) (individual counseling or group education, immediate breastfeeding support at delivery and lactation management) increased exclusive breastfeeding by 49% and any breastfeeding by 66%.

Box 2

Breastfeeding in The Gambia – an exemplar country

According to the 2021 Global Nutrition Report [41], 53.3% of mothers in The Gambia practice exclusive breastfeeding to 6 months and the country is therefore rated as “on course” to meet the target of 50% and is well ahead of the global average of 41%. Breastfeeding at 1 year is almost universal and the rate at 2 years is very high. The International Code on Marketing of Breast-milk Substitutes is fully implemented in law and the National Nutrition Agency (NaNA) has, for many years, invested immense effort and resource toward the promotion of breastfeeding. A high proportion of rural villages are classified as Baby Friendly Villages and receive reinforcement messages and training. Hospitals and their staff are also educated in baby-friendly practices.

These initiatives have built upon, and sustained, an exemplary national social and cultural attitude to breastfeeding. The author of this review has been working in The Gambia for over 4 decades and has never seen a baby being bottle fed. In the 1970s, some rural villagers had a belief (driven by its strange color and consistency) that colostrum would harm babies and it was expressed and discarded. When informed of the value of colostrum, this habit quickly disappeared. Mothers exhibit great joy in breastfeeding and do so openly in any social circumstances. Young children, acting as nursemaids for their mothers, learn that breastfeeding is the norm and, by the time they become mothers themselves, are well versed in the art of breastfeeding through many years of observing and assisting their own mothers. At birth, babies are rarely put to the breast within the first hour and may be fed by another family member or given prelacteal feeds; this does not seem to harm the ability to establish full and exclusive breastfeeding.

Weaning foods have traditionally been introduced at about 3–4 months when women perceive that their own milk is becoming insufficient. As in many societies this perception is overemphasized, but mothers do have a good ability to detect when their infant is ready for and requires additional foods. Sadly, the quality of these weaning foods is often very poor and they are frequently contaminated by microorganisms leading to rapid growth faltering [42]. At 6 months, there is no difference in the growth of weaned or exclusively breastfed babies [43]. The only disadvantage of extensive breastfeeding is that the infants become very iron deficient and hence anemic [44]. This should be correctable by early iron supplements and trials are ongoing.

Meta-analysis of family-based interventions shows increases of 48% in exclusive breastfeeding, 26% in continued breastfeeding, and 16% in any breastfeeding [2]. Interventions targeting fathers give equivocal results. Community-based interventions (including group counseling or education and social mobilization, with or without mass media) increase early breastfeeding initiation by 86% and exclusive breastfeeding by 20%.

Workplace Interventions

Just over half of the world’s countries meet the International Labor Organization’s minimum standard of 14 weeks’ statutory maternity leave and hundreds of millions of women in the informal and self-employed sectors have no provision whatever [2]. There is little formal analysis available, but, not surprisingly, greater maternity leave and positive workplace interventions (nursing breaks and rooms for mothers) are associated with better breastfeeding rates [2].

Barriers to Breastfeeding

Practical Difficulties and Negative Experiences

In settings that lack a historical community knowledge of how to breastfeed, many women encounter difficulties that discourage a full commitment to breastfeeding [45, 46]. Poor positioning and latching can lead to nipple damage and pain [47], and consequent engorgement can lead to pain and mastitis. Fussiness and crying by a baby can lead mothers to conclude that they have insufficient milk for their baby, a conclusion that is rarely true. Establishing breastfeeding with premature and low birthweight babies can be especially challenging but, with appropriate support and guidance, will be successful and is all the more important in such babies.

Negative experiences about breastfeeding in public are also highly undermining. These negative experiences do not need to be experienced by the mother herself but may be transmitted from friends, family members, and social memes, thus undermining the woman’s intentions.

Individual factors such as smoking, overweight and obesity, and depression are also associated with much lower rates of breastfeeding [2], and the HIV epidemic has significantly undermined confidence in breastfeeding in heavily affected regions.

Marketing of Breastmilk Substitutes

For their 2016 *Lancet* paper entitled “Why Invest, and What Will It Take to Improve Breastfeeding Practices?”, Rollins and colleagues [2] commissioned market research into the breastmilk substitute sales. Readers are referred to this excellent paper for a full report on the findings and a discussion of their implications.

In brief, the retail value of infant formula has increased at a rate of about 5% per annum for many years and was estimated to be worth about USD 45 billion globally in 2014 [2]. The market is led by some large multinationals, but there are increasing numbers of small local producers whose marketing practices may be more difficult to monitor and regulate.

In 2018, the World Health Organization reported that 136 of 194 countries had adopted at least some of the provisions of the 1981 International Code of Marketing of Breastmilk Substitutes [48]. Thirty-five of these had enacted the full provisions into law, and 31 had adopted many of the provisions, but 70 had only adopted a few of the provisions and a further 58 had not adopted the code at all.

Mothers are free to choose how best to feed their babies and many of the most ardent breastfeeding mothers will introduce commercial feeds after a period of exclusive breastfeeding. Problems arise when inappropriate marketing of breastmilk substitutes undermines breastfeeding in vulnerable mothers [2], and to this end, the International Code has been a powerful regulatory tool in countries in which it has been adopted. The code has had a powerful effect in influencing the marketing practices of the world's top producers many of whom invest considerable resources in ensuring that their corporate image is not harmed by contraventions of the code (e.g., [49, 50]). Nonetheless, there is still much work to be done among less responsible producers and in countries that have not adopted the code.

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Conclusion

There is overwhelming evidence, backed by an increasingly detailed knowledge of the mechanisms at play, that breastfeeding benefits both child and mother. This certainty has underpinned numerous efforts at the international, national, and local levels to promote breastfeeding, and after some precipitate declines in breastfeeding rates in the 20th century, there are signs of recovery albeit at a slow rate in many regions. Further implementation of known interventions to promote breastfeeding could offset estimated losses of USD 300 billion per annum and might save 823,000 child lives and 22,000 mothers' lives each year.

Conflict of Interest Statement

The author is on the Scientific Advisory Board of the Nestlé Nutrition Institute (NNI) and contributes annually to the NNI Pediatric Nutrition Course. The writing of this article was supported by Nestlé Nutrition Institute and the author declares no other conflicts of interest.

Funding Sources

The author receives grant funding from the UK Medical Research Council and the Wellcome Trust.

Author Contributions

The author was the sole contributor to this review.

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