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REVIEW

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Breastfeeding as a public health investment: a narrative review of evidence on economic value

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Abstract

Background Breastfeeding improves infant and maternal health, reducing mortality, disease, and healthcare costs. Despite global recommendations, exclusive breastfeeding (EBF) remains suboptimal due to various factors including formula marketing and maternal employment. Limited economic value evidence hinders policy development. This narrative review examines the economic value of breastfeeding to strengthen the case for promoting, protecting, and supporting breastfeeding initiatives.

Methods We searched PubMed, ProQuest, Web of Science, and Scopus databases for studies from 1999 to February 2025 on the economic value of breastfeeding and breast milk. Eligible studies were screened, extracted, and analysed. All reported costs were adjusted to 2024 U.S. dollars using annual national exchange rates and U.S. inflation rates.

Results We reviewed 26 articles across diverse income settings. Breastfeeding-related cost savings varied widely, with global breast milk valued between US$1.4–64 billion, while formula costs reached up to US$394.5 million annually. EBF saved up to US$90.9 million in lifetime maternal cancer treatment costs and US$1.26–73.5 million annually in paediatric healthcare costs. In Sub-Saharan Africa, improved EBF was linked to US$23.9 billion in non-health gross domestic product gains. Three studies showed high economic returns on breastfeeding promotion, with up to 139% investment return.

Conclusion Breastfeeding provides economic benefits in all settings, underscoring the need for prioritising breastfeeding as a public health investment. Stronger policies accompanied by implementation commitments and multi-stakeholder collaboration in breastfeeding promotion initiatives are essential to improve EBF rates, leading to better health outcomes and economic returns. Standardized costing approaches and longitudinal designs, especially in low-income settings, are needed to capture the full economic potential.

Keywords Breastfeeding, Breast milk, Exclusive breastfeeding, Economic value, Cost savings, Global health

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1 Background

Breastfeeding, as a cornerstone of optimal health, confers health benefits to both infants and mothers. Globally, infants who did not receive breast milk had 14.4 times infection-related mortality, including deaths from sepsis, meningitis, pneumonia, diarrhoea, measles, malaria, and other infections, compared to those who exclusively breastfed (EBF) during the first 5 months of life [1]. Breastfeeding also supports cognitive and neurological development in infants [2, 3]. A cohort study showed that infants who consumed breast milk for 1 to 8 months scored higher on IQ tests when they were 4 to 5 years old compared to non-breastfed infants [4]. Long-term benefits of breastfeeding on IQ have also been confirmed at 30 years of age in another cohort study [5]. Breastfeeding mothers who continue feeding for 12 months have a lower risk of developing ovarian cancer, breast cancer, and type II diabetes later in life [6, 7]. Furthermore, prolonged EBF strengthens maternal-infant attachment and thus reduces the risk for mothers to develop postpartum depression [8]. Due to those health benefits, the World Health Organization (WHO) recommends that infants should take breast milk within the first hour after birth, be EBF for the first 6 months of life, and continue to breastfeed with the addition of appropriate complementary foods until 2 years of age or older [9].

Despite the significant health benefits of early initiation and sustained breastfeeding, breastfeeding practice remains suboptimal globally. As of 2023, 52% of infants under 6 months were not EBF [10]. Several factors contribute to this shortfall, including the aggressive marketing of breast milk substitutes and maternal employment. The availability of breast milk substitutes has been associated with a significant reduction in the duration of breastfeeding [11]. In 2014, global sales of these substitutes reached US$44.8 billion, undermining breastfeeding practices [12]. As the largest and fastest-growing market for breast milk substitutes, China reported an EBF rate of only 34.1% in 2023 [13, 14]. In some low-income countries (LICs), maternal employment is associated with lower rates of EBF [15, 16]. For example, in Ethiopia, employed mothers were 3.7 times more likely to stop EBF before their children were 6 months old compared with non-employed mothers [16]. In response to these challenges, the WHO Member States at the 78th World Health Assembly endorsed a revised global target, aiming for 60% of infants under six months to be EBF by 2030, up from the earlier 50% target for 2025 [17].

From an economic standpoint, breastfeeding yields significant cost savings. By reducing the incidence of childhood illness, such as diarrhoea and pneumonia, as well as maternal conditions, like type II diabetes, it is estimated that US$697 million could be significantly reduced through the promotion and support of breastfeeding [18]. Economic valuation of breastfeeding is essential for public health policy, resource allocation, and health system planning. Economic evidence clarifies how investments in breastfeeding promotion reduce healthcare costs, enhance national productivity, and generate substantial financial returns. Such evaluations are central for policymakers to identify scalable and sustainable interventions that can achieve the greatest health and societal impacts within limited budgets.

However, there is a critical gap in the global evidence base. While numerous studies have assessed economic aspects of breastfeeding within individual countries, there remains a lack of comprehensive, up-to-date data synthesizing current evidence on the economic value of breastfeeding or breast milk across diverse countries [18]. This creates a barrier for policymakers, advocates, and health planners to prioritize breastfeeding

within the broader health and economic development agenda. This narrative review aims to fill this gap by integrating the existing evidence on the economic value of breastfeeding and breast milk across countries with different income levels. It will analyse how such economic evidence can inform public health policy, financing, and health system planning for breastfeeding promotion. Finally, this narrative review will provide actionable recommendations for integrating breastfeeding promotion into broader economic and public health strategies.

2 Methods

We conducted a narrative review following the Narrative Overview Rating Scale to ensure the reproducibility of the literature collection and that the narrative review was well-constructed [19]. The literature search was conducted in four electronic databases: PubMed, ProQuest, Web of Science, and Scopus. We searched for published full-text literature with titles or abstracts containing keywords related to breastfeeding and economic value. Panel 1. shows the search strategy used for PubMed. Similar terms were used for searching the other three databases. The literature search was done between January and February 2025.

Panel 1. Search Strategy (PubMed):

1. 'breast feeding'[Title/Abstract] OR 'breastfeeding'[Title/Abstract] OR 'breast feed'[Title/Abstract] OR 'breastfeed'[Title/Abstract] OR 'breastfed'[Title/Abstract] OR 'human milk'[Title/Abstract] OR 'breast milk'[Title/Abstract].
2. 'economic value'[Title/Abstract] OR 'cost analysis'[Title/Abstract] OR 'cost savings'[Title/Abstract] OR 'cost effectiveness'[Title/Abstract] OR 'economic evaluation'[Title/Abstract].
3. Autobiography[Publication Type] OR Bibliography[Publication Type] OR Biography[Publication Type] OR Case Reports[Publication Type] OR Clinical Conference[Publication Type] OR Clinical Trial Protocol[Publication Type] OR Comment[Publication Type] OR Congress[Publication Type] OR Consensus Development Conference[Publication Type] OR Dictionary[Publication Type] OR Directory[Publication Type] OR Duplicate Publication[Publication Type] OR Editorial[Publication Type] OR Expression of Concern[Publication Type] OR Festschrift[Publication Type] OR Legislation[Publication Type] OR Letter[Publication Type] OR News[Publication Type] OR Newspaper Article[Publication Type] OR Overall[Publication Type] OR Periodical Index[Publication Type] OR Portrait[Publication Type] OR Retracted Publication[Publication Type] OR Twin Study[Publication Type].
4. #1 AND #2.
5. #4 NOT #3.

All literature searches and the initial screening of titles and abstracts were performed by one author (XJ). Two reviewers (XJ and JWM) independently screened the full texts for potential eligibility and inclusion in the study. The selection was further discussed with the third author (MDK), and discrepancies were resolved.

To ensure that the included literature was of high relevance, we established the following inclusion and exclusion criteria:

Inclusion criteria: (i) Literature published in peer-reviewed journals. (ii) Literature with open access to full text. (iii) Literature published between 1999 and February 2025. (iv) Literature contained the economic value of breastfeeding or breast milk.

Exclusion Criteria: (i) Literature not involving the monetary value. (ii) Literature with insufficient data. (iii) Non-English literature. (iv) Autobiography, case reports, commentaries, conference papers, legislation, newspaper articles, twin studies, and preprinted articles. (v) Subject area not related to the topic (e.g. Agricultural and Biological Sciences and Environmental Sciences).

Records were imported into Rayyan (http://rayyan.qcri.org/), an electronic screening tool, for the removal of duplicates. The search process and selection of relevant literature are outlined in Fig. 1. A data extraction table was created to organize information from all included studies (Table 1). Data extracted from each article included the following details: author(s), year of publication, country or region of the study, aim, study design, analysis tools, participant characteristics, and key findings. After data extraction, the three authors independently identified recurring economic valuation outcomes and classified the literature into thematic categories. Disagreements on thematic classification were resolved through discussion.

To standardize the reported costs across studies, all monetary values were adjusted to 2024 United States Dollars (USD). For studies reporting historical cost savings of breast milk or breastfeeding in USD, inflation adjustments were made to bring values to 2024 levels, using inflation rates from the U.S. Bureau of Labor Statistics Consumer Price Index (CPI) calculator for USD [20]. This online tool converts historical USD values into their equivalent 2024 purchasing power. The adjustment followed the formula:

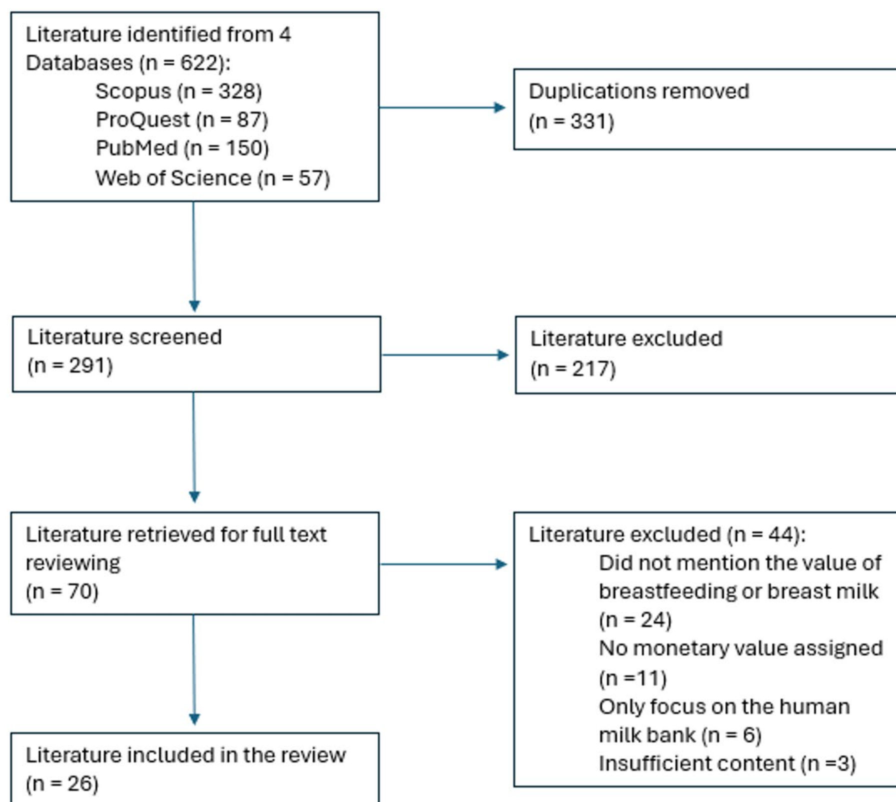

Fig. 1 The literature search, screening, and selection strategy flow chart

Table 1 Summary of studies on the economic value of breast milk/breastfeeding

Author, Year	Country/region	Aim addressed	Study design	Analysis tool/method	Participants	Key findings and reported costs/monetary value [Estimated present cost/monetary value (US$2024)]
Theme 1: Direct cost savings of breast milk						
Gupta et al., 1999 [22]	India	To estimate the economic value of breast milk	EA	• Economic modelling	Infants under 12 months in 1994	• In 1998, breastmilk (BM) economic value surpassed key national sectors, e.g. railways, education • BM market value is Rs 59.16 billion [USD 2.6 billion] valued at the cost of fresh animal milk vs. Rs 118.32 billion [USD 5.2 billion] valued at the cost of tinned milk • The cost to produce 3944 million L BM is Rs 15.78 billion [USD 690 million] • Artificial feeding costs families Rs 1100/month [USD 48/month]
Zabotti et al., 2024 [36]	Italy	To estimate the volume and value of breast milk produced by three mother cohorts and assess the MMT's usefulness for tracking regional changes over time	CohS	• The Mother's Milk Tool	842 FVG mothers and their healthy newborns in 1999 400 FVG mothers and their healthy newborns in 2007 265 FVG mothers and their healthy newborns in 2016	• The volume of BM produced per mother increased from 130 L in 1999 to 226 L in 2016 • The percentage of lost BM decreased from 67.7% to 55.4% to 43.7% • Overall, in 2016, 250,000 L BM were produced by 1,507 mothers, valued at US$25 million [USD 32.5 million] • If all mothers in FVG breastfed at similar rates, 2 million L would be produced annually, worth US$200 million [USD 260 million]
Taylor et al., 2018 [23]	South Africa	To determine the best allocation of limited breast milk for very low birthweight infants to maximize lives saved and minimize costs	EA	• Economic modelling	10,000 very low birthweight infants (< 1,500 g)	• In 2015, formula milk (FM) costs US$0.053/ml [USD 0.07/ml] vs. US$0.137/ml [USD 0.18/ml] for donor BM • Prioritizing donor BM for the lowest birthweight infants (< 1,000 g) for 14 days maximizes lifesaving • Donor BM is highly cost-effective compared to FM feeding, with US$25/L [USD 33/L] cost savings in South Africa when 1,000–1,250 g birthweight infants receive it for 14 days

Table 1 (continued)

Author, Year	Country/region	Aim addressed	Study design	Analysis tool/method	Participants	Key findings and reported costs/monetary value [Estimated present cost/monetary value (US$2024)]
Smith et al., 2013 [24]	Australia, the United States, and Norway	To show that breast milk production can be valued in GDP and impact economic statistics and public policy making	EA	• Economic modelling	4,662,545 infants aged 0–2 years born in 2010	• From 2009 to 2010, the annual production of BM in the U.S., Australia, and Norway was 526 million L, 42 million L, and 11 million L, respectively • In 2010, the estimated value of BM production ranged from nearly US$1 billion [USD 1.4 billion] in Norway, to US$45 billion [USD 64 billion] in the U.S., and US$3.6 billion [5.1 billion] in Australia • In 2010, ~ 60% of potential BM production was lost in the U.S. and Australia, resulting in economic losses of ~ US$63 billion [USD 90 billion] and US$4 billion [USD 5.7 billion], respectively • In 2010, Norway experienced a 40% potential BM production loss valued at US$598 million [USD 851 million] due to high weaning rates between 12 and 24 months
Colchero et al., 2015 [25]	Mexico	To estimate the health and economic costs associated with inadequate breastfeeding practices in Mexico for infants under 1 year old	EA	• Economic modelling	2,643,908 infants born in 2012	• In 2012, the total costs associated with no breastfeeding, including paediatric costs of five childhood diseases, lost future earnings, and FM costs, ranged from US$745.7 million to US$2.4 billion [USD 1–3.3 billion] • The costs of FM accounted for US$289.9 million [USD 394.5 million], comprising 11–38% of the total costs • Due to the decrease in breastfeeding prevalence from 2006 to 2012, Mexico lost between US$3.7 billion to US$11.6 billion [USD 5–15.8 billion]
Theme 2: Healthcare savings of breastfeeding						
Hui et al., 2025 [26]	China (Hong Kong)	To assess the healthcare cost savings from breast cancer due to increased breastfeeding rates in Hong Kong	CohS	• Economic modelling based on Monte Carlo model	A hypothetical cohort of 33,500 Hong Kong women aged 20 in 2018	• In 2018, increasing cumulative breastfeeding to 12 months could prevent 59 breast cancer cases (95% CI 54, 62), saving US$0.65 million [USD 0.9 million] • Increasing the 6-month EBF rate from 22 to 90% could avert 266 breast cancer cases (95% CI 259,273), saving US$3.07 million [USD 3.8 million]
Unar-Munguí et al., 2017 [27]	Mexico	To estimate the lifetime economic and disease burden of breast cancer if 95% of parous women do EBF for 6 months and continued for 12–36 months	CohS	• Economic modelling based on a static micro-simulation model	A hypothetical cohort of 100,000 nulliparous Mexican women aged 15 years old in 2012	• In 2015, if 95% of parous women do EBF for 6 months and continue for 12–36 months, 9,936 breast cancer cases, 2,186 premature deaths, 45,109 DALYs, and US$245 million [USD 323 million] could be prevented over the lifetime of a cohort of 1.116 million women • If 6 months EBF rates increased from 14 to 95%, 573 breast cancer cases and 126 premature deaths per 100,000 women could be avoided over their lifetime, 2,629 DALYs, US$11.09 million [USD 14.64 million] medical costs could be saved

Table 1 (continued)

Author, Year	Country/region	Aim addressed	Study design	Analysis tool/method	Participants	Key findings and reported costs/monetary value [Estimated present cost/monetary value (US$2024)]
Pokhrel et al., 2014 [28]	UK	To estimate potential cost savings from increased breastfeeding rates from the perspective of the National Health Service	EA	• Incidence-based disease model economic modelling	Children born in 2009 A cohort of 100,000 first-time mothers from 2009	• Between 2009–2010, having 'never breastfed' rates and enabling 32% of women to breastfeed 7–18 months could save over £21 million [USD 50 million] in breast cancer costs for 313,817 mothers • Supporting EBF from 1 week to 4 months could save over £11 million [USD 26 million] annually by reducing the incidence of three acute infections (GE infection, LRTI, and acute OM) in children • Increasing breast milk feeding in neonatal units from 35 to 75% could save £6.12 million [USD 14.5 million] per year by reducing cases of NEC
Onah et al., 2025 [34]	Canada	To estimate the health-care cost of suboptimal breastfeeding in Ontario and model the potential cost savings from increasing EBF rates	EA	• Economic modelling based on a static micro-simulation model	140,541 children born in 2019 A hypothetical cohort of 100,000 women	• In 2019, the cost savings for 2 maternal illnesses (breast cancer & ovarian cancer) were over US$40.7 million [USD 50 million] when increasing 6-month EBF rates from 36.3% to 64.9% hospital discharge EBF rates and US$74.2 million [USD 90.9 million] when increasing 6-month EBF rates from 36.3% to 92.1% initiation EBF rate at birth • 952 cases of breast cancer and 186 cases of ovarian cancer could be prevented among 100,000 women when raising 6-month EBF rates from 36.3% to 64.9% • 1,850 cases of breast cancer and 293 cases of ovarian cancer could be prevented among 100,000 women when raising 6-month EBF rates from 36.3% to 92.1% • The treatment cost savings for reduction in 5 childhood illnesses (LRTI, GE infection, acute OM, NEC & CL) was over US$32.7 million [USD 40.1 million] when increasing 6-months EBF rates from 36.3% to 64.9% hospital discharge EBF rates and over US$60 million [USD 73.5 million] when increasing 6-months EBF rates from 36.3% to 92.1% initiation EBF rate at birth
Unar-Munguí et al., 2019 [33]	Mexico	To estimate the lifetime economic and disease burden of type 2 diabetes, breast and ovarian cancer, myocardial infarction, and hypertension in mothers associated with suboptimal breastfeeding	CohS	• Economic modelling based on a static micro-simulation economic model	A hypothetical cohort of 100,000 Mexican women aged 15 years old in 2012	• In 2016, if 95% of parous women breastfed for 24 months, 4,315 cases of breast cancer, 390 cases of ovarian cancer, and 1,180 premature deaths could be prevented among 1.116 million women, saving 22,872 DALYs and US$283.84 million [USD 369.5 million] in direct and indirect costs

Table 1 (continued)

Author, Year	Country/region	Aim addressed	Study design	Analysis tool/method	Participants	Key findings and reported costs/monetary value [Estimated present cost/monetary value (US$2024)]
Quesada et al., 2020 [29]	Spain	To estimate the potential healthcare savings from reduced prevalence of four infant pathologies due to higher 6-month EBF rates	RCT	• Economic modelling	426,303 children born in 2014	• In 2014, increasing EBF rates from 85 to 95% at discharge and from 15 to 50% at 6 months could save the Spanish healthcare system €197 million [USD 324.7 million] annually • Each 1% increase in EBF rates could save €5.6 million [USD 9.2 million] in healthcare costs for 4 infant pathologies, OM, GE, RI, and NEC
Pretorius et al., 2021 [44]	Sub-Saharan Africa	To explore the economic impact of EBF on under-5 mortality	MA	• Cost analysis	Children under 5 from 2000 to 2018	• Although EBF rates in Sub-Saharan Africa increased by 1% annually, it is unlikely to reach the 50% EBF rate target by 2025 • A 10% increase in EBF rates could reduce under-5 mortality by 5.6% • In 2018, the total cumulative non-health GDP loss in Sub-Saharan Africa exceeded US$37 billion [USD 46 billion]
Santacruz-Salas et al., 2019 [38]	Spain	To estimate the impact of breastfeeding on healthcare costs by comparing EBF with alternative nutrition in healthy newborns during the first 6 months	CohS	• Longitudinal cost analysis	236 mother-newborn pairs (46 EBF groups, 190 non-EBF groups)	• At 6 months, 19.5% of mothers do EBF, 28.4% combined breastfeeding with FM, and 45.8% used FM only • In 2014, newborns EBF for 6 months had estimated healthcare cost savings of €454.4 to €503.5 [USD 748.9–829.8] compared to who were not EBF for 6 months
Pretorius et al., 2020 [45]	Sub-Saharan Africa	To review the link between breastfeeding practices and under-5 mortality in sub-Saharan Africa and assess the economic benefits of improved breastfeeding	MA	• Cost analysis	Children under 5 from 2000 to 2019	• In 2019, non-EBF practices led to a five-fold increase in under-5 mortality risk • EBF prevalence was 34%, and early initiation of breastfeeding was 47% • Promoting appropriate breastfeeding could prevent 55–75% of under-5 deaths and save US$19.5 billion [USD 23.9 billion] in non-health GDP loss

Table 1 (continued)

Author, Year	Country/region	Aim addressed	Study design	Analysis tool/method	Participants	Key findings and reported costs/monetary value [Estimated present cost/monetary value (US$2024)]
Siregar et al., 2018 [40]	Indonesia	To estimate the economic impact of not breastfeeding according to the WHO recommendation by assessing the treatment costs of diarrhoea and PRD in children under 24 months	EA	• Cost analysis	Diarrhoea and PRD data from 13 healthcare facilities were collected in 2015–2016 across five Indonesian regions 615 caregiver/child pairs with cases of diarrhoea or PRD in 2016	• In 2016, the mean cost to treat diarrhoea and PRD were US$11.37 [USD 14.8] and US$3.85 [USD 5.01] per treatment • The annual healthcare system cost of not breastfeeding, according to the WHO recommendation, related to diarrhoea and PRD, was US$118.62 million [USD 154.4 million] • The annual out-of-pocket cost for treating diarrhoea and PRD due to not breastfeeding as recommended is estimated at US$83 million [USD 108 million]
Mahon et al., 2016 [30]	UK	To estimate the cost savings and health benefits for the United Kingdom NHS from increasing breast milk consumption among preterm infants	EA	• Economic modelling	51,703 preterm infants born in 2013	• In 2013, increasing breast milk consumption in the NICU for preterm infants from 35 to 100% could result in total lifetime savings of £46.7 million [USD 78.2 million] to the NHS, and £904 [USD 1,513] per infant • Introducing EBF in NICU could prevent 238 deaths from neonatal infections and SIDS, leading to a £153.4 million [USD 256.8 million] gain in lifetime productivity
Ma et al., 2013 [41]	The United States	To estimate cost savings in Louisiana if 80–90% of children are EBF for 6 months	CS	• Cost analysis	63,186 newborns in Louisiana in 2006	• In 2010, 90% infants in Louisiana receiving EBF for 6 months could save US$216 million [USD 307 million], due to the reduction in LRTI, GE, NEC, and SIDS cases among infants

Table 1 (continued)

Author, Year	Country/region	Aim addressed	Study design	Analysis tool/method	Participants	Key findings and reported costs/monetary value [Estimated present cost/monetary value (US$2024)]
Bartick et al., 2010 [42]	The United States	To update a 2001 analysis on the economic benefits of increased breastfeeding, using current rates and additional paediatric disease data	EA	• Cost analysis	4.14 million live births and 80.8 million individuals younger than 20 years in 2005	• In 2007, if 90% US families EBF for 6 months, US$13 billion [USD 19.8 billion] could be saved, preventing 911 deaths from 10 paediatric diseases (OM, LRTI, GE, NEC, AD, T1D, SIDS, childhood leukaemia, childhood asthma, and childhood obesity) • 6 months of EBF for 90% of families would save US$9.6 billion in medical costs for premature death and US$2.2 billion [USD 3.4 billion] in medical costs for paediatric illness • US$10.08 billion [USD 15.4 billion] could be saved if 90% of families EBF for 6 months, due to the reduction in LRTI, GE, NEC, and SIDS cases and deaths • US$592 million [USD 902 million] could be saved if 90% families EBF for 6 months due to the prevention of childhood obesity
Hui et al., 2025 [31]	China (Hong Kong)	To estimate healthcare cost savings in Hong Kong from preventing GE infection and LRTI in the first year of life due to increased EBF rates at 4 months	EA	• Economic modelling	18,620 hospitalized 0–12 months infants due to GE, and 23,400 due to LRTI between 2010–2019	• In 2020, increasing EBF rates at 4 months from 15–30% in 2010–2019 to 50% would have prevented at least 198 GE and 141 LRTI admissions per year, resulting in annual healthcare savings of US$1.05 million [USD 1.26 million] (95% CI 1.03–1.07) • Raising 4-month EBF rates to 70% would increase savings to US$1.89 million [USD 2.26 million] (95% CI 1.86–1.92)
Ajetunmobi et al., 2024 [43]	UK	To assess the impact of infant feeding practices on direct healthcare costs and potential healthcare savings	CohS	• Cost analysis	502,948 infants born in Scotland between 1997–2009 with valid infant feeding records at the 6–8 weeks review	• Between 2009–2010, in the first six months, the average hospital cost per visit was £42 [USD 100] for EBF babies, £52 [USD 123] for mixed-fed babies, and £79 [USD 187] for FM-fed babies • If EBF rate increased from 27 to 100% until the 6–8 week review, approximately 10% of hospital admission costs for 9 childhood illness (GE infection, RI, OM, urinary tract infections, asthma, eczema, diabetes, dental caries and fevers) could have been avoided, saving at least £10 million [USD 23.7 million] in healthcare costs

Table 1 (continued)

Author, Year	Country/region	Aim addressed	Study design	Analysis tool/method	Participants	Key findings and reported costs/monetary value [Estimated present cost/monetary value (US$2024)]
Carrello et al., 2024 [35]	Australia	To investigate the association between breastfeeding duration and child BMI, and to estimate the potential health, economic, and equity benefits of increasing breastfeeding duration to at least 6 months	CS	• Economic modelling based on a static micro-simulation economic model	3,935 children aged 6–7 years born in 2004	• In 2023, for each additional month of breastfeeding, BMI was 0.043 kg/m^2 lower, with a potential reduction of up to 0.25 kg/m^2 if breastfeeding lasted for 6 months • It is estimated that achieving a breastfeeding duration of at least 6 months in a cohort of 221,103 Australian children could prevent 2,933 cases of overweight by age 16–17 years, leading to healthcare cost savings of approximately AU$4.29 million [USD 2.95 million]
Walters et al., 2019 [18]	Global	To estimate the economic consequences of not breastfeeding by developing and using a new tool	EA	• The Cost of Not Breastfeeding Tool • Economic modelling	Infants, young children, and mothers in 130 countries	• In 2017, a total of US$1.1 billion [USD 1.4 billion] health costs for diarrhoea, pneumonia, and diabetes linked to not breastfeeding globally • Global economic losses due to child and maternal mortality and cognitive losses from non-breastfeeding reach US$341.1 billion [USD 433.2 billion] annually, with Sub-Saharan Africa facing the highest loss
Straub et al., 2019 [32]	UK	To assess the economic impact of breastfeeding-associated improvements on childhood cognitive development	CohS	• Economic modelling	14,541 pregnant women in Avon area of Southwest England and their 13,988 children	• In 2012, Children breastfed for 6 months were 1.72 times more likely to achieve high school attainment at KS4 compared with non-breastfeeding children (95% CI 1.46, 2.05) • Children breastfed for up to 6 months had a £4,208 [USD 9,543] lifetime income boost, and those breastfed longer had a £8,799 [USD 19,954] increase • A 1% increase in breastfeeding rates could generate over £33 million [USD 74.8 million] in lifetime economic benefits

Table 1 (continued)

Author, Year	Country/region	Aim addressed	Study design	Analysis tool/method	Participants	Key findings and reported costs/monetary value [Estimated present cost/monetary value (US$2024)]
Walters et al., 2016 [37]	Southeast Asia	To estimate the cost of suboptimal breastfeeding in seven Southeast Asian countries and evaluates a national breastfeeding strategy in Vietnam	EA	• Cost-component estimation • Cost–benefit analysis	7 Southeast Asia countries (Cambodia, Indonesia, Laos, Myanmar, Thailand, Timor-Leste, and Viet Nam)	• In 2015, inadequate breastfeeding costed Southeast Asia US$1.63 billion [USD 2.15 billion] annually, due to cognitive losses • Inadequate breastfeeding causes 10,718 annual child deaths from diarrhoea and acute respiratory infection, resulting in US$293.5 million [USD 387.3 million] in healthcare costs • FM feeding requires 13.8% to 47% mean monthly earnings in low- and middle-income countries • Vietnam's breastfeeding promotion strategy costs US$30.13 million [USD 39.8 million] annually but generates US$72.14 million [USD 95.2 million] in health system savings, resulting in a 139% return on investment

Theme 3: Economic returns on breastfeeding intervention

Table 1 (continued)

Author, Year	Country/region	Aim addressed	Study design	Analysis tool/method	Participants	Key findings and reported costs/monetary value [Estimated present cost/monetary value (US$2024)]
McLardie-Hore et al., 2023 [46]	Australia	To evaluate if the proactive telephone-based peer support breastfeeding intervention is cost-effective	EA	• Cost analysis	1152 first-time mothers and 246 peer female volunteers who had over 6 months of personal experience of breastfeeding	• In 2020, Telephone-based peer support for breastfeeding cost AU$263.75 [USD 210.2] per mother, or AU$90.33 [USD 72] when excluding the value of donated volunteer time • Outpatient visits for infants were higher in the control group compared to the intervention group, with the most common reason being follow-up for congenital hip dysplasia (37.4% in the control vs. 26.5% in the intervention) • The incremental cost-effectiveness ratio for the intervention is AU$4,146 [USD 3,305] per additional mother breastfeeding at 6 months, or AU$1,393 [USD 1,110] when excluding the value of volunteer time
Basbous et al., 2024 [39]	Lebanon	To evaluate the direct and indirect costs and benefits of a multicomponent breastfeeding intervention at various time points during the first two years of an infant's life	RCT	• Cost–benefit analysis	399 mothers who participated in the breastfeeding trial for more than one month	• In 2023, the multicomponent breastfeeding intervention (prenatal BF education, peer support, and professional lactation support) cost an additional US$138 [USD 142] per participant in the first month, but became cost-efficient thereafter, yielding incremental net benefits of US$374 [USD 386] ($BCR = 2.44$) at one year and US$472 [USD 487] ($BCR = 2.82$) at two years per participant • Infants in the exclusive/predominant breastfeeding group had fewer illness visits (14.9% vs. 38.9%, $p = 0.009$) and hospitalizations (3.4% vs. 6.7%, $p = 0.039$) in the first month compared to those in the exclusively artificial milk feeding group • Healthcare costs were lowest in the Exclusive/Predominant breastfeeding group at all time points

BM Breast milk, *FM* Formula Milk, *RCT* randomized controlled trial, *EA* economic analysis, *MA* meta-analysis, *CohS* cohort study, *CS* case study, *EBF* exclusive breastfeeding, *MMT* mother's milk tool, *AD* atopic dermatitis, *OM* otitis media, *CL* childhood leukaemia, *GNI* gross national income, *GE* gastroenteritis, *LRTI* lower respiratory tract infection, *FVG* Friuli Venezia Giulia, *T1D* type 1 diabetes, *QALY* quality-adjusted life year, *PRD* pneumonia-related diseases, *NHS* National Health Service, *NICU* neonatal intensive care unit, *NEC* necrotizing enterocolitis, *SIDS* sudden infant death syndrome

$$Cost\,(2024\,USD) = Cost\,(reported\;year\;USD) \times \frac{CPI\;\;(2024\,USD)}{CPI\,(reported\;year\;USD)}$$

For studies reporting costs in local currency units (LCU), values were first converted to USD using the official exchange rate for the relevant year (either the year the monetary value was reported or the study's publication year), sourced from the World Bank Global Economic Monitor [21]. The standardized calculation was:

$$Cost\,(reported\;year\;USD) = \frac{Cost\,(reported\;year\;LCU)}{Exchange\;rate\,(reported\;year)}$$

After conversion to USD, inflation adjustment to 2024 was applied using the CPI method described above.

3 Results

A total of 622 articles met the inclusion criteria. After the removal of duplicates, 291 articles remained. Following the screening of titles and abstracts, 217 articles were excluded due to a lack of relevance. 44 articles were excluded after full text review, due to missing information on the economic value of breastfeeding or breast milk ($n = 24$), no assigned monetary value ($n = 11$), only focusing on human milk bank ($n = 6$) and having insufficient content ($n = 3$) (Fig. 1). Of the 26 included studies, 21 were published since 2015.

Studies spanned diverse geographic and economic contexts, including fifteen studies conducted in high-income countries or regions (HICs), five in upper-middle-income countries (UMICs), two in lower-middle-income countries (LMICs), while four studies used multi-country samples that spanned several income countries (Supplementary Table).

This review synthesizes evidence on three main economic themes: (i) direct cost savings from breast milk production and formula replacement based on market price; (ii) healthcare savings from either maternal disease prevention or paediatric illness reduction; and (iii) economic returns on breastfeeding promotion interventions (Table 1). Figure 2 summarises the economic value pathway of breastfeeding under each of the three themes.

Most studies adopted indirect costing methods, with economic models and cost analysis being the most utilized methods. Specifically, fourteen studies applied economic modelling to assess healthcare cost reductions and long-term economic benefits [18, 22–34]. Four studies applied static microsimulation models to estimate outcomes [27, 33–35], while a few utilized the direct valuation methods based on the Cost of Not Breastfeeding Tool [18] and the Mother's Milk Tool (MMT) [36].

3.1 Theme 1: direct cost savings of breast milk

Five studies reported direct cost savings of breast milk by comparing the volume of breast milk produced with the cost of fresh animal milk (FAM) [22], infant formula [22, 23, 25], or human donor milk in milk banks (HDM) [23, 24, 36]. Based on these methods, the estimated breastmilk monetary value ranged from US$394.5 million to US$64 billion, with higher savings demonstrated in HICs. In a LMIC (India), the value was US$2.6 million based on the market price of FAM and US$5.2 billion based on replacing breast

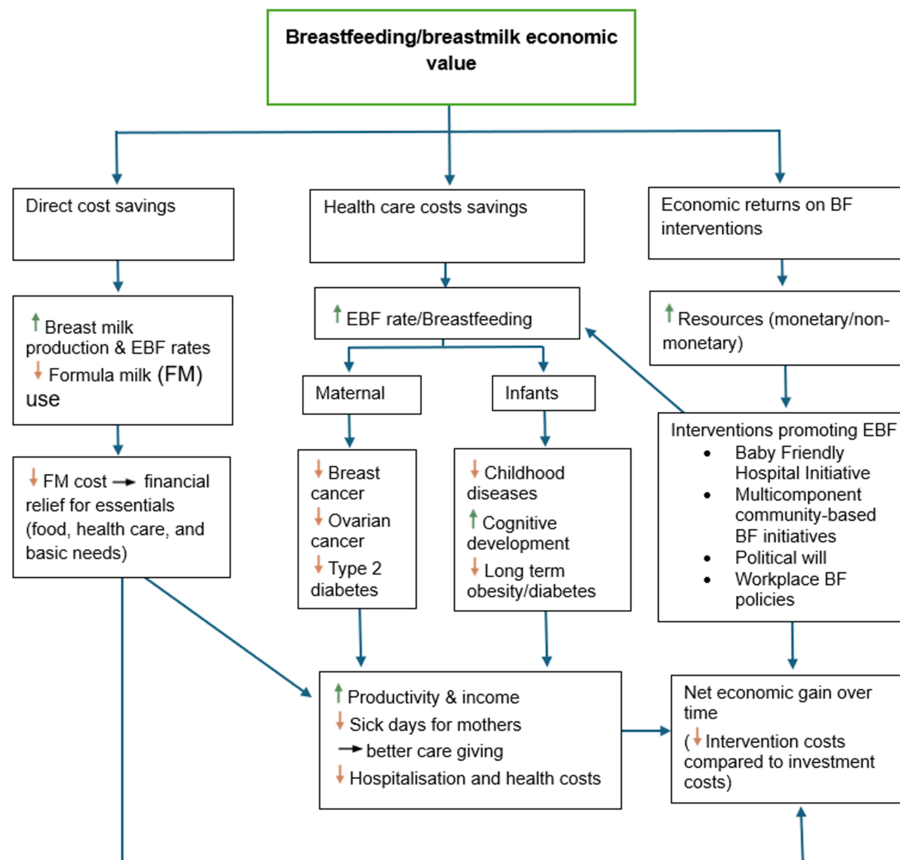

Fig. 2 A summary of the economic value pathways of breastfeeding for three identified themes

milk with tinned milk [22]. In Mexico, a UMIC, inadequate breastfeeding practices resulted in US$394.5 million spent on infant formula in 2012 [25]. Based on a real data model study in another UMIC (South Africa), US$33 per litre could be saved if HDM were used instead of the formula for very low birthweight infants [23]. In HICs, the value was estimated at US$1.4 billion, US$5.1 billion and US$64 billion based on HDM (Norway, Australia and the USA, respectively) and US$32.5 million based on HDM and MMT (Italy) [24, 36].The study in the three HIC (Norway, Australia and the USA) also estimated a 60% economic loss, translating to between US$5.7 billion and US$90 billion, due to sub-optimal breastfeeding and resultant lower breast milk production [24].

Two studies demonstrated that formula costs represent a significant financial burden to households. In a UMIC (Mexico), the annual formula expenditure accounted for 11–38% of total costs attributable to suboptimal breastfeeding practices [25]. In Southeast Asian LMICs, formula feeding consumed 13.8–47% of mean monthly household earnings [37].

3.2 Theme 2: healthcare costs savings of breastfeeding

3.2.1 Maternal healthcare costs savings from breastfeeding

Six studies reported maternal healthcare cost savings of appropriate breastfeeding by reducing the risk of breast cancer [26–28, 33, 34], ovarian cancer [33, 34], and maternal mortality [18]. Economic benefits related to the aversion of breast cancer and/or ovarian cancer ranged from US$3.8 million to US$90.9 million. Cost savings of US$3.8 million

through preventing 794 breast cancer cases per 100,000 women would be realised if EBF rate increased from 22% to 90% in Hong Kong, a HIC [26]. While in Mexico, a UMIC, US$14.64 million to US$33.1 million could be saved through preventing breast cancer and ovarian cancer, respectively, if the EBF rate increased from 14% to 95% [27, 33]. The largest savings were estimated from a Canadian study, whereby raising the 6-month EBF rate from 36.3% to 64.9% and 36.3% to 92.1% could save US$50 million and US$90.9 million lifetime treatment costs, respectively, through preventing breast and ovarian cancers [34].

3.2.2 Paediatric healthcare costs savings from breastfeeding

Sixteen studies reported significant healthcare savings and economic benefits associated with appropriate breastfeeding practices, primarily through reductions in paediatric illnesses [18, 25, 28–31, 34, 35, 37–43] and cognitive losses [18, 32, 37] among global children. In HICs, increasing EBF rates could provide healthcare savings by reducing cases of ten paediatric diseases, including otitis media, respiratory infections, gastroenteritis infections, necrotizing enterocolitis (NEC), atopic dermatitis, diabetes, sudden infant death syndrome, childhood leukaemia, childhood asthma, and childhood obesity. In HICs, cost savings related to the reduction in childhood illness due to increased rates of EBF ranged from US$73.5 million to US$829.8 million for multiple childhood conditions, based on studies in Spain and Canada [29, 34, 38], while US$14.5 million could be saved annually due to a reduction in NEC cases if breastfeeding rates in neonatal units were increased, based on a UK study [28]. Other economic returns savings included US$2.95 million due to the prevention of overweight in an Australian study, and potential generation of US$74.8 million in lifetime economic benefits due to cognitive development if breastfeeding rates increased by 1% in the UK [32, 35].

Similar trends were observed across studies conducted in UMICs. One Mexican study estimated that the total costs associated with inadequate breastfeeding in 2012, including paediatric healthcare costs for five childhood diseases, lost future earnings, and formula expenses, ranged from US$1 billion to US$3.3 billion [25]. In Indonesia, the mean treatment costs for diarrhoea and pneumonia-related diseases were US$14.8 and US$5.01 per episode, contributing to an annual healthcare system cost of US$154.4 million due to suboptimal breastfeeding practices [40].

In LMICs and LICs, particularly Sub-Saharan Africa, two studies estimated that a 10% increase in EBF rates could reduce under-5 mortality by 5.6%, and US$23.9 billion in non-health gross domestic product (GDP) losses could be saved if 55–75% of under-5 deaths were prevented [44, 45]. Globally, another study estimated that inadequate breastfeeding is linked to US$1.4 billion in health costs for diarrhoea, pneumonia, and diabetes, and US$433.2 billion in annual economic losses due to child and maternal mortality and cognitive deficits, with Sub-Saharan Africa facing the greatest impact [18].

3.3 Theme 3: economic returns on breastfeeding interventions

Three studies reported the economic costs and cost-effectiveness of breastfeeding promotion interventions across different countries. The studies demonstrated economic gains of investing in breastfeeding intervention ranging from US$386 to US$3,305 per participant. An Australian telephone-based peer support program for breastfeeding found the intervention's incremental cost-effectiveness ratio of US$3,305 per additional

mother breastfeeding at 6 months, or US$1,110 excluding volunteer time [46]. An incremental net benefit of US$386 at one year and US$487 at two years per participant due to reduction in illness-related visits and hospitalisations was demonstrated in a Lebanese multicomponent intervention study [39]. A 139% annual return on investment, US$39.8 million generated US$95.2 million in health system savings, was shown in a Vietnam study [37].

3.3.1 Regional Patterns: high-income versus middle- and low-income countries and regions

A clear pattern emerges when comparing economic findings across income settings. In HICs, studies primarily focused on healthcare savings from preventing specific childhood or maternal conditions, including chronic conditions such as obesity and diabetes. In contrast, studies in LMICs emphasized cost reduction in child mortality due to reduction in infections such as diarrhoea and pneumonia and impacts on gross domestic product (GDP). No studies in LIC reported on maternal-related savings. HICs report larger health cost savings compared to LMIC countries.

4 Discussion

This review gathered and synthesized evidence from 26 costing studies in different geographic and economic settings and demonstrated that breastfeeding is a multifaceted economic asset that generates direct cost savings, reduces healthcare expenditure, and delivers returns on interventions. While economic estimates vary widely across contexts, these differences may reflect underlying factors, such as local healthcare prices, disease epidemiology, household expenditure, and methodological choices, rather than inconsistencies in breastfeeding's economic value. HICs report larger cost savings because medical treatment costs are higher, while LICs show greater relative benefits due to higher infectious disease prevalence, under-five mortality, as well as household financial vulnerability [47]. Thus, breastfeeding promotion could be viewed as a cost containing strategy in HIC and a survival strategy in LICs.

Breastfeeding offers significant direct cost savings for families and healthcare systems, especially in LMICs, where the economic burden of suboptimal breastfeeding is higher [18]. Use of formula in these settings deepens economic inequality because formula expenses consume a larger share of income. For example, in Southeast Asia, low-income families spend up to 47% of their monthly income on formula, compared to only 13.8% for high-income families, perpetuating poverty cycles [37]. Social factors further stratify impacts through lower maternal education, cultural barriers, and inequities facing adolescent mothers, refugees, and women without employment [16, 48]. Thus, special attention regarding breastfeeding is critical in LMICs.

As a health system investment, breastfeeding emerges as a cost-effective strategy with returns exceeding 139% in some settings, yet its economic potential remains systematically undervalued in global health financing frameworks [37]. The WHO reports that every US$1 spent on breastfeeding promotion yields about US$35 in economic gains [49]. Literature consistently documents the investment of returns on breastfeeding initiatives in different settings. For example, an evaluation of a baby-friendly workplace initiative that provides breastfeeding rooms, flexible hours, and childcare facilities for mothers in a private tea plantation in Kenya, a LMIC, showed that nearly 90% of infants were breastfed, and each dollar invested yielded 111% returns [50]. In a USA study, a

lactation program among 343 breastfeeding employees associated with a multinational managed healthcare and insurance company realised $240,000 savings in healthcare expenses, resulting in 62% fewer prescriptions, and $60,000 in reduced absences [51]. Thus, reallocating even a small fraction of existing child health financing toward breastfeeding interventions has the potential to reduce infant mortality and generate meaningful gains in national productivity. Aside from health returns related to the third Sustainable Development Goal (SDG), breastfeeding impact spans multiple other SDGs, including 1 "No poverty", 2 "Zero hunger", 4 "Quality education" , 5 "Gender equality", 8 "Decent work and economic growth", 10 "Reduced inequalities" and 12 "Responsible consumption and production" [52]. This further underlines the need for heightened breastfeeding promotion and support efforts.

Maximizing the benefits of breastfeeding, particularly EBF, requires strong policies and programs at global, regional, and national levels as well as implementation commitment. Expanding paid maternal leave to at least six months is essential, given the reported high likelihood of early stoppage of EBF in employed mothers compared to their counterparts in some settings, such as Ethiopia, a LIC, where it was reported to be ~ 4 times [16]. Workplace supports, such as paid nursing breaks, access to on-site childcare and private lactation rooms, can help reduce breastfeeding challenges faced by employed mothers and promote longer breastfeeding duration. Governments need to strengthen enforcement of regulations on the marketing of breast milk substitutes by fully implementing the International Code of Marketing of Breast-milk Substitutes and performing monitoring across all health facilities and health systems. Health systems should strengthen the Baby-Friendly Hospital Initiative so that all birthing facilities support EBF for six months. Importantly, breastfeeding counselling and support services should be integrated into universal health coverage to guarantee equitable access for all mothers and infants. Targeted pro-poor policies, including conditional cash transfers linked to EBF rates, community-based peer support programs, and prioritization of breastfeeding support in low-income populations, can ensure economic benefits reach those bearing the highest burden.

4.1 Limitations of this review

This review has several limitations. First, no formal quality appraisal or risk-of-bias assessment was conducted for the included studies. Although the review focused on economic valuation rather than assessing intervention effects or causality, the lack of a quality or risk-of-bias assessment means that studies with methodological limitations may be considered alongside more rigorous analyses, which could affect the comparability and reliability of economic estimates.

Secondly, language restrictions also introduce bias. Only English-language, peer-reviewed journal articles were included, which may have excluded relevant evidence from non-English-speaking countries and grey literature sources such as government reports and local health economics evaluations.

A further limitation is the overrepresentation of studies from HICs and UMICs. Over two-thirds of the included studies were conducted in HICs or UMICs. This imbalance limits the generalizability of the findings, as economic estimates derived primarily from HICs may not reflect the disease burdens, healthcare structures, or economic conditions of resource-constrained countries.

A lack of longitudinal data in many of the reviewed studies is another limitation. While the studies provide useful insights into the immediate economic impact of breastfeeding, there are fewer studies tracking long-term outcomes. The absence of long-term data limits the ability to fully understand the long-term economic benefits of breastfeeding.

In addition, there is an inconsistency in the economic valuation of breast milk across the studies included. Different methods were used, with some studies using direct valuation techniques while others relied on indirect approaches such as economic modelling. This heterogeneity in valuation methods complicates comparisons between different studies and regions, potentially leading to underestimation or overestimation of breast milk value in different contexts.

Finally, wide variation in cost inputs and healthcare prices between countries and over time further complicates interpretation, as differences in labour costs, treatment expenses, and health system structures mean that standardizing all estimates to a common currency year cannot fully capture local economic realities, limiting the transferability of cost estimates across contexts.

4.2 Recommendations for further studies and policy

Future research should focus on applying a more consistent methodology for evaluating the economic value of breastfeeding. By using standardized cost analysis tools, applying statistical tests to validate economic estimates, and incorporating sensitivity analyses, researchers can improve the comparability of results across regions and contexts. In addition, more longitudinal studies are needed to explore the long-term outcomes of breastfeeding on lifetime economic productivity.

Future research should also examine the cost-effectiveness of breastfeeding promotion programs in LMICs or LICs, where resources are scarce, and intervention strategies need to be carefully targeted. Understanding how these programs contribute to long-term health and economic outcomes can inform more effective public health policies.

Given the growing but methodologically heterogeneous literature, a carefully designed quantitative synthesis may be feasible in the future. For example, a meta-analysis restricted to studies with comparable definitions of breastfeeding practices, similar health outcome measures, and consistent economic methods to generate pooled estimates that could inform global or national policy,

Policy efforts should focus on eliminating barriers to breastfeeding, such as inadequate maternity leave policies, insufficient workplace support, and sociocultural challenges. Governments and health organizations should prioritize breastfeeding promotion as a key public health strategy, integrating it into broader health and development frameworks. This will require collaboration across sectors, including healthcare, education, and social services, to create environments that support breastfeeding and maximize its economic and health benefits.

5 Conclusion

This review demonstrates that breastfeeding not only results in better health outcomes for both children and mothers but also serves as a strategic public health and economic investment by reducing feeding and healthcare costs, preventing maternal and paediatric diseases, and enhancing cognitive development. Conversely, inadequate breastfeeding can lead to an economic burden, in terms of increased healthcare expenditures,

productivity losses, and unrealized economic potential, underscoring the importance of scaling breastfeeding promotion programs.

Despite its clear advantages, EBF practices remain suboptimal worldwide due to aggressive marketing of breast milk substitutes, maternal employment challenges, and inadequate policy support. To address these challenges, governments should allocate annual funding for breastfeeding promotion, integrating maternity protection and workplace breastfeeding support into the universal health coverage framework. More funding needs to be directed to LICs with high investment returns but limited resources, to establish targeted interventions for those bearing the greatest burden of suboptimal breastfeeding, ensuring that economic benefits reach those most in need.

To better capture the long-term economic benefits of breastfeeding, standardized costing frameworks are urgently needed to enable cross-national comparison and guide resource allocation. WHO and UNICEF should convene technical experts to develop consensus methodologies for valuing breastfeeding or breast milk, quantifying healthcare savings, and measuring human capital returns. Only with reliable and comparable data can breastfeeding be positioned as a core component of national economic and health strategies.

In conclusion, adequate breastfeeding is a critical investment in global health and economic stability. Strengthening breastfeeding promotion efforts through comprehensive policies, health interventions and public awareness campaigns is essential to achieving its full potential. Governments, nongovernmental organizations, and healthcare systems must work together to remove barriers and create an environment in which mothers can successfully breastfeed, ensuring better health outcomes for mothers and children while achieving substantial economic gains at the household and national levels.

Abbreviations

EBF	Exclusive breastfeed
FAM	Fresh animal milk
GDP	Gross domestic product
HDM	Human donor milk in milk banks
HIC	A high-income country or region
LIC	A low-income country
LMIC	A lower middle-income country
MMT	The Mother's Milk Tool
NEC	Necrotizing enterocolitis
SDG	Sustainable Development Goal
UMIC	An upper middle-income country

Supplementary Information

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Supplementary Table

Author contributions

MDK and JWM conceptualized the study. XJ did the article searches, analysis and wrote the draft manuscript. JWM and MDK reviewed and edited the draft manuscript. All others read and approved the final manuscript for submission.

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No datasets were generated or analysed during the current study.

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Ethics approval and consent to participant

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Not applicable.

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The authors declare no competing interests.

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