Review

Breastfeeding in a Global Context: Epidemiology, Impact, and Future Directions

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ABSTRACT

Introduction: More than 98% of infant deaths occur in low- and middle-income countries (LMICs). Breastfeeding improves infant survival and protects against certain illnesses, such as diarrhea and pneumonia, which are leading causes of deaths in those <5 years of age in LMICs. The World Health Organization (WHO) recommends early initiation of breastfeeding within 1 hour of birth, exclusive breastfeeding up to 6 months of age, and continued breastfeeding up to 2 years of age. However, fewer than half of infants in LMICs are breastfed optimally to these standards. The objectives of this article are to describe the global epidemiology and health benefits of breastfeeding with particular focus on LMICs.

Methods: We searched PubMed to identify original research articles on breastfeeding in LMICs and reviews related to the benefits of breastfeeding, with particular focus on articles published in the past 5 years. We used reports and data published by the WHO and the United Nations Children's Fund (UNICEF) related to global breastfeeding rates, targets, and programmatic initiatives. We used the Lives Saved Tool to estimate mortality related to breastfeeding practices.

Findings: Less than half of infants globally receive early, exclusive, or continued breastfeeding. Certain high-risk groups, such as premature or HIV-exposed infants, face particular challenges and benefits related to breastfeeding. The WHO, UNICEF, and other global partners have developed a multipronged strategy to promote global breastfeeding, ranging from government-level advocacy to grassroots community support groups. Using the Lives Saved Tool, we estimate that nearly 200,000 lives of those <5 years of age could be saved in LMICs from 2020 to 2030 if early, exclusive, and continued breastfeeding rates were linearly increased from current rates to meet the WHO 2030 goals of 60% to 80% coverage. If this goal were exceeded and near-universal coverage were achieved, the number of lives would increase even further such that >820,000 lives per year could potentially be saved by universal breastfeeding. In this review, we delineate the health and economic benefit of breastfeeding in LMICs, discuss breastfeeding epidemiology in the global context, and describe targeted strategies to improve breastfeeding uptake. (*Clin Ther.* 2022;44:228–244.) © 2021 Elsevier Inc.

Keywords: Breastfeeding, Economic benefits, Global public health strategies, Health benefits, Low- and middle-income countries.

INTRODUCTION

Breastfeeding is one of the most effective global public health strategies to improve child health and survival. The benefits of breastfeeding in infancy last into adulthood. Breastfeeding also positively affects the health of the lactating mother. Despite these advantages, fewer than half of infants are optimally breastfed per global standards. A previous study estimated that near 100% adherence to key breastfeeding recommendations would save >820,000 children's lives per year and >$300 billion dollars annually.[1]

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Most of these deaths occur in low- and middle-income countries (LMICs).[2] In 2016, an estimated 101.1 million children in LMICs were not breastfed according to international standards, including encouraging early initiation after birth, exclusive breastfeeding up to 6 months, and continued breastfeeding to 2 years of age. Given the advantages to both infant and mother and the huge public health benefit, increased advocacy and action are needed to increase rates of breastfeeding worldwide as a key public health strategy to optimize the health of current and future generations.

METHODS

We searched PubMed to identify systematic reviews related to the health benefits of breastfeeding and original research articles related to breastfeeding in LMICs. We also used reports and data published by the World Health Organization (WHO) and the United Nations Children's Fund (UNICEF) related to global breastfeeding rates, targets, and programmatic initiatives. The effects of breastfeeding on maternal and offspring health were recently systematically reviewed by *The Lancet* Breastfeeding Series Group.[3] We used this review as a reference for meta-analyses published before 2016 and targeted more recent systematic reviews in our literature search.

We used the Lives Saved Tool developed by Johns Hopkins University (https://www.livessavedtool.org/) to estimate mortality related to suboptimal breastfeeding practices.[4] For our analysis, we included the 123 countries with population survey data related to breastfeeding practices available in the Lives Saved Tool database.[5,6] We calculated the number of lives of those <5 years of age that would be saved in the included countries if the 2020 rates of early, exclusive, and continued breastfeeding in each country were linearly increased to the WHO and UNICEF 2030 goals outlined by the Global Breastfeeding Collective which are as follows: (1) early initiation within 1 hour of birth in 70% of infants, (2) exclusive breastfeeding to 6 months in 70% of infants, (3) continued breastfeeding to 12 months in 80% of infants, and (4) continued breastfeeding to 24 months in 60% of infants.[7,8] In the case of countries currently above goal rates for any of the included metrics, we did not adjust downward.

FINDINGS AND DISCUSSION

Health Benefits of Breastfeeding

Breastfeeding has been associated with many positive health outcomes for both the mother and the breastfed infant throughout the life course (Figure 1). The Table summarizes the results of meta-analyses that report on the effects of breastfeeding on maternal and infant health outcomes.

Overall Mortality

Multiple studies from LMICs have found that breastfeeding is associated with lower all-cause mortality rates in a dose-dependent relationship.[9] In a meta-analysis from Sub-Saharan Africa, early initiation of breastfeeding in the first hour after birth was associated with a 70% decrease in mortality compared with delayed initiation of breastfeeding (relative risk [RR] = 0.3; 95% CI, 0.22–0.40).[10] In a meta-analysis of 18 studies predominantly from Latin America, South Asia, and Africa, infants who were exclusively breastfed up to 6 months had a 93% decrease in risk of death compared with those who were never breastfed (RR = 0.07; 95% CI, 0.03–0.16) and a 65% decrease in risk of death compared with those who were partially breastfed (RR = 0.35; 95% CI, 0.20–0.61).[11] These positive benefits extend beyond the period of early infancy. Infants and young children 6 to 23 months of age in LMICs who are ever breastfed (partial, predominant, or exclusive) up to 6 months of age have a 46% decrease in mortality risk compared with infants who were never breastfed (meta-analysis of 9 studies; RR = 0.54; 95% CI, 0.39–0.73).[9] Notably, none of these meta-analyses addressing mortality accounted for confounders such as infant illness that could be associated with a delay in breastfeeding initiation. However, early and exclusive breastfeeding are consistently associated with improved survival during infancy and early childhood.

Health Benefits During Infancy and early childhood

Breastfeeding reduces the risk of childhood infection–related morbidity and mortality. A meta-analysis of data from LMICs found that optimal breastfeeding in the first 6 months of life reduced infection-related mortality by 88% compared with infants who never breastfed (RR = 0.12; 95% CI, 0.04–0.31).[9] The unique immunologic and anti-inflammatory components of human breast milk

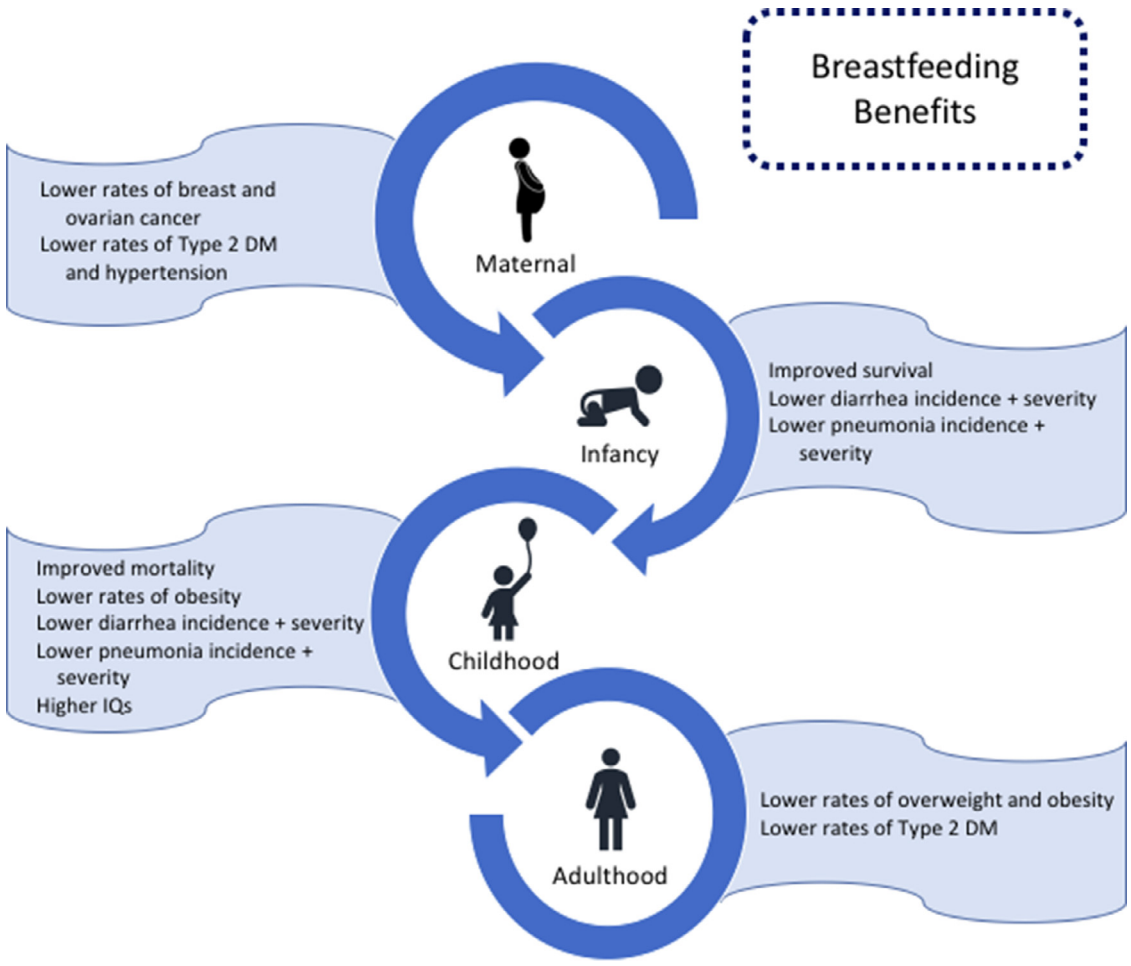


Figure 1. Benefits of breastfeeding throughout the life course.

protect the infant against infections.[12] Maternal IgA and IgG are transmitted through breast milk, bind to bacteria, viruses, and toxins, and inhibit pathogens from binding to cells. IgA protects against respiratory and diarrheal infection because it acts on the mucosal surface and neutralizes pathogens.[12] Lactoferrin, an iron-binding glycoprotein in breast milk, has multiple antimicrobial properties from sequestering iron, which prevents bacterial growth, to binding proteins on bacteria cell membranes, which disrupts the integrity of the bacteria, to inhibiting pathogen adhesion.[12] These compounds together transfer specific and nonspecific passive immunity from mother to infant, protecting the infant from common pathogens, particularly those that cause diarrheal and respiratory illnesses.

Diarrhea is 1 of the most common infectious risks for children in LMICs, causing approximately 525 000 deaths annually in those <5 years of age.[10,13] Multiple meta-analyses have reported on the beneficial effects of breastfeeding to reduce the incidence of diarrhea and associated mortality. Exclusively breastfed infants have a 56% lower diarrhea incidence and a 56% lower diarrhea-related mortality compared with predominantly breastfed infants <6 months of age (Table 1).[11,14] More recent individual studies from LMICs further affirm the protective effect of breastfeeding against diarrheal diseases. A cluster randomized controlled trial from the Democratic Republic of Congo found that implementation of the Baby-Friendly Hospital Initiative (BFHI) was associated with a 38% reduction in diarrheal incidence in children <6 months of age, suggesting that increased promotion of breastfeeding practices can also contribute to better health outcomes (RR = 0.72;

Table 1. Key systematic reviews reporting effect of breastfeeding on maternal-infant health outcomes.

	Age	Outcome	Source	Breastfeeding Intervention	Intervention Timing (Age of Infant)	Reference	Standardized Effect Size (95% CI	Population	No. of Studies
Mortality									
	0-6 mo	Mortality, all cause	Sankar et al,[9] 2015	Exclusive	<6 mo	None	RR = 0.07 (0.03 to 0.17)	LMIC	2
						Partial	RR = 0.36 (0.21 to 0.62)	LMIC	3
						Predominant	RR = 0.68 (0.53 to 0.88)	LMIC	3
		Mortality, infection related	Sankar et al,[9] 2015	Exclusive	<6 mo	None	RR = 0.12 (0.05 to 0.32)	LMIC	2
						Partial	RR = 0.22 (0.15 to 0.35)	LMIC	3
						Predominant	RR = 0.59 (0.41 to 0.85)	LMIC	3
	6-23 mo	Mortality, all cause	Sankar et al,[9] 2015	Continued	12-<24 mo	None	RR = 0.51 (0.38 to 0.69)	LMIC	9
		Mortality, infection related	Sankar et al,[9] 2015	Continued	12-<24 mo	None	RR = 0.48 (0.39 to 0.60)	LMIC	9
	<5 y	Mortality, all cause	Pretorius et al,[10] 2020	Exclusive	<6 mo	Nonexclusive	RR = 0.18 (0.07 to 0.47)	SSA	6
	<5 y	Mortality, all cause	Pretorius et al,[10] 2020	Early	<1 h	Delayed	RR = 0.31 (0.23 to 0.41)	SSA	5
Diarrhea									
	0-6 mo	Diarrhea, incidence	Horta et al,[14] 2013	Exclusive	<6 mo	None	RR = 0.20 (0.13 to 0.29)	HIC/LMIC	11
						Partial	RR = 0.51 (0.37 to 0.70)	HIC/LMIC	11
						Predominant	RR = 0.44 (0.38 to 0.50)	HIC/LMIC	11
		Diarrhea, hospitalization	Horta et al,[14] 2013	Exclusive	<6 mo	None	RR = 0.09 (0.02 to 0.44)	HIC/LMIC	9
						Partial	RR = 0.20 (0.10 to 0.41)	HIC/LMIC	9
						Predominant	RR = 0.67 (0.23 to 1.98)	HIC/LMIC	9
	0-5 mo	Diarrhea, mortality	Lamberti et al,[11] 2011	Exclusive	<6 mo	None	RR = 0.10 (0.03 to 0.36)	LMIC	3
						Partial	RR = 0.22 (0.09 to 0.56)	LMIC	3
						Predominant	RR = 0.44 (0.17 to 1.18)	LMIC	3
	6-23 mo	Diarrhea, mortality	Lamberti et al,[11] 2011	Continued	12-23 mo	None	RR = 0.24 (0.13 to 0.45)	LMIC	3
Respiratory infection									
	<6 mo	Pneumonia, hospitalization	Horta et al,[14] 2013	Any	<6 mo	None	RR = 0.41 (0.25 to 0.69)	HIC/LMIC	4
	<5 y	Pneumonia, incidence	Horta et al,[14] 2013	Any	Varied	None	RR = 0.68 (0.60 to 0.77)	HIC/LMIC	18
	<5 y	Pneumonia, incidence	Alamneh,[76] 2020	Exclusive	<6 mo	None	OR = 0.41 (0.21 to 0.55)	Ethiopia	8
	<5 y	Pneumonia, hospitalization	Horta et al,[14] 2013	Any	Varied	None	RR = 0.33 (0.24 to 0.46)	HIC/LMIC	18
	<5 y	Pneumonia, mortality	Horta et al,[14] 2013	Any	Varied	None	RR = 0.30 (0.16 to 0.56)	HIC/LMIC	4
Intelligence									
	1-15 y	Intelligence scores	Horta et al,[17,18] 2015	Any	Varied	None to <6 mo	MD = 3.44 (2.30 to 4.58)	HIC/LMIC	18
				Any	Varied		MD = 1.88 (−0.07 to 3.83)	LMIC	2

(*continued on next page*)

Table 1. (*continued*)

	Age	Outcome	Source	Breastfeeding Intervention	Intervention Timing (Age of Infant)	Reference	Standardized Effect Size (95% CI	Population	No. of Studies
Noncommunicable disease									
	Varied	Systolic blood pressure	Horta et al,[17,18] 2015	More*	Varied	Less or none*	MD = −0.30 mm Hg (−1.02 to 0.43)	LMIC	9
	Varied	Diastolic blood pressure	Horta et al,[17,18] 2015	More*	Varied	Less or none*	MD = 0.17 mm Hg (−0.12 to 0.45)	LMIC	8
	Varied	Total cholesterol	Horta et al,[17,18] 2015	More*	Varied	Less or none*	MD = −0.09 mmol/L (-0.25-0.08)	LMIC	7
	Varied	Overweight or obesity	Horta et al,[17,18] 2015	More*	Varied	Less or none*	OR = 0.76 (0.67 to 0.85)	LMIC	34
	Varied	Type 2 diabetes mellitus	Horta et al,[17,18] 2015	Any or continued	Varied	None to <6 mo	OR = 0.65 (0.49 to 0.86)	HIC/LMIC	11
Maternal illness									
		Breast cancer	Unar-Munguía et al,[22] 2018	Any	Varied	None	SRR = 0.69 (0.40 to 1.18)	HIC/LMIC	11
				Exclusive	<6 mo	None	SRR = 0.72 (0.58 to 0.90)	HIC/LMIC	6
			Chowdhury,[77] 2015	Any	Varied	None	OR = 0.78 (0.87 to 0.96)	HIC/LMIC	98
				Any	Varied	None	OR = 0.66 (0.56 to 0.77)	LMIC	26
				Continued	>12 mo	None	OR = 0.74 (0.69 to 0.79)	HIC/LMIC	50
		Ovarian cancer	Chowdhury,[77] 2015	Any	Varied	None	OR = 0.70 (0.64 to 0.77)	HIC/LMIC	41
				Any	Varied	None	OR = 0.48 (0.29 to 0.77)	LMIC	6
				Continued	>12 mo	None	OR = 0.63 (0.56 to 0.71)	HIC/LMIC	29
		Type 2 diabetes mellitus	Rameez,[78] 2019	Continued	>12 mo	Truncated	OR = 0.70 (0.62 to 0.78)	HIC	4
		Hypertension	Rameez,[78] 2019	Continued	>12 mo	Truncated	OR = 0.87 (0.78 to 0.97)	HIC	4

HICs = high-income countries; LMICs = low- and middle-income countries; MD = mean difference; OR = odds ratio; RR = relative risk; SSA = Sub-Saharan Africa.

* Criteria for intervention and control groups varied widely between groups.

95% CI, 0.53–0.99; adjusted for clustering at clinic level).[15]

Respiratory infections are another leading cause of death among children <5 years of age in LMICs. Promotion of breastfeeding practices is considered a cost-effective intervention against the incidence of respiratory infection–related hospitalizations and deaths.[14] In a meta-analysis of 18 studies from LMICs, exclusively breastfed infants <5 years of age were 67% less likely to be hospitalized for pneumonia compared with nonbreastfed infants (unadjusted RR = 0.33; 95% CI, 0.24–0.46).[14] Even nonexclusive breastfeeding is beneficial. In the same meta-analysis, infants <5 years of age exposed to any type of breastfeeding were 70% less likely to die of respiratory infections compared with nonbreastfed infants (unadjusted RR = 0.30; 95% CI, 0.16–0.56).[14] Recent individual population-based studies from Ethiopia and India found a

decreased incidence of acute respiratory infection in infants associated with both exclusive and continued breastfeeding. Similarly, a prospective cohort study from India found that infants <6 months of age who were exclusively breastfed had a 74% lower risk of developing acute respiratory infection compared with infants not exclusively breastfeed (unadjusted odds ratio [OR] = 0.26; 95% CI, 0.14–0.50).[16]

Health Benefits During Childhood and Adulthood

The benefits of breastfeeding reach beyond infancy to affect child and adult health. There is consistent evidence that breastfeeding for >12 months is linked with improved cognitive outcomes in children and adolescents.[17] Breastfeeding has been linked with better performance in intelligence tests, with breastfed children and adolescents scoring a mean of 3.44 points higher than those who were never breastfed (meta-analysis of 18 studies; mean difference = 3.44; 95% CI, 2.30–4.58).[18] A randomized controlled trial of 17,046 infants in Belarus found that children who were allocated to a breastfeeding promotion group scored 7.5 points higher on verbal IQ testing at 6½ years of age than the control group (verbal IQ difference, +7.5; 95% CI, +0.8 -to +14.3; results adjusted only for cluster, although the article states that numbers are similar to sensitivity analysis accounting for multiple individual factors, such as birth weight and parental education).[19] Breastfeeding is consistently associated with higher scores on cognitive tests, which may also lead to improved educational attainment and income.

Breastfeeding in infancy is associated with lower rates of several noncommunicable diseases in adulthood. Adults who were predominantly breastfed as infants had a 35% reduced risk of developing type 2 diabetes mellitus in adulthood compared with those who were predominantly formula fed.[18] A similar relationship has been observed with obesity.[20] Breastfeeding has a protective effect against childhood and adulthood obesity and can lower the odds of developing obesity or being overweight later in life.[18] This positive effect seems to be closely linked to the duration and exclusivity of breastfeeding; the protective effect is negligible with <6 months of exclusive breastfeeding.[21] Although most of the data related to type 2 diabetes and obesity is from high-income countries, these data are relevant to LMICs. A meta-analysis of LMIC studies found a 24% reduction in overweight or obesity risk related to breastfeeding (unadjusted OR = 0.76; 95% CI, 0.67–0.85).[18] Noncommunicable diseases are increasingly accounting for a greater proportion of the global burden of disease. Breastfeeding has the potential to mitigate the development of these diseases.

Maternal Health Benefits

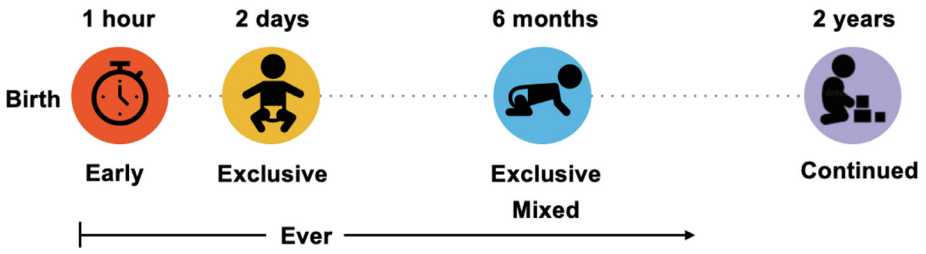
Breastfeeding has also been associated with maternal health benefits and lower risk of breast and ovarian cancer, hypertension, cardiovascular health, and diabetes (Table 1). Longer duration of breastfeeding, particularly beyond 12 months, decreases the risk of developing breast and ovarian cancer.[22–24] The positive effect of breastfeeding on maternal health outcomes have been found in both high- and low-income settings (Table 1).

Global Breastfeeding Epidemiology: Indicators, Trends, and Targets

The WHO has established a set of key indicators to assess breastfeeding practices. Historically, the 3 key indicators have been (1) early breastfeeding within the first hour after birth, (2) exclusive breastfeeding up to 6 months of age, and (3) continued breastfeeding up to 2 years of age. In April 2021, 3 additional indicators were added to expand our understanding of global infant feeding practices: (4) ever breastfed, (5) exclusively breastfed for the first 2 days after birth, and (6) mixed feeding for children <6 months of age.[7] These 6 indicators are incorporated into global demographic health surveys and breastfeeding quality assessment tools to provide policy, advocacy, and research stakeholders with information regarding the state of breastfeeding both globally and in individual countries and regions (Figure 2).

Global Indicator 1: Early Initiation of Breastfeeding Within 1 Hour of Birth

The WHO recommends the initiation of breastfeeding within 1 hour of birth.[7] Early initiation of feeding has been associated with many benefits. The time to initiate breastfeeding has been directly correlated with the likelihood of early infant death. A meta-analysis of >130,000 infants in 5 studies found that exclusively breastfed infants who did not initiate breastfeeding until 2 to 24 hours after birth had a 33% increased chance of neonatal mortality compared with those who initiated within 1 hour of birth (95% CI, 13%–56%).[26] Despite the benefits, only 49% of infants



Indicator	Definition	2020 Rate	2030 Goal
Ever	Child ever breastfed	95%	--
Early initiation	Child put to breast within 1 hour of birth	49%	70%
Exclusive – 2 days	Child fed exclusively breastmilk for first 2 days after birth	No data	--
Exclusive – 6 months	Child fed exclusively breastmilk for up to 6 months	44%	70%
Mixed	Child fed formula/animal milk + breastmilk up to 6 months	No data	--
Continued	Child fed breastmilk at 12-23 months	44%*	60%*

Figure 2. Timeline of global breastfeeding indicators, current rates, and 2030 goals. Data are from the Global Breastfeeding Collective,[8] World Health Organization Indicators for Infant and Young Child Feeding,[7] and United Nations Children's Fund 2030 Nutrition Targets.[25]
*These rates refer to the rate of continued breastfeeding at 20 to 23 months.

globally were breastfed within the hour after delivery in 2020. The time to initiate breastfeeding varies widely across the world. An analysis of demographic health survey data from 57 LMICs in 2015 found regional variation in early initiation of breastfeeding ranging from 30.8% in Asia to 60.3% in Latin America.[27] Barriers to early initiation include cultural beliefs, lack of education regarding the value of early lactation, and illness affecting the mother or infant.

Global Indicator 2: Exclusive Breastfeeding Up to 6 Months of Age

In 2012, the WHO set a 2025 global target that 50% of infants will be exclusively breastfed up to 6 months of age. This goal was extended to a 2030 target that 70% of infants will be exclusively breastfed up to 6 months of age.[25,28] If the 2030 target is reached, the global rate of exclusive breastfeeding will have nearly doubled in 25 years from a baseline rate of 37% globally in 2005.[29,30] Although the global rate has steadily increased, less than half (44%) of infants were exclusively breastfed up to 6 months in 2020.[29] Certain global regions have had faster rates of improvement than others. Sub-Saharan Africa has had steady improvement, whereas exclusive breastfeeding rates in the Middle East and North Africa have remained largely flat (Figure 3).[31,32] Accelerated progress in nearly all regions is necessary to reach the 2030 targets.

Global Indicator 3: Continued Breastfeeding Up to 2 Years of Age

To maximize the benefits of breastfeeding, women are encouraged to continue breastfeeding their infants up to at least 2 years of age. In 2020, 69% of infants globally were breastfed up to 1 year of age, and 44% were breastfed up to 2 years of age.[29] Continued breastfeeding rates vary substantially by country and region (Figure 4). On the basis of UNICEF data from 2014 to 2019, only 23% of infants in the Middle East and North Africa were breastfed until 20 to 23 months of age, as opposed to 70% of infants in South Asia.[29] Continued breastfeeding at both 1 and 2 years

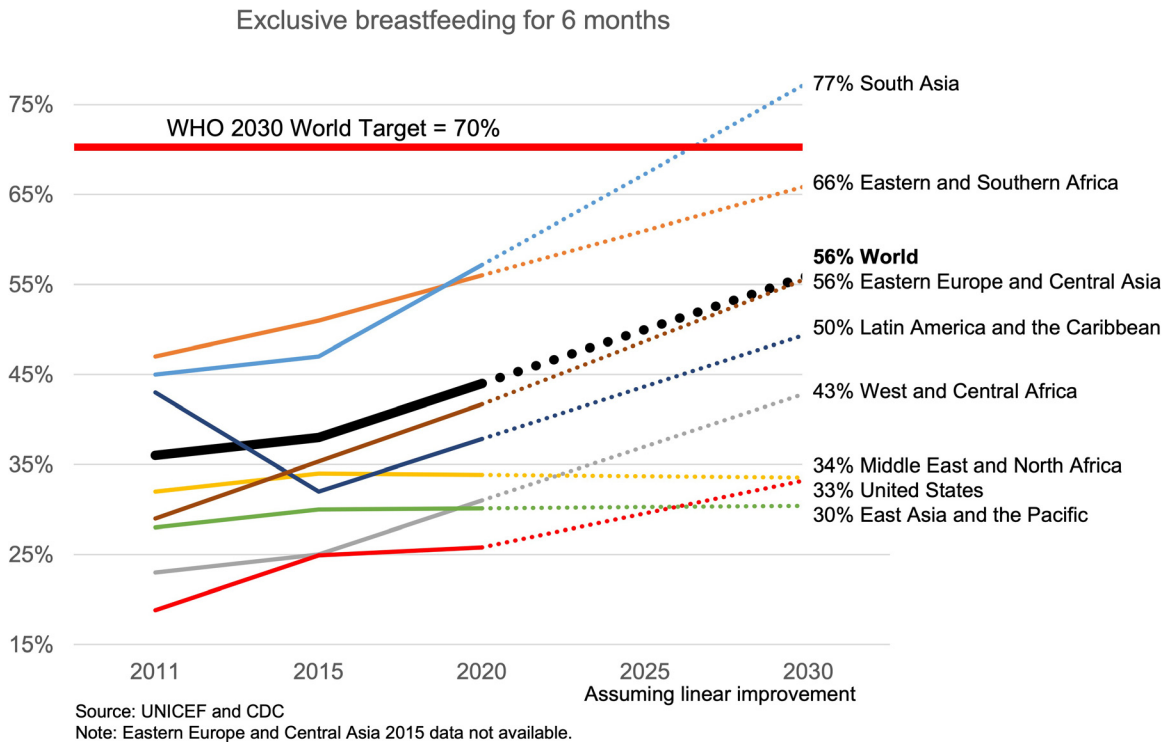


Figure 3. Exclusive breastfeeding rates by region from 2011 to 2020 with projection based on a linear rate of increase from 2015 to 2020 through 2030. Red line indicates the World Health Organization (WHO) 2030 target rate. Data are from the United Nations Children's Fund and the Centers for Disease Control and Prevention.[8,75] Data for 2015 were not available for Eastern Europe and Central Asian.

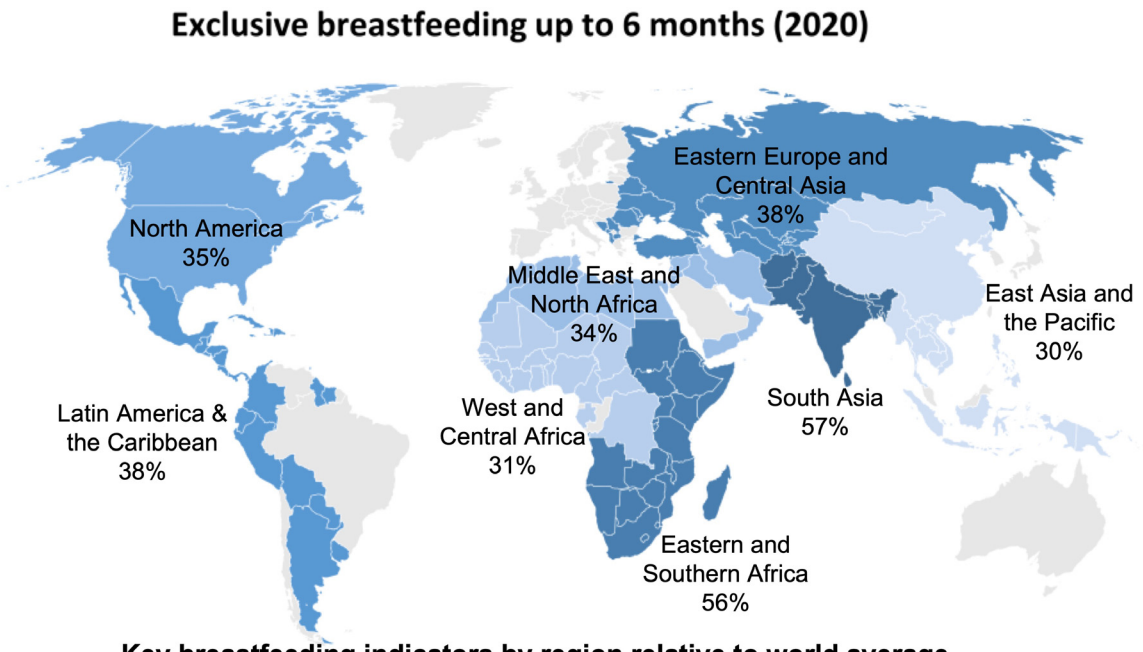
of age is more common among women living in the world's poorest quintile of countries than women in the world's wealthiest quintile of countries.[29] Within countries, women in LMICs with lower educational attainment are more likely to breastfeed than women with higher levels of education, a trend that is the opposite of high-income countries.[29] This trend may be changing, however, because a recent analysis of 20 years of breastfeeding data from 81 countries found a more positive trajectory in continued breastfeeding rates among women with higher educational levels.[33] Continued breastfeeding has not been found to correlate with rates of exclusive breastfeeding up to 6 months, suggesting that personal and societal factors that influence exclusive breastfeeding may differ from those influencing continued breastfeeding.[3]

Global Indicator 4: Ever Breastfed

A fourth WHO metric is the presence of any breastfeeding.[7] Even in the absence of early, exclusive, or continued breastfeeding, infants who receive any breast milk still receive benefits compared with infants who were never breastfed.[34] Globally, 95% of infants have ever breastfed.[29] Although this percentage is high, this metric was added to better identify subgroups of the world in which breastfeeding is not practiced and to identify infants who may have received some benefits of breast milk even if they do not meet the early, exclusive, or continued criteria.[7] A recent analysis of surveys and data from 113 countries found significant gains in any breastfeeding at 6 months of age among high-income countries (1.3% per year; 95% CI, 1.1%–1.5%) but small decreases in low-income countries (−0.1% per year; 95% CI, −0.1% to −0.2%).[35]

Global Indicator 5: Exclusively Breastfed for the First 2 Days After Birth

The indicator exclusively breastfed for the first 2 days after birth provides information related to the



Key breastfeeding indicators by region relative to world average.

Difference vs World Average (%)	Early initiation of breastfeeding (2020)	Exclusive breastfeeding to 6 months (2020)	Continued breastfeeding to 2 years (2020)
World Average	49%	44%	44%
South Asia	+1	+13	+26
Eastern & Southern Africa	+16	+12	+7
Latin America & the Caribbean	+4	-6	-9
West & Central Africa	-3	-13	-11
Eastern Europe & Central Asia	+25	-2	-13
East Asia & the Pacific	-10	-14	-21
Middle East & North Africa	-15	-10	-21
North America	N/A	-9	-32

Figure 4. Map shows the regional rates of exclusive breastfeeding up to 6 months. Data below the map indicate regional breastfeeding rates for early, exclusive, and continued breastfeeding by region compared with the world mean for each indicator. Positive numbers indicate rates that are above the mean, whereas negative numbers indicate rates that are below the mean. NA = not applicable.

provision of colostrum, a substance that is rich in bioactive components. Despite the benefits, prelacteal feeds of animal milk or other liquids are often given as alternatives to breast milk in the first days after birth in certain cultural contexts.[36] Prelacteal feeding patterns are often closely associated with cultural beliefs regarding the beneficial (or detrimental) effects of colostrum. An analysis of demographic health survey data from 2000 to 2013 in 56 countries found that slightly less than half (49.2%) of infants were exclusively breastfed up to 3 days after birth.[27] Although there was a moderate degree of regional variability (41.0% in Asia vs 65.2% in Latin America), there was very wide country-to-country variability in prelacteal feed rates, ranging from 3.2% to 97.3%.[27] Twenty-five percent of breastfed newborns were fed non–milk-based liquids, such as sugar water or tea, in the first 3 days of life.[36] Nearly half (44%) of newborns who received milk-based liquids shortly after birth had a delay of at least 24 hours until they were breastfed.[36] Global recognition of the value of exclusive breastfeeding for the first 2 days after birth has the potential to positively affect the health of millions of children annually.

Global Indicator 6: Mixed Feeding Up to 6 Months of Age

The new indicator mixed feeding up to 6 months of age provides information about exposure to formula or animal milk in addition to breast milk during the first 6 months. In LMICs, infants have 3 times the risk of death if they have received foods and liquids in addition to breast milk at <6 months of age.[9] A recent analysis of global feeding trends in 81 LMICs found a 0.6% increase per year of formula use among infants in upper- to middle-income countries between 2000 and 2019 (95% CI, 0.2-0.9).[33] Increased awareness of the rates of mixed milk feeding may be used to improve advocacy around this practice.[7]

Special Considerations for Breastfeeding

Certain subgroups within the global population face unusually difficult circumstances that make breastfeeding a particular challenge. These groups include infants born to mothers infected by HIV, small or premature infants, infants born in complex emergencies, and infants born to adolescent mothers or in the setting of substance abuse. Recently, the global community has encountered the challenge of COVID-19, which has disrupted many health systems and created new breastfeeding challenges.

HIV

Infants born to mothers with HIV in LMICs are recommended to receive early, exclusive, and continued breast milk.[37] These recommendations are based on several decades of research, but breastfeeding in the setting of HIV has been a controversial topic because infants are at risk for vertical HIV transmission during breastfeeding. As such, some high-income countries, such as the United States, encourage HIV-infected mothers to never breastfeed.[38] However, the use of commercial breast milk substitutes has been associated with increased mortality in regions of the world with poor access to affordable breast milk substitutes, clean water, and proper sanitation. In 2016, the WHO published guidelines on HIV and infant feeding that are targeted to countries with high rates of HIV, infant diarrhea, and child malnutrition.[37] Mothers living with HIV in these settings are encouraged to breastfeed for at least 12 months and continue breastfeeding for up to 24 months or longer if they are adherent to antiretroviral therapy and have no evidence of treatment failure.[37] In the case of nonexclusive breastfeeding, mothers are encouraged to practice mixed feeding as opposed to no breastfeeding at all.[37] Local health facilities are encouraged to promote and support breastfeeding and antiretroviral adherence among women living with HIV.[37] Mothers are strongly encouraged to adhere to antiretroviral therapy throughout the time that they are breastfeeding.[37] Historically, infants who are breastfed were encouraged to receive 6 weeks of antiretroviral prophylaxis, but recent studies have found a benefit of even more prolonged prophylaxis throughout the duration of breastfeeding without added harm.[39,40] A multisite study of 2431 HIV-1–infected breastfeeding women with high CD4 cell counts found similarly low HIV transmission rates among infants whose mothers were adherent to antiretroviral therapy (0.57%) when infants were treated with prophylactic nevirapine for either 18 months after delivery or breastfeeding cessation (0.58%).[41]

Small Infants

Infants who are born small or premature are at high risk for morbidities and mortality that may be mitigated by exclusive breast milk consumption. They also face many challenges related to feeding. In 2011, the WHO published guidelines entitled *Guidelines on Optimal Feeding of Low Birth-Weight Infants in Low- and Middle-Income Countries*.[42] Given the beneficial effect of breastfeeding on complications of prematurity, such as necrotizing enterocolitis, the guidelines recommend the prioritization of maternal breast milk with donor breast milk as the next best alternative.[42] Human milk banks have been established to safely provide pasteurized donor breast milk to small infants who require intensive or specialized care who do not have sufficient access to their mother's own milk. Although there are approximately 700 human milk banks currently in existence worldwide, most of these are located in Europe and the Americas, with limited penetration in Africa and most countries in Asia.[43] Those who fail to gain weight with unfortified breast milk should be given human milk fortifiers, preferably human milk–based fortification.[42]

Breastfeeding in Difficult Circumstances

Other groups of vulnerable infants warranting special attention include malnourished infants, infants born in complex emergencies, and infants living in special circumstances, such as foster care, situations of

parental substance abuse, and with teenage mothers. Although these infant-mother dyads face unique feeding challenges, they may also uniquely benefit from the physical and emotional advantages of breastfeeding. Where possible, infants should not be separated from their mothers. Although some infants may require breast milk substitutes, these should be promoted judiciously and should ideally be used in conjunction with breastfeeding.[44]

Breastfeeding and COVID-19

The recent and ongoing pandemic caused by COVID-2019 has significantly affected pregnant and nursing mothers. At the start of the pandemic, because of inconsistencies in original guidelines and an incomplete understanding of COVID-19 pathogenesis and transmission, parents were frequently separated from their newborn and prevented from breastfeeding.[45,46] Multiple international health organizations now recommend direct breastfeeding with appropriate hygiene precautions during maternal COVID-19 illness, unless the health of the mother or infant necessitates separation.[47,48] Studies have found that the role of breast milk as a vehicle of COVID-19 transmission is limited.[47] Breast milk produced by infected mothers contains anti–SARS-CoV-2 IgA and IgG, which can protect the infants from infection.[48] Furthermore, initial studies found that maternal immunization results in significant secretion of COVID-19 antibodies in breast milk as early as 2 weeks after vaccination, indicating a protective effect against infection in the infant.[49]

Despite evidence of overwhelming benefits of breastfeeding, contradictory statements by formula companies and widespread false rumors have contributed to poor breastfeeding rates during the COVID-19 pandemic in LMICs. In multiple LMICs, formula companies capitalized on fear and uncertainty and violated the International Code of Marketing of Breast-Milk Substitutes.[50] Formula companies used unfounded health claims of formula boosting immunity and emphasized the uncertain risks of COVID-19 transmission during breastfeeding in multiple marketing efforts in Kenya, Pakistan, and the Philippines.[50] Similarly, in Mexico, inconsistent and negative media coverage on breastfeeding during the COVID-19 pandemic led to a widespread notion that mothers with COVID-19 should not breastfeed, despite the Mexican government endorsing breastfeeding.[51] These reports suggest that community breastfeeding practices may be susceptible to false information, potentially exacerbating child health inequities in LMICs.

Breastfeeding Interventions

The effectiveness of intervention approaches to improve breastfeeding rates were systematically reviewed in *The Lancet* Breastfeeding Series.[52]

Health System, Hospital, and Health Worker Support

A woman's interaction with the hospital and health care system during the antenatal and perinatal period is an opportunity for individualized and system-wide interventions to improve breastfeeding support. The provision of skilled breastfeeding counseling by health workers increases rates of exclusive and continued breastfeeding. A systematic review of 63 studies found that counseling interventions increased the rate of any breastfeeding at 6 months (RR = 1.1; 95% CI, 1.1–1.3) and the rate of exclusive breastfeeding at 6 months (RR = 1.2; 95% CI, 1.1–1.3).[53] Counseling was found to be most effective if it was delivered at least 4 times postnatally.[53] Breastfeeding counseling by trained health workers is an opportunity for mothers to receive individualized breastfeeding support that has been associated with significant improvements in breastfeeding rates.

Breastfeeding-friendly hospital policy is another way in which the health system may support breastfeeding. The BFHI is a global initiative intended to promote early breastfeeding during the first days after an infant is born. The initiative published Ten Steps to Successful Breastfeeding that are focused on optimizing clinical support for mother-infant dyads using evidence-based guidelines that improve early breastfeeding rates.[54] The BFHI has been implemented in nearly all countries in the world; however, as recently as 2017, only approximately 10% of infants were born in a "baby-friendly" facility.[54,55] One study of demographic and health surveillance survey data from 14 LMICs found that the BFHI initiation has been associated with increased rates of exclusive breastfeeding, although not significantly higher than preinitiation trends.[56] The Ten Steps championed by the BFHI are composed of both institutional procedures to ensure consistent and ethical care of newborns, such as written feeding policies and ongoing data management systems, as well as clinical

standards for the care of mother-infant dyads, such as immediate, uninterrupted skin-to-skin contact and support of cue-based feeding.[54] The BFHI program is intended to provide a framework for facilities and policymakers to create a breastfeeding-supportive environment during the immediate hospitalization after an infant's birth. One component of the Ten Steps is adherence to the 21st International Code of Marketing of Breast-milk Substitutes, a statement published by the World Health Assembly in 1981 and recently affirmed by the WHO at the 40th anniversary in May 2021.[57,58] The code calls on governments to enact legislation that limits the marketing of breast milk substitutes, health workers to promote and support breastfeeding, and the commercial breast milk substitute industry to limit sponsorship or gifts to promote their products.[57] "Baby-friendly" hospital initiatives have been associated with a 20% increase in the early initiation of breastfeeding within an hour of birth (10 studies; 95% CI, 11%–28%) and a 49% increase in exclusive breastfeeding up to 6 months of age (15 studies; 95% CI, 33%-68%).[59]

Peer and Community Support

In addition to infant and young child feeding counseling by health workers, community-based peer support increases the duration of exclusive breastfeeding. A meta-analysis of 47 studies found that community support increased the rate of exclusive breastfeeding at 5 months by 9.6-fold (95% CI, 6.7–13.7) in LMICs.[60] Another meta-analysis found that antenatal and postnatal support to mothers and family members at home increased exclusive breastfeeding up to 6 months by 48% (43 studies; 95% CI, 32%–66%) and continued breastfeeding for 12 to 23 months up by 26% (95% CI, 5%–50%).[59] Support from both community and family members are important components of a breastfeeding-supportive environment.

Workplace Support

A mother's return to work after the birth of an infant is a vulnerable time for breastfeeding. In 2021, a cross-sectional study of 449 employed women in North Ethiopia found that return to work was the primary reason that women discontinued exclusive breastfeeding (31.5%).[61] In many countries, women receive no or little paid maternity leave, particularly women in the informal workforce. To address these concerns, the International Labor Organization published Convention No. 183 in 2000, which states that maternity leave should be at least 14 weeks, with an additional Recommendation No. 191, which suggests a minimum of 18 weeks of leave.[62,63] Nevertheless, only 98 of 185 countries (53%) met the minimum standard of 14 weeks of maternity leave in 2016.[64] This convention also recommended that compensation benefits be provided to the mother during leave because many families cannot afford the financial impact of unpaid maternity leave. In addition, Convention No. 183 calls for breastfeeding breaks and facilities to be available for mothers to either breastfeed or express breast milk after their return to work.[62] An analysis of country-level data found that paid breaks for breastfeeding or breast milk expression for at least 6 months after delivery have been associated with a 8.9% increase in exclusive breastfeeding rates.[65] Although many women will return to work, businesses and policymakers can institute breastfeeding-friendly policies to minimize the negative effects on exclusive and continued breastfeeding.

Advocacy: Global Breastfeeding Collective

The WHO and UNICEF have developed several global breastfeeding initiatives focused on advocacy, policy, and community-level changes to support mothers and infants. These initiatives target policymakers, advocacy groups, researchers, health workers, and grass-roots community support groups with a multipronged approach to increasing breastfeeding worldwide. One of the key initiatives is the Global Breastfeeding Collective, a WHO- and UNICEF-led advocacy platform that is aimed at increasing global transparency and accountability related to breastfeeding. The Global Breastfeeding Collective partners with leading international agencies to rally support for funding, research, and policies to support breastfeeding worldwide.[66] The collective has developed a Global Breastfeeding Scorecard to increase awareness of country-level data related to current breastfeeding rates and probreastfeeding policies.[8] The scorecard consists of 7 key policy action priorities and 3 breastfeeding indicators that are graded on a stoplight scale.[8] Each item on the scorecard has a progress indicator and 2030 target rate that is intended to be an impetus for global policymakers to prioritize breastfeeding. The scorecard has key policies that the WHO regards as fundamental to creating a breastfeeding-enabling

environment. The Global Breastfeeding Collective is advocating for country and global leaders to enact breastfeeding-friendly policies around the world.

Global Impact: Millions of Lives Could Be Saved If Goals Are Met

In 2016, *The Lancet* Breastfeeding Series went beyond the WHO 2030 breastfeeding targets and modeled the lifesaving effect of near-universal early, exclusive, and continued breastfeeding in 71 countries accounting for 95% of global child deaths. They estimated that 820,000 deaths of children <5 years of age could be avoided annually if all infants were breastfed early within 1 hour of birth, exclusively for 6 months, and until 2 years.[3] They also estimated the effect of breastfeeding on maternal mortality and found that 20,000 maternal deaths from breast cancer would be avoided.[3] The full effect on maternal lives saved would be even higher when accounting for the effect on ovarian cancer, hypertension, myocardial infarction, and type 2 diabetes.[67]

In our analysis of trends to achieve the WHO goals for early, exclusive, and continued breastfeeding by 2030, South Asia was the only region on target to achieve the goals. All other regions are lagging and thus will miss the opportunity to optimize the health of mothers and their infants. We used the Lives Saved Tool to estimate the effect of linearly increasing the rates of early, exclusive, and continued breastfeeding from 2020 levels to the WHO 2030 goals in 123 LMICs. We calculated that >190,000 lives of those <5 years of age would be saved by 2030 if the breastfeeding rates at 2020 were linearly increased to meet the WHO goals. Although this number is substantially lower than *The Lancet* Breastfeeding Series Group estimate, our values reflect both the gains in breastfeeding rates that have been made in the past 5 years and the smaller incremental increase in breastfeeding rates that is necessary to meet the global 2030 goals compared with *The Lancet* Breastfeeding Series Group goal of near-universal coverage (90% rates). If the 2030 breastfeeding goals are attained, nearly 200,000 lives will be saved globally between 2020 and 2030.

In addition to the lives saved, the economic effect of inadequate breastfeeding practices is substantial. *The Lancet* Breastfeeding Series Group published an economic model that estimated that 0.49% of world gross national product is lost because of lack of universal breastfeeding.[52] In 2020, that would equate to $414 billion lost because of inadequate breastfeeding.[68] Every $1 invested in breastfeeding support is estimated to yield $35 in economic returns related to earning gains from decreased all-cause child mortality and earning gains related to improved cognitive outcomes.[69] A 2016 meta-analysis of the economic effect of breastfeeding in the United States estimated $20,000 in additional lifetime earnings associated with breastfeeding.[70]

CONCLUSIONS

Breastfeeding has the potential to positively affect millions of lives around the world. Breastfeeding significantly improves many health outcomes throughout the lifespan. Optimal breastfeeding is initiated early within 1 hour after birth, exclusively practiced until 6 months, and continued until at least 2 years. To achieve global breastfeeding goals, mother-infant dyads require multilayered support, ranging from policymakers to health workers and community leaders to their immediate family members. Many avenues remain for future research related to breastfeeding in the global setting. Scant literature exists regarding breast milk composition in LMICs; breastfeeding vulnerable populations, such as small infants in LMICs; and the efficacy of global strategies to optimize breastfeeding. Breastfeeding is a powerful, cost-effective tool to improve the health of the global community, but global support is needed to achieve its maximal potential value.

CASE STUDIES

Yemen

Yemen has 1 of the lowest exclusive breastfeeding rates worldwide, with only 10% of women breastfeeding exclusively for up to 6 months.[29] A total of 50% of women report using milk substitutes as their primary infant feeding method.[71] Unsafe and uninformed practices are common among mothers in Yemen; 33% have claimed to mix breastfeeding with a sugar and water combination thought to better hydrate the infant, and milk substitutes are often heavily diluted to last longer, which may result in nutrition and dangerous electrolyte abnormalities.[71] The country's financial and humanitarian crises heavily affect women's

abilities to receive correct information and effective support when breastfeeding. A 2018 report delineating a strategy against Yemen's nutritional struggles described the many contributors to Yemen's poor breastfeeding practices, ranging from lack of support and misinformation spread from relatives to disapproval from their community to lack of information for proper breastfeeding.[72] Infant and young child feeding counseling has been difficult to establish and maintain because access to services may require long travel distances, missing work, and having to await a male relative to accompany the mothers. Some clinics even receive financial incentives from formula companies to promote substitutes over breastfeeding.[72] UNICEF and the World Food Program have sponsored 1300 infant and young child feeding clinics in an attempt to increase breastfeeding education and support. Currently, data are insufficient to assess the effectiveness of these programs, but close monitoring will continue.[71,73] Using the Lives Saved Tool, we estimate that >3200 infant lives will be saved by 2030 if current breastfeeding rates are increased to meet global goals.

Rwanda

Rwanda has 1 of the highest rates of breastfeeding in the world, with 87% of women exclusively breastfeeding between months 1 and 5.[29] A total of 99% of children <5 years of age have received breast milk.[25,29] One reason Rwandan women breastfeed at such a high rate is the overwhelming support they receive from their government. After the 1994 genocide, Rwanda placed particular emphasis on their national health care, specifically on maternal and child health services. Their health sector was decentralized in favor of a community-based system that relied on village input. Each village elects 3 Ministry of Health–trained volunteers to monitor health across the village. One of these officials (always a woman) specializes in maternal and newborn care and is responsible for disseminating information on same antepartum and postpartum practices.[74] Community health care workers are rewarded based on selected indicators, such as percentage of adherence to WHO practices. In addition to community-level systems, maternal and child health services are integrated under one national monitoring and evaluation framework to improve priority setting and resource allocation.[74] The proactive efforts of the Rwandan government have placed its maternal and child health systems above many developed countries and may be used as a framework for other countries for reforming their health systems.

DISCLOSURE

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