Breastfeeding support in low and middle-income countries: secondary analysis of national survey data

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Conflict of interest statement

The authors declare that they have no conflicts of interest. The contents expressed in the article are those of the authors and do not necessarily reflect the policies or views of the organisations they are affiliated with.

Ethical approval

Data for this study were used under an agreement with the DHS Program. In addition to Institutional Review Board (IRB) approval in each host country, the ICF International IRB reviewed all survey procedures and tools for DHS surveys. Informed consent and voluntary participation were ensured before each interview and data were kept strictly confidential during the survey implementation and identifying information was destroyed after data processing. The King's College London College Research Ethics Committee granted approval to conduct these analyses (LRS-17/18-5570) and the project has been registered with the King's College London Data Protection Registration (DPRF-17/18-8170), in compliance with European data protection regulations.

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Abstract

Background-Early initiation of breastfeeding and exclusive breastfeeding can reduce infant mortality. Breastfeeding support interventions such as counselling may improve adherence to recommended practices. However, it is not known if these interventions work at the population level.

Objective-The aim of this study was to assess the relationship between early postnatal breastfeeding support and recommended breastfeeding practices.

Design/setting-We pooled data from 11 Demographic and Health Surveys in Africa (n=7), South East Asia (n=2), the Americas (n=1), and Europe (n=1) to analyse these associations at the population level.

Participants-We limited the data to the most recent live births in the two years before the survey, including 41431 births.

Analysis-We fitted three multivariable logistic regression models to estimate the relationship between early postnatal breastfeeding support (a newborn postnatal check within an hour of birth plus counselling and observation of breastfeeding within two days) and three breastfeeding outcomes (early initiation of breastfeeding, absence of prelacteal feeding, and exclusive breastfeeding), adjusting for sociodemographic characteristics and birth-related factors.

Findings-Early breastfeeding support was associated with a 24% increase (OR=1.24 95%CI=1.11,1.39) in the odds of initiating breastfeeding within one hour of birth. No relationships were found between breastfeeding support and prelacteal feeding in the first three days or exclusive breastfeeding at six months.

Key conclusion-While postnatal breastfeeding counselling and observation may improve early initiation of breastfeeding, impact is not persistent for longer term breastfeeding outcomes.

Implication for practice-Improved training for breastfeeding support and an enabling policy environment are required to improve breastfeeding practices for women and newborns.

Introduction

Early initiation of breastfeeding and exclusive breastfeeding to six months can protect against infant mortality in low- and middle-income countries (LMIC) (Edmond et al., 2006; Sankar et al., 2015). It has been suggested that near universal breastfeeding could prevent over 800,000 child deaths as well as 20,000 deaths from maternal breast cancer, annually (Victora et al., 2016). As lack of knowledge, confidence, and perception of insufficient milk have been associated with suboptimal breastfeeding practices, care providers should actively promote, educate and support women to breastfeed (Haroon, Das, Salam, Imdad, & Bhutta, 2013). The World Health Organization (WHO) recommends exclusive breastfeeding for the first six months of life and that breastfeeding

counselling and support should be offered to women at all postnatal contacts (World Health Organization, 2014).

A systematic review of breastfeeding interventions in low- and middle-income countries by Sinha et al. (2017) showed that interventions led to improvements in breastfeeding outcomes such as early (28 studies, OR: 3.31; 95% CI: 2.44, 4.50, I^2=96.3), exclusive (exclusive breastfeeding at 1-5 months, 62 studies, OR: 3.08; 95% CI: 2.57, 3.68, I^2=95.1), and continued breastfeeding (7 studies, OR: 1.62; 95% CI: 1.16, 2.27, I^2= 72.1); although all were subject to high levels of heterogeneity. The largest improvements in breastfeeding outcomes were seen when interventions were delivered in multiple settings in parallel (i.e. home, community, and health systems). An earlier systematic review by Haroon et al. (2013) showed that counselling (individual or group; prenatal, postnatal, or both) increased exclusive breastfeeding and decreased rates of no breastfeeding, particularly in low-resource countries (exclusive breastfeeding at 1-5 months increased by 90%, 66 studies, RR:1.9, 95% CI: 1.54,2.34, I^2 =96%). Additionally, a systematic review by Imdad et al. (2011) of breastfeeding promotion studies in diverse settings found a significant 43% increase in exclusive breastfeeding at 4-6 weeks when breastfeeding support interventions were implemented antenatally, postnatally, or both (32 studies, RR = 1.43; 95% CI: 1.28, 1.60, I^2 =85%). Furthermore, the review supported interventions such as education, professional and lay support (Imdad et al., 2011).

These systematic reviews synthesised evidence from small randomised control trials (RCT) and quasi-experimental studies, most with fewer than 1,000 participants, some with fewer than 50 people (Haroon et al., 2013; Imdad et al., 2011). While this research provides insight on early changes in breastfeeding practices during small-scale, researcher supported studies, it does not necessarily elucidate the relationship between scaled-up interventions and population-level breastfeeding practices (Proctor et al., 2015). Indeed, scale-up of newborn care is a global priority (Knippenberg et al., 2005), and additional research is needed outside of the realm of RCTs to adequately understand the association between national-level coverage of breastfeeding support interventions and

population breastfeeding practices. Here, we aim to assess the relationship between early postnatal breastfeeding support and recommended breastfeeding practices at the national level across 11 LMICs. A better understanding of this relationship could inform decision making by policy makers and programme implementers.

Methods

Data

We analysed secondary data from 11 Demographic and Health Surveys (DHS) implemented since 2015 (see Supplemental Table 1 for countries, survey years, and number of women). Funded largely by the United States Agency for International Development (USAID), DHS surveys collect data on a range of population and health issues, including early postnatal breastfeeding support and breastfeeding outcomes. Data are collected at the household- and the individual-level, primarily from women of reproductive age (15-49 years). Nationally representative results are produced for each country through a complex, multi-stage cluster sampling procedure with stratification (ICF International, 2012a). Standard procedures and methodologies ensure comparable data across countries (ICF International, 2012b). Survey results, data, and further information about the program can be found at the DHS Program website: dhsprogram.com.

Population

Countries were included in the analysis if the survey contained data on postnatal breastfeeding support and breastfeeding practices. Further information is provided in Supplementary table 1.

DHS surveys included detailed information about all of a woman's births in the previous five years. We limited the data to last (most recent) live births in the two years before the survey. Outcome variables included prelacteal feeding in the first three days of life, therefore newborns that did not live to three days (i.e. were born in the three days before the survey or did not survive to day three)

were excluded. The age of children is calculated using century day codes and subtracting the day of birth from the day of the interview (Croft, Marshall, & Allen, 2018).

Variables

The main outcome variables for this study were all dichotomised breastfeeding practices including initiation of breastfeeding within one hour of birth, absence of prelacteal feeding in the first three days of birth, and exclusive breastfeeding status. The outcome variable definitions and populations are presented in Table 1.

Postnatal breastfeeding support variables were the key independent variables considered. Specifically, receipt of breastfeeding counselling and observation of breastfeeding by any health care provider in the first two days after birth (both binary variables). This was combined with newborns who received a postnatal check in the first hour of life as we assumed breastfeeding support took place at the postnatal check. Breastfeeding support could have been provided in a facility, in the community, or at home. These are the only standard breastfeeding support variables included in DHS. As we were interested in whether a woman received early and comprehensive support, we created a binary variable for whether a woman reported a newborn postnatal check (see Table 1) and breastfeeding support. We coded this variable as a '1' if a woman received both breastfeeding support interventions in the first two days after birth and additionally reported a newborn postnatal check in the first hour of birth; otherwise, it was coded as '0'.

For each outcome measure, we adjusted for a different set of covariates as shown in Table 2, including socio-demographic characteristics (e.g. education, residence, wealth, age at the index birth, employment), pregnancy- (e.g. attended antenatal care, previous birth interval), birth- (e.g. skilled delivery assistance, mode of birth), and newborn- (e.g. size of the baby, immediate skin-to-skin contact) related factors. The functional form of each of these covariates is described in Table 2.

Analysis

All statistical analyses were conducted in R (R Core Team, 2018). We used the weights provided by DHS to account for sampling probability and non-response and R's Survey package (Lumley, 2018) to adjust for the complex, cluster sampling design. For each survey, we applied individual-level weights to ensure the sample was nationally representative. In the pooled analysis, we scaled the weights up or down so all countries held equal weight. The pooled analysis excludes cases with any missing values for the independent or dependent variables.

Descriptive statistics are presented for each country as well as the pooled data from all surveys. To assess for multi-collinearity, we calculated a Pearson's correlation matrix; any variables with high correlation ($r>0.6$) were excluded from the regression models.

In the regression analysis, we fitted three different logistic regression models, one for each outcome of interest- initiation of breastfeeding within one hour, absence of prelacteal feeding in the first three days, and current exclusive breastfeeding status. First, we fitted unadjusted models to assess for association between breastfeeding support variables and each covariate. In multivariable analysis, we fitted logistic regression models adjusting for breastfeeding support and all the covariates selected for the outcome. As information on skin-to-skin contact was not collected for non-facility births in Zimbabwe (n=375) and Burundi (n=750), these births were excluded from the early breastfeeding and exclusive breastfeeding models. In analysis of exclusive breastfeeding, the sample was reduced to living children under six months of age. In this sub-population, some survey strata had only one cluster and sampling variance could not be calculated. In such cases, the strata contribution to variance was taken as the average of all strata with two or more clusters (Lumley, 2010).

Ethical approval

The ICF International Institutional Review Board (IRB) reviewed all survey procedures and tools for standard DHS surveys and country-specific protocols and tools. Each country survey is also approved

by an IRB in the host country and informed consent and voluntary participation were ensured before each interview (ICF International, 2012b).

We accessed and used these data under an agreement with the DHS Program. Further ethical approval to conduct these analyses was granted by King's College London College Research Ethics Committee (LRS-17/18-5570). Additionally, in compliance with European data regulations, this project was registered with the King's College London Data Protection Registration (DPRF-17/18-8170).

Results

Sample characteristics

Table 3 shows the background characteristics of last (most recent) births in the two years before the survey for each country and the pooled sample. Nearly three-quarters (72%) of births were rural, ranging from 40% in Angola to 91% in Burundi. Sixty-three percent of births had four or more antenatal visits during pregnancy, ranging from 34% in Ethiopia to 97% in Armenia. Three-quarters of births (76%) were vaginal and attended by a skilled provider, ranging from 35% in Ethiopia and Haiti to 79% in Armenia.

Prevalence of breastfeeding practices

Figure 1 shows the coverage of breastfeeding counselling and observation of breastfeeding and the prevalence of breastfeeding practices by country. While initiation of breastfeeding within 24 hours of the birth was high, ranging from 84% in Haiti to 98% in Burundi, initiation of breastfeeding within one hour of birth was substantially lower in all settings of interest. Initiation of breastfeeding within an hour of birth ranged from 41% in Armenia to 85% in Burundi.

Prelacteal feeding was absent for 72% of births in Nepal and for 97% in Malawi. Prelacteal feeding was more common among women who did not commence early breastfeeding (46%) than among women who commenced breastfeeding within one day of birth (11%).

Exclusive breastfeeding among last-born children under six months ranged from 37% in Angola to 82% in Burundi.

Coverage of postnatal breastfeeding support

Early postnatal breastfeeding support was highest in Armenia where 50% of women received both breastfeeding support interventions (along with a postnatal check in the first hour of birth). Breastfeeding support in Burundi, however, was extremely low with only 2% of women recorded as receiving both interventions.

Logistic regression results

Early breastfeeding

After adjusting for sociodemographic, pregnancy-, birth-, and newborn-related factors, women who received both breastfeeding support interventions from any health care provider (counselling and observation) in the first hour after birth, had a 24% increase (OR=1.24 95%CI=1.11,1.39) in the odds of initiating breastfeeding within one hour of birth (Table 4). Having no skilled attendant present at the birth (OR=0.77, 95%CI=0.70-0.85), having a c-section (OR=0.23, 95%CI=0.19-0.28), no immediate skin-to-skin contact (OR=0.62, 95%CI=0.58-0.68), and being in the richer wealth quintile (OR=0.87, 95%CI=0.78-0.89) were all associated with a decrease in the odds of early breastfeeding. Any birth interval was associated with an increase in the odds of early breastfeeding, as compared with first births (<2 years: OR=1.27, 95%CI=1.11,1.45; 2+years: OR=1.29, 95%CI=1.16,1.42).

Prelacteal feeding

Receiving both early postnatal breastfeeding interventions was not associated with absence of prelacteal feeds (anything other than breastmilk given in the first three days of life) (OR=0.99, 95%CI=0.81-1.14). Decreased odds of absence of prelacteal feeds was associated with having a c-section (OR=0.31, 95%CI=0.26-0.37), not having a skilled attendant present at the birth (OR=0.67, 95%CI=0.60-0.75), being in the middle (OR=0.70, 95%CI=0.61-0.82), richer (OR=0.67, 95%CI=0.57-

0.78), or richest (OR=0.55, 95%CI=0.46-0.66) wealth quintiles, and perceived size of the newborn as small or very small (OR=0.87, 95%CI=0.79-0.96). Multiparous births were associated with an increase in the odds of absence of prelacteal feeding, as compared with first births (birth interval <2 years: OR=1.21, 95%CI=1.04,1.41; birth interval 2+years: OR=1.34, 95%CI=1.17,1.53).

Exclusive breastfeeding

Receipt of both early postnatal breastfeeding support interventions was not associated with exclusive breastfeeding in infants under six months of age (OR=0.93, 95%CI=0.82-1.06). Factors that were positively associated with exclusive breastfeeding included giving birth to a female newborn (OR=1.09, 95%CI=1.01-1.19), and older maternal age (20-34 years: OR=1.24, 95%CI=1.08-1.42; 35+ years: OR=1.41, 95%CI=1.18,1.68). Factors negatively associated with exclusive breastfeeding included living in an urban residence (OR=0.87, 95%CI=0.77,0.98), having no skilled attendant present at the birth (OR=0.84, 95%CI=0.75-0.95), a birth interval of less than two years (as compared to first birth) (OR=0.79, 95%CI=0.68-0.92), and having a small or very small baby (OR=0.86, 95%CI=0.78-0.95).

Discussion

We analysed the relationships between early postnatal breastfeeding support and recommended breastfeeding practices in 11 LMICs using nationally representative DHS survey data. We found wide variations between countries in support received by women and their newborns and breastfeeding practices. While receipt of early postnatal breastfeeding support was associated with early initiation of breastfeeding, it was not associated with exclusive breastfeeding in the first six months of life or absence prelacteal feeding in the first three days. It is likely that any effect from early postnatal breastfeeding support was short-lived. As the complex nature of exclusive breastfeeding is likely to be heavily influenced by sociocultural factors, duration of exclusive breastfeeding is unlikely to be modified to any great extent by implementation of short-term interventions.

Findings from Burundi and Armenia highlight the heterogeneity in receipt of breastfeeding support and breastfeeding practices. While early postnatal breastfeeding support was almost non-existent in Burundi, early and exclusive breastfeeding was widely practiced and offering of prelacteal feeds was rare. Conversely, in Armenia, although early postnatal breastfeeding support was more common, implementation of recommended breastfeeding practices were amongst the lowest in this study. This may be explained by external contextual factors. Armenia suffered a rapid decrease in breastfeeding rates in the aftermath of the 1988 earthquake when infant formula was widely distributed by aid agencies (Harutyunyan, 2015). Breastfeeding practices further suffered during the early 1990s from poor hospital practices (such as routine feeding with water and use of bottles) (Abazyan, 2009) and formula marketing (Harutyunyan, 2015). To improve breastfeeding practices, Armenia revised numerous policies and practices to promote breastfeeding, including the implementation of the Baby Friendly Hospital Initiative (BFHI), the Baby Friendly Polyclinics Initiative (BFPI), the Breastfeeding Promotion and Regulation of Marketing of Baby Food law, and the Improving health and nutrition of infants and young children educational project (Harutyunyan, 2015). The strong political efforts in Armenia may explain the high coverage of early postnatal breastfeeding support while these external contextual and historical factors may continue to explain the low breastfeeding practices.

Devastation from civil war in Burundi from 1993 to 2000 included disruption to the health system. Challenges in the health sector include insufficient and poorly trained staff, concentration of staff in the capital, poor quality health services, and lack of reliable health information (World Health Organization, 2015). To improve maternal and child mortality rates, a policy of free health care for children under five and access to facility deliveries was adopted in Burundi in 2006. Utilization of health services rose substantially and increased pressure on understaffed and underequipped facilities. Further changes to the health system, particularly performance-based financing, have contributed to more recent improvements in the stability of health personnel and quality of services (World Health Organization, 2015). A study of nutrition in children under two years of age in two

241 districts in Burundi showed high levels of contact with pre-, peri-, and postnatal health services but
242 poor service delivery (i.e. few recommended interventions were provided at these contacts) (Parker,
243 Leroy, Olney, Harris, & Ruel, 2012). Despite high rates of skilled delivery assistance, an understaffed
244 and underequipped health system may explain poor early postnatal breastfeeding support.
245 Furthermore, with high rates of breastfeeding practiced by women in Burundi, health workers may
246 not see a need to offer breastfeeding support.

247 Receipt of early postnatal breastfeeding support was not associated with exclusive breastfeeding in
248 infants under six months of age. This finding is consistent with other findings from the literature
249 which show that while postnatal breastfeeding support may achieve higher breastfeeding rates than
250 the absence of intervention, interventions have often failed to achieve high rates of breastfeeding
251 (Imdad et al., 2011). Furthermore, studies have shown a dose-dependent relationship where more
252 breastfeeding support visits have been associated with increased breastfeeding rates (Morrow et al.,
253 1999). A systematic review of breastfeeding interventions for exclusive breastfeeding at six months
254 showed that the most effective interventions were on a continuum, commencing in the antenatal
255 period and continuing through the postnatal period and involving multiple types of interventions
256 (e.g. emotional support, counselling, education) (Kim, Park, Oh, Kim, & Ahn, 2018). In fact, Kim et al.
257 (2018) found postnatal-only interventions to be the least effective. Additionally, systems-level
258 changes play an important role in behaviours, particularly sustainability of behaviour change, such as
259 breastfeeding where legal and regulatory action is needed to support maternity leave and limit
260 breastmilk substitute marketing (Bradley et al., 2012). There may also be regional differences in the
261 cultural valuation of breastfeeding (Daglas & Antoniou, 2012) as well as the structural development
262 of health systems and breastfeeding support (Patil et al., 2015) which would affect both the quality
263 of postnatal breastfeeding support and the broader contextual support for breastfeeding.

264 These studies and reviews reported the results of focused implementation efforts. However,
265 evidence shows after initial implementation efforts, routine and sustained integration of evidence-

based practices in healthcare settings are low. Furthermore, the degree to which interventions are sustained is heavily influenced by context, adaptability, and health system capacity (Wiltsey Stirman et al., 2012). Therefore, extrapolating to the population level from small focused efforts to improve breastfeeding practices may not be reliable. In contrast, nationally representative data can show levels and association of breastfeeding support in a broader context, without specific, time-limited implementation support. This can improve our understanding of how these interventions work in routine practice.

Common bottlenecks to delivering and sustaining interventions such as breastfeeding counselling include low quality of services, insufficient number of providers, and financial, cultural, and geographical barriers (Chopra, Sharkey, Dalmiya, Anthony, & Binkin, 2012). At the national level, providers need adequate and ongoing training to support the uptake and continuation of exclusive breastfeeding. Furthermore, providers require the time and motivation to provide support, and require training themselves. Analysis of recent facility-based surveys on service delivery showed that only approximately one-third or fewer providers in most countries have received recent training on breastfeeding or child-nutrition topics (Mallick, Temsah, & Benedict, 2018). Education and training are associated with improved provider communication (Larson, Leslie, & Kruk, 2017) so improved provider training could increase breastfeeding support and improve breastfeeding practices.

In addition to provider training and education, the country policy environment must be supportive of breastfeeding practices. Drafting, monitoring, and enforcing local regulations can improve compliance with the International Code of Marketing of Breast-milk Substitutes (Barennes, Slesak, Goyet, Aaron, & Srour, 2016), as seen in Armenia (Harutyunyan, 2015). However, policy must also support maternity leave and workplace breastfeeding provisions (Save the Children, 2013). Additionally, context and cultural preferences might explain variability in breastfeeding support effectiveness (Sudfeld, Fawzi, & Lahariya, 2012). Health practice, education, research and policy

interact in complex and dynamic ways. Integrating systems-thinking approaches may improve use of resources and improve health outcomes (Swanson et al., 2012).

Strengths and limitations

While data on breastfeeding practices have been collected by DHS since the inception of the programme, early postnatal breastfeeding support was only recently added to the model survey questionnaire (DHS, 2015). This has allowed us to examine breastfeeding support and practices at the national level to understand their relationship outside of specific, time-limited implementation efforts typically studied in RCTs and quasi-experimental studies. Furthermore, we were able to examine a diverse population, representative at the national level, and pool data to provide a large number of recent births.

However, some limitations should be noted. Detailed analysis of the health system and cultural context within the countries included in this analysis was outside the scope of this study. Furthermore, survey-based measurement of breastfeeding support and practices is subject to respondents being able to understand the questions and accurately recall the answers. Qualitative research in Bangladesh and Malawi has shown women's recall of timing of events around the time of birth becomes less precise over time (Yoder et al., 2010). A recent study in Nigeria showed that women's report of early initiation of breastfeeding was accurate at an exit-interview, the same level of accuracy wasn't met at future follow-up interviews (Bhattacharya et al., 2019).To increase the likelihood of accurate recall of support and practices, we limited the study population to the most recent birth in the two years before the survey. Other validation studies have also shown women can accurately report on multiple aspects of postnatal care, however, early initiation of breastfeeding has shown variable results for survey-reported accuracy (Blanc, Diaz, McCarthy, & Berdichevsky, 2016; Blanc, Warren, et al., 2016; McCarthy et al., 2016; Stanton et al., 2013) .

DHS survey questions asked women if they were counselled on or observed breastfeeding in the first two days of life. Additionally, they were asked the timing of the first newborn postnatal check. We

combined these variables to estimate breastfeeding support in the first hour of life under the assumption the breastfeeding support took place during the newborn postnatal check. However, it is possible the newborn had a postnatal check in the first hour after birth and the breastfeeding support took place at another time during the first two days of life and we cannot test the validity of this assumption. If our assumption is incorrect, then we may have overestimated early postnatal breastfeeding support and over emphasised its association with early initiation of breastfeeding.

Another limitation of this study is that there is no information on the quality of the breastfeeding support provided to women. The survey data include only maternal report of any observation of or counselling on breastfeeding from any health care provider. While the counselling could have been thorough and based on recommended practices, it also could have been superficial or included inaccurate information. Studies of antenatal, family planning, and sick child counselling have shown poor quality of counselling and over-reporting of receipt of services (Assaf, Wang, & Mallick, 2016).

As this is a cross-sectional study, causation cannot be inferred. While early postnatal breastfeeding support was associated with early initiation of breastfeeding, it may not be causally linked. Where early postnatal breastfeeding support is provided, cultural, political and promotion environments may also be conducive to supporting breastfeeding (Lindsay Mallick, Benedict, & Wang, 2019; Pérez-Escamilla, Curry, Minhas, Taylor, & Bradley, 2012). Improvement of breastfeeding outcomes has been successful in settings where goals, coordination, and monitoring have been aligned across multiple domains including political will, policy, research and promotion (Pérez-Escamilla et al., 2012).

Conclusion

While receipt of breastfeeding support was associated with early initiation of breastfeeding, it was not associated with exclusive breastfeeding or absence of prelacteal feeding, thereby lacking sustainability of impact. Key risk factors for poorer breastfeeding practices included not having a skilled attendant at the birth, having a c-section birth, relatively richer groups, and smaller newborns

(size as perceived by the woman). Increased education and improved ongoing training of health care providers to deliver breastfeeding support may improve breastfeeding practices. Furthermore, national and local policies must create an enabling environment for health care providers to support breastfeeding women as well as for workplaces, communities, and families to support breastfeeding women. Further research is needed to understand what features of breastfeeding support improve breastfeeding practices at scale.

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Tables and Figures

Table 1 Breastfeeding practices and support, definitions and populations

Practice/Support	Definition	Survey question	Population
Early initiation of breastfeeding	Newborn was put to the breast within one hour	How long after birth did you first put (NAME) to the breast?	Last births in the two years before the survey
Prelacteal feeding	Feeding the newborn anything other than breast milk in the first three days of life	In the first three days after delivery, was (NAME) given anything to drink other than breastmilk?	Last births in the two years before the survey
Exclusive breastfeeding	Infant under six months and living with the mother was given nothing besides breastmilk during the day and night before the survey	Are you still breastfeeding (NAME)? Now I would like to ask you about liquids or foods that (NAME) had yesterday during the day or at night. I am interested in whether your child had the item I mention even if it was combined with other foods. Did (NAME) drink or eat: (LIST OF FOODS/DRINKS)	Last births in the six months before the survey living with their mother
Breastfeeding counselling	Any health care provider counselled on breastfeeding within two days of birth	During the first two days after (NAME)'s birth, did any health care provider do the following: Counsel you on breastfeeding?	Last births in the two years before the survey
Breastfeeding observation	Any health care provider observed breastfeeding within two days of birth	During the first two days after (NAME)'s birth, did any health care provider do the following: Observe (NAME) breastfeeding?	Last births in the two years before the survey
Newborn postnatal check	Anyone checked on the newborn's health in the first hour after birth	I would like to talk to you about checks on (NAME)'s health after delivery – for example, someone examining (NAME), checking the cord, or seeing if (NAME) is OK. In the two months after (NAME) was born, did any health care provider or a traditional birth attendant check on (NAME)'s health? How long after delivery did the first check take place?	Last births in the two years before the survey
Both early breastfeeding support interventions	Women received counselling and was observed breastfeeding plus had a newborn postnatal check in the first hour of birth	--	Last births in the two years before the survey

Table 2 Covariates

Covariate	Definition	Models used for
Country	Categorical variable with a level for each country included in the analysis	All
Residence	Binary variable for urban/rural residence	All
Mode of delivery	Categorical variable for c-section, vaginal delivery with skilled delivery attendant, and vaginal delivery with no skilled attendant. Skilled attendant was defined for each country based on DHS final reports	All
Education	Binary variable for no/primary education or secondary/higher education	All
Wealth	Categorical variable created by the DHS Program for country-specific wealth quintile	All
Birth interval	Categorical variable for first birth, <2 years since previous birth, or + years since previous birth	All
Sex of baby	Binary variable for sex of the baby	All
Size of baby	Binary variable for mother's perceived size of the baby at birth being small or very small	All
Age of mother at last birth	Categorical variable for age of mother <20 years, 20-34 years, 35+years	All
Antenatal care	Binary variable for receipt of 4 or more antenatal care visits	All
Immediate skin-to-skin contact[a]	Binary variable for immediate skin-to-skin contact	Early breastfeeding, exclusive breastfeeding
Formal employment	Binary variable for mother works for cash or doesn't work/paid in kind	Exclusive breastfeeding only

[a] In Zimbabwe and Burundi, information on immediate skin-to-skin contact was only collected for facility births

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486 *Table 3 Sample characteristics*

487 *Percent distribution of socio-demographic characteristics of respondents, mean number of years in education, and mean age, by country*

	Angola	Armenia	Burundi	Ethiopia	Haiti	Malawi	Nepal	Timor-Leste	Tanzania	Uganda	Zimbabwe	Pooled sample (SE)
Rural	39.6	41.3	91.0	87.9	66.8	86.3	46.2	72.6	72.3	78.7	72.0	68.28 (0.0052)
Not formally employed	56.7	79.5	57.1	83.7	41.4	76.0	82.2	82.2	57.2	40.0	57.1	64.5 (0.0041)
Male baby	49.9	50.7	50.6	47.9	49.5	50.6	53.6	51.1	51.0	50.9	50.5	50.56 (0.0034)
Primary or no education	66.8	5.8	88.0	91.2	56.9	78.8	48.3	39.6	83.0	70.2	33.3	59.97 (0.0048)
Poorest	21.8	17.6	22.1	23.5	26.2	25.4	21.0	19.5	24.4	22.4	25.0	22.36 (0.0044)
Poorer	23.9	21.1	22.1	22.1	22.4	22.7	20.9	20.5	21.0	21.2	20.4	21.49 (0.0035)
Middle	21.8	18.8	20.6	20.6	21.3	19.3	23.1	20.6	18.8	19.0	18.1	20.15 (0.0036)
Richer	17.6	18.3	18.9	18.2	16.6	16.9	20.6	20.5	18.9	17.6	22.3	18.94 (0.0037)
Richest	14.9	24.2	16.3	15.6	13.5	15.7	14.5	18.9	16.9	19.9	14.3	17.05 (0.0045)
<20 years at delivery	20.6	5.4	7.5	11.9	12.7	20.7	22.7	7.8	18.6	17.4	18.2	14.91 (0.0025)
20-34 years at delivery	65.7	86.8	73.8	72.7	69.2	67.2	73.5	77.5	65.9	69.8	70.4	72.05 (0.0032)
35+ years at delivery	13.8	7.8	18.7	15.4	18.1	12.1	3.8	14.7	15.5	12.8	11.4	13.03 (0.0023)
First birth	20.8	41.5	17.3	20.6	29.8	27.6	40.7	25.3	27.0	22.6	26.5	27.45 (0.0036)
<2 years since last birth	17.2	12.9	12.7	13.3	10.6	6.4	11.4	21.4	13.0	16.4	7.3	12.67 (0.0025)
2+ years since last birth	62.0	45.5	70.0	66.0	59.6	66.0	47.9	53.4	60.0	61.0	66.2	59.88 (0.0036)
Average or large baby	71.7	66.9	66.0	70.1	81.6	65.8	85.0	78.6	80.0	74.0	64.8	73.01 (0.0034)
4+ ANC visits	60.0	96.8	51.7	33.5	63.1	48.4	71.2	76.7	48.1	60.7	73.7	62.53 (0.0043)
C-section	3.8	21.5	5.2	2.6	5.7	6.5	10.0	3.4	6.6	7.2	6.1	7.28 (0.0025)

Vaginal delivery, skilled attendant	47.5	78.5	80.4	34.5	34.5	84.5	54.5	56.0	59.3	69.4	75.7	62.5 (0.0048)
Vaginal delivery, no skilled attendant	48.5	0.0	13.8	62.9	59.2	8.7	35.4	40.4	34.1	23.1	18.1	30.21 (0.0048)
National total, <24 months[a]	5263	664	5348	4210	2370	6549	1956	2810	4081	5765	2415	41431 (350.57)
National total, <6 months[a]	1465	173	1247	1175	672	1653	443	743	992	1451	622	10636 (131.5)
Pooled total, <24 months[b]	3766	3766	3766	3766	3766	3766	3766	3766	3766	3766	3766	41431 (387.49)[c]
Pooled total, <6 months[b]	967	967	967	967	967	967	967	967	967	967	967	10636 (131.06)[c]

[a] Total using un-scaled, nationally-representative survey weights, [b] Total using scaled weights with all countries weighted equally, [c] Sum of country pooled sample totals do not add up to the full pooled sample total due to rounding

491 *Table 4 Logistic regression results*

	Early breastfeeding model (n=37,807)				Absence of prelacteal feeding model (n=39,601)				Exclusive breastfeeding model (n=9,920)			
Characteristic	COR[a]	95% CI	AOR[b]	95% CI	COR	95% CI	AOR	95% CI	COR	95% CI	AOR	95% CI
Breastfeeding assistance (ref= one or no interventions)												
Both interventions	0.92	(0.84,1.02)	1.24	(1.11,1.39)	0.92	(0.81,1.05)	0.99	(0.86,1.14)	0.97	(0.87,1.09)	0.93	(0.82,1.06)
Country (ref=Angola)												
Armenia	0.73	(0.59,0.90)	0.62	(0.49,0.79)	0.96	(0.70,1.33)	1.05	(0.75,1.49)	1.34	(0.97,1.85)	1.16	(0.82,1.66)
Burundi	6.13	(5.31,7.08)	7.34	(6.18,8.71)	2.06	(1.68,2.54)	2.03	(1.63,2.54)	7.31	(6.1,8.75)	6.58	(5.29,8.18)
Ethiopia	3.03	(2.58,3.56)	3.49	(2.95,4.13)	1.40	(1.13,1.74)	1.63	(1.29,2.04)	2.01	(1.70,2.39)	1.92	(1.60,2.30)
Haiti	0.97	(0.84,1.12)	1.09	(0.93,1.28)	0.54	(0.44,0.66)	0.58	(0.47,0.72)	1.00	(0.83,1.22)	0.92	(0.75,1.12)
Malawi	3.54	(3.10,4.04)	3.03	(2.61,3.52)	3.95	(3.14,4.97)	4.03	(3.16,5.15)	2.33	(2.01,2.70)	2.06	(1.73,2.45)
Nepal	1.29	(1.10,1.51)	1.27	(1.08,1.50)	0.30	(0.24,0.37)	0.31	(0.25,0.38)	3.38	(2.69,4.26)	3.20	(2.51,4.07)
Timor-Leste	3.32	(2.78,3.96)	2.81	(2.31,3.42)	0.54	(0.44,0.66)	0.45	(0.36,0.55)	1.64	(1.36,1.98)	1.33	(1.08,1.65)
Tanzania	1.12	(0.97,1.29)	1.19	(1.02,1.38)	0.75	(0.60,0.93)	0.79	(0.63,0.99)	1.89	(1.60,2.23)	1.77	(1.48,2.12)
Uganda	2.10	(1.85,2.40)	1.81	(1.57,2.09)	0.33	(0.28,0.39)	0.33	(0.27,0.39)	3.08	(2.63,3.61)	2.73	(2.29,3.26)
Zimbabwe	1.46	(1.24,1.72)	1.32	(1.10,1.58)	0.83	(0.66,1.05)	0.77	(0.60,0.98)	1.51	(1.25,1.82)	1.40	(1.13,1.75)
Residence (ref=rural)												
Urban	0.63	(0.58,0.68)	0.92	(0.82,1.02)	0.70	(0.63,0.78)	1.02	(0.89,1.17)	0.72	(0.66,0.79)	0.87	(0.77,0.98)
Mode of delivery (ref= vaginal, skilled attendant)												
C-section	0.17	(0.14,0.19)	0.23	(0.19,0.28)	0.29	(0.25,0.34)	0.31	(0.26,0.37)	0.88	(0.75,1.04)	0.91	(0.75,1.11)
Vaginal, no skilled attendant	0.63	(0.59,0.68)	0.77	(0.70,0.85)	0.70	(0.63,0.77)	0.67	(0.60,0.75)	0.66	(0.61,0.72)	0.84	(0.75,0.95)
Education (ref=primary or none)												
Secondary or higher	0.70	(0.65,0.75)	1.01	(0.93,1.10)	0.74	(0.68,0.82)	1.05	(0.94,1.17)	0.86	(0.79,0.94)	1.04	(0.93,1.16)
Wealth (ref= poorest)												
Poorer	0.99	(0.90,1.09)	0.97	(0.88,1.07)	0.89	(0.79,1.01)	0.88	(0.77,1.00)	0.95	(0.85,1.07)	0.96	(0.85,1.09)
Middle	0.97	(0.88,1.07)	0.92	(0.83,1.02)	0.72	(0.63,0.83)	0.70	(0.61,0.82)	1.07	(0.95,1.21)	1.08	(0.94,1.23)
Richer	0.94	(0.85,1.04)	0.87	(0.78,0.98)	0.72	(0.62,0.82)	0.67	(0.57,0.78)	1.01	(0.89,1.14)	0.92	(0.80,1.06)
Richest	0.89	(0.79,1.00)	0.91	(0.78,1.06)	0.57	(0.49,0.65)	0.55	(0.46,0.66)	1.06	(0.94,1.20)	0.91	(0.77,1.07)
Birth interval (ref=First birth)												
<2 years	1.33	(1.20,1.48)	1.27	(1.11,1.45)	1.17	(1.03,1.33)	1.21	(1.04,1.41)	0.89	(0.79,1.02)	0.79	(0.68,0.92)

2+ years	1.41	(1.31,1.52)	1.29	(1.16,1.42)	1.4	(1.26,1.54)	1.34	(1.17,1.53)	1.04	(0.95,1.14)	0.88	(0.78,1.00)
Sex of baby (ref=male)												
Female	1.05	(0.99,1.12)	1.05	(0.98,1.12)	1.04	(0.96,1.13)	1.02	(0.93,1.11)	1.08	(1.00,1.16)	1.09	(1.01,1.19)
Size of baby (ref= average, large, or very large)												
Small or very small	1.10	(1.02,1.18)	1.03	(0.95,1.12)	1.06	(0.96,1.16)	0.87	(0.79,0.96)	0.91	(0.83,0.99)	0.86	(0.78,0.95)
Maternal age at delivery (ref= less than 20 years)												
20-34 years	1.13	(1.05,1.22)	1.02	(0.92,1.12)	1.11	(1.00,1.23)	0.97	(0.85,1.11)	1.19	(1.07,1.32)	1.24	(1.08,1.42)
35+ years	1.23	(1.11,1.36)	1.01	(0.88,1.17)	1.09	(0.94,1.25)	0.85	(0.71,1.01)	1.36	(1.18,1.56)	1.41	(1.18,1.68)
Antenatal care (ref=4+ ANC visits)												
<4 ANC visits	1.12	(1.05,1.20)	0.93	(0.87,1.00)	0.99	(0.91,1.08)	0.76	(0.69,0.83)	0.96	(0.89,1.04)	0.93	(0.85,1.01)
Immediate skin-to-skin (ref= yes)												
No	0.68	(0.64,0.73)	0.62	(0.58,0.68)	--	--	--	--	0.94	(0.87,1.02)	0.95	(0.86,1.05)
Employed (ref= Not in formal employment)												
Formal employment	--	--	--	--	--	--	--	--	1.02	(0.94,1.11)	0.97	(0.89,1.07)

492 [a] COR=Crude odds ration; [b] AOR=Adjusted odds ratio

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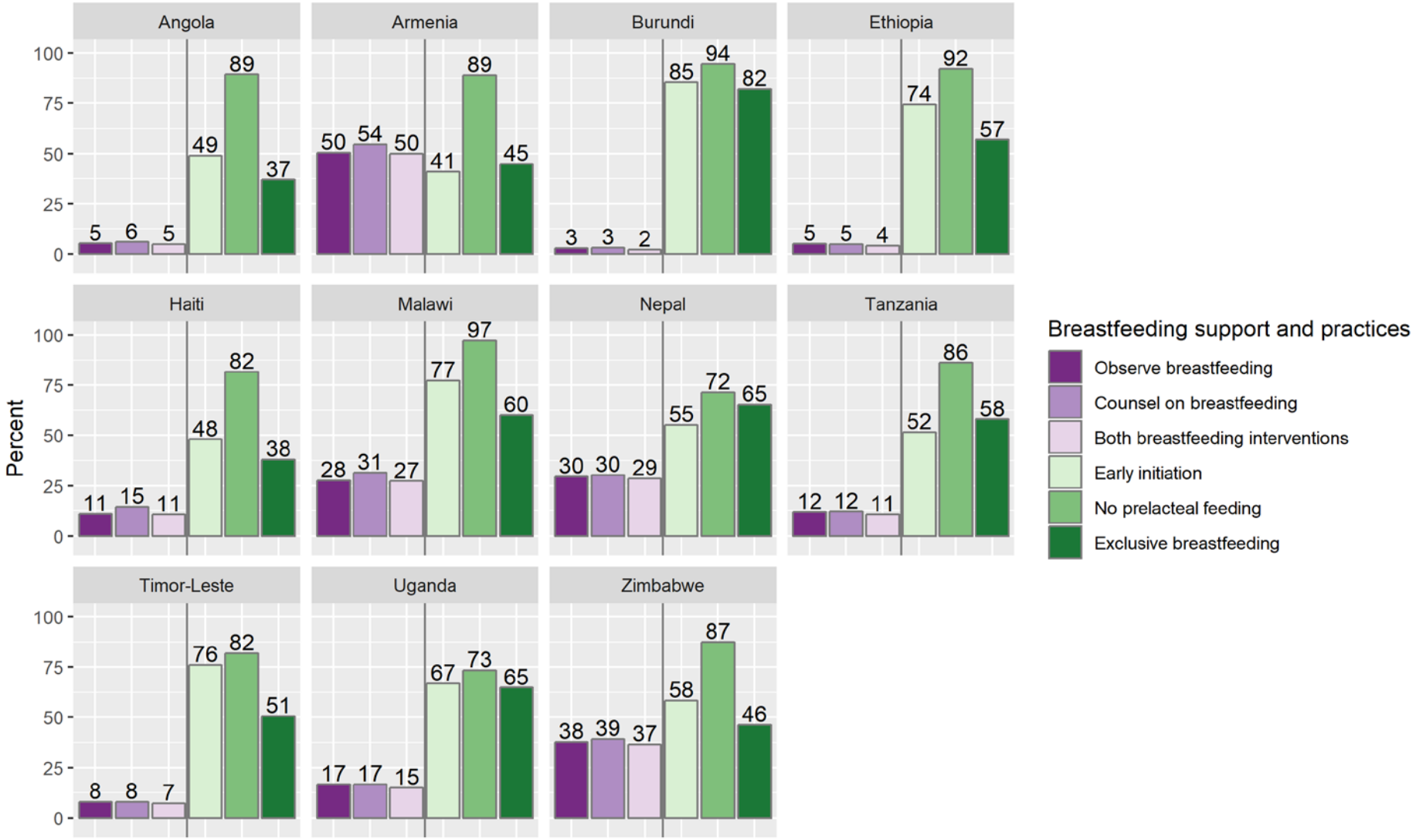
Figure 1 Coverage of breastfeeding support and prevalence of breastfeeding practices, by country



Supplementary table

Supplementary table 1 Included countries, survey year, and sample size

Country	Survey year	Number of women interviewed[a]
Angola	2015-16	14379
Armenia	2015-16	6116
Burundi	2016-17	17269
Ethiopia	2016	15683
Haiti	2016-17	14371
Malawi	2015-16	24562
Nepal	2016	12862
Timor-Leste	2016	13266
Tanzania	2015-16	12607
Uganda	2016	18506
Zimbabwe	2015	9955

***[a]Weighted, from ICF International* (2015)**

Author contribution statement

Kimberly Peven: Conceptualisation, Formal analysis, Visualization, Writing - Original Draft
Edward Purssell: Conceptualisation, Supervision, Writing - Review & Editing
Cath Taylor: Conceptualisation, Supervision, Writing - Review & Editing
Debra Bick: Conceptualisation, Supervision, Writing - Review & Editing
Velma K. Lopez: Conceptualisation, Methodology, Supervision, Writing - Review & Editing

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