



## City Research Online

### City, University of London Institutional Repository

---

**Citation:** Pursell, E., Peven, K., Bick, D., Taylor, C. & Lopez, V. (2019). Breastfeeding support in low and middle-income countries: secondary analysis of national survey data. *Midwifery*, 82, 102601. doi: 10.1016/j.midw.2019.102601

This is the accepted version of the paper.

This version of the publication may differ from the final published version.

---

**Permanent repository link:** <https://openaccess.city.ac.uk/id/eprint/23354/>

**Link to published version:** <https://doi.org/10.1016/j.midw.2019.102601>

**Copyright:** City Research Online aims to make research outputs of City, University of London available to a wider audience. Copyright and Moral Rights remain with the author(s) and/or copyright holders. URLs from City Research Online may be freely distributed and linked to.

**Reuse:** Copies of full items can be used for personal research or study, educational, or not-for-profit purposes without prior permission or charge. Provided that the authors, title and full bibliographic details are credited, a hyperlink and/or URL is given for the original metadata page and the content is not changed in any way.

---

---

---

City Research Online:

<http://openaccess.city.ac.uk/>

[publications@city.ac.uk](mailto:publications@city.ac.uk)

---

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

Kimberly Peven<sup>a</sup>, Edward Purcell<sup>b</sup>, Cath Taylor<sup>c</sup>, Debra Bick<sup>d</sup>, Velma K. Lopez<sup>e</sup>

1 <sup>a</sup> *Corresponding author*: Florence Nightingale Faculty of Nursing, Midwifery & Palliative Care, King's  
2 College London, kimberly.peven@kcl.ac.uk  
3 57 Waterloo Road, London, SE1 8WA, United Kingdom

<sup>b</sup> School of Health Sciences, City, University of London, London, UK

<sup>c</sup> School of Health Sciences, University of Surrey, Surrey, UK

<sup>d</sup> Warwick Clinical Trials Unit, Warwick Medical School, University of Warwick, Coventry, UK

<sup>e</sup> Department of Epidemiology, School of Public Health, University of Michigan, Ann Arbor, Michigan, USA

## 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

4 Data for this study were used under an agreement with the DHS Program. In addition to Institutional  
5 Review Board (IRB) approval in each host country, the ICF International IRB reviewed all survey  
6 procedures and tools for DHS surveys. Informed consent and voluntary participation were ensured  
7 before each interview and data were kept strictly confidential during the survey implementation and  
8 identifying information was destroyed after data processing. The King's College London College  
9 Research Ethics Committee granted approval to conduct these analyses (LRS-17/18-5570) and the  
10 project has been registered with the King's College London Data Protection Registration (DPRF-  
11 17/18-8170), in compliance with European data protection regulations.

## Source of funding

King's College London Centre for Doctoral Studies

## Acknowledgements

We would like to acknowledge the Demographic and Health Survey Program for making the data for this study accessible and thank all of the women and families that participated in the surveys.

## 13 Abstract

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

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

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

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

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

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

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

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

## 38 Introduction

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

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

49 A systematic review of breastfeeding interventions in low- and middle-income countries by Sinha et  
50 al. (2017) showed that interventions led to improvements in breastfeeding outcomes such as early  
51 (28 studies, OR: 3.31; 95% CI: 2.44, 4.50,  $I^2=96.3$ ), exclusive (exclusive breastfeeding at 1-5 months,  
52 62 studies, OR: 3.08; 95% CI: 2.57, 3.68,  $I^2=95.1$ ), and continued breastfeeding (7 studies, OR: 1.62;  
53 95% CI: 1.16, 2.27,  $I^2= 72.1$ ); although all were subject to high levels of heterogeneity. The largest  
54 improvements in breastfeeding outcomes were seen when interventions were delivered in multiple  
55 settings in parallel (i.e. home, community, and health systems). An earlier systematic review by  
56 Haroon et al. (2013) showed that counselling (individual or group; prenatal, postnatal, or both)  
57 increased exclusive breastfeeding and decreased rates of no breastfeeding, particularly in low-  
58 resource countries (exclusive breastfeeding at 1-5 months increased by 90%, 66 studies, RR:1.9, 95%  
59 CI: 1.54,2.34,  $I^2 =96%$ ). Additionally, a systematic review by Imdad et al. (2011) of breastfeeding  
60 promotion studies in diverse settings found a significant 43% increase in exclusive breastfeeding at  
61 4-6 weeks when breastfeeding support interventions were implemented antenatally, postnatally, or  
62 both (32 studies, RR = 1.43; 95% CI: 1.28, 1.60,  $I^2 =85%$ ). Furthermore, the review supported  
63 interventions such as education, professional and lay support (Imdad et al., 2011).

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

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

## 76 Methods

### 77 Data

78 We analysed secondary data from 11 Demographic and Health Surveys (DHS) implemented since  
79 2015 (see Supplemental Table 1 for countries, survey years, and number of women). Funded largely  
80 by the United States Agency for International Development (USAID), DHS surveys collect data on a  
81 range of population and health issues, including early postnatal breastfeeding support and  
82 breastfeeding outcomes. Data are collected at the household- and the individual-level, primarily  
83 from women of reproductive age (15-49 years). Nationally representative results are produced for  
84 each country through a complex, multi-stage cluster sampling procedure with stratification (ICF  
85 International, 2012a). Standard procedures and methodologies ensure comparable data across  
86 countries (ICF International, 2012b). Survey results, data, and further information about the program  
87 can be found at the DHS Program website: [dhsprogram.com](http://dhsprogram.com).

### 88 Population

89 Countries were included in the analysis if the survey contained data on postnatal breastfeeding  
90 support and breastfeeding practices. Further information is provided in Supplementary table 1.  
91 DHS surveys included detailed information about all of a woman's births in the previous five years.  
92 We limited the data to last (most recent) live births in the two years before the survey. Outcome  
93 variables included prelacteal feeding in the first three days of life, therefore newborns that did not  
94 live to three days (i.e. were born in the three days before the survey or did not survive to day three)

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

## 97 Variables

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

102 Postnatal breastfeeding support variables were the key independent variables considered.

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

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

## 118 Analysis

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

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

128 In the regression analysis, we fitted three different logistic regression models, one for each outcome  
129 of interest- initiation of breastfeeding within one hour, absence of prelacteal feeding in the first  
130 three days, and current exclusive breastfeeding status. First, we fitted unadjusted models to assess  
131 for association between breastfeeding support variables and each covariate. In multivariable  
132 analysis, we fitted logistic regression models adjusting for breastfeeding support and all the  
133 covariates selected for the outcome. As information on skin-to-skin contact was not collected for  
134 non-facility births in Zimbabwe (n=375) and Burundi (n=750), these births were excluded from the  
135 early breastfeeding and exclusive breastfeeding models. In analysis of exclusive breastfeeding, the  
136 sample was reduced to living children under six months of age. In this sub-population, some survey  
137 strata had only one cluster and sampling variance could not be calculated. In such cases, the strata  
138 contribution to variance was taken as the average of all strata with two or more clusters (Lumley,  
139 2010).

## 140 Ethical approval

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



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

145 We accessed and used these data under an agreement with the DHS Program. Further ethical  
146 approval to conduct these analyses was granted by King's College London College Research  
147 Ethics Committee (LRS-17/18-5570). Additionally, in compliance with European data regulations, this  
148 project was registered with the King's College London Data Protection Registration (DPRF-17/18-  
149 8170).

## 150 Results

### 151 Sample characteristics

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

### 158 Prevalence of breastfeeding practices

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

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

167 Exclusive breastfeeding among last-born children under six months ranged from 37% in Angola to  
168 82% in Burundi.

### 169 Coverage of postnatal breastfeeding support

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

### 174 Logistic regression results

#### 175 Early breastfeeding

176 After adjusting for sociodemographic, pregnancy-, birth-, and newborn-related factors, women who  
177 received both breastfeeding support interventions from any health care provider (counselling and  
178 observation) in the first hour after birth, had a 24% increase (OR=1.24 95%CI=1.11,1.39) in the odds  
179 of initiating breastfeeding within one hour of birth (Table 4). Having no skilled attendant present at  
180 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  
181 skin-to-skin contact (OR=0.62, 95%CI=0.58-0.68), and being in the richer wealth quintile (OR=0.87,  
182 95%CI=0.78-0.89) were all associated with a decrease in the odds of early breastfeeding. Any birth  
183 interval was associated with an increase in the odds of early breastfeeding, as compared with first  
184 births (<2 years: OR=1.27, 95%CI=1.11,1.45; 2+years: OR=1.29, 95%CI=1.16,1.42).

#### 185 Pre-lacteal feeding

186 Receiving both early postnatal breastfeeding interventions was not associated with absence of  
187 pre-lacteal feeds (anything other than breastmilk given in the first three days of life) (OR=0.99,  
188 95%CI=0.81-1.14). Decreased odds of absence of pre-lacteal feeds was associated with having a c-  
189 section (OR=0.31, 95%CI=0.26-0.37), not having a skilled attendant present at the birth (OR=0.67,  
190 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-

191 0.78), or richest (OR=0.55, 95%CI=0.46-0.66) wealth quintiles, and perceived size of the newborn as  
192 small or very small (OR=0.87, 95%CI=0.79-0.96). Multiparous births were associated with an increase  
193 in the odds of absence of prelacteal feeding, as compared with first births (birth interval <2 years:  
194 OR=1.21, 95%CI=1.04,1.41; birth interval 2+years: OR=1.34, 95%CI=1.17,1.53).

#### 195 Exclusive breastfeeding

196 Receipt of both early postnatal breastfeeding support interventions was not associated with  
197 exclusive breastfeeding in infants under six months of age (OR=0.93, 95%CI=0.82-1.06). Factors that  
198 were positively associated with exclusive breastfeeding included giving birth to a female newborn  
199 (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+  
200 years: OR=1.41, 95%CI=1.18,1.68). Factors negatively associated with exclusive breastfeeding  
201 included living in an urban residence (OR=0.87, 95%CI=0.77,0.98), having no skilled attendant  
202 present at the birth (OR=0.84, 95%CI=0.75-0.95), a birth interval of less than two years (as compared  
203 to first birth) (OR=0.79, 95%CI=0.68-0.92), and having a small or very small baby (OR=0.86,  
204 95%CI=0.78-0.95).

## 205 Discussion

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

215 Findings from Burundi and Armenia highlight the heterogeneity in receipt of breastfeeding support  
216 and breastfeeding practices. While early postnatal breastfeeding support was almost non-existent in  
217 Burundi, early and exclusive breastfeeding was widely practiced and offering of prelacteal feeds was  
218 rare. Conversely, in Armenia, although early postnatal breastfeeding support was more common,  
219 implementation of recommended breastfeeding practices were amongst the lowest in this study.  
220 This may be explained by external contextual factors. Armenia suffered a rapid decrease in  
221 breastfeeding rates in the aftermath of the 1988 earthquake when infant formula was widely  
222 distributed by aid agencies (Harutyunyan, 2015). Breastfeeding practices further suffered during the  
223 early 1990s from poor hospital practices (such as routine feeding with water and use of bottles)  
224 (Abazyan, 2009) and formula marketing (Harutyunyan, 2015). To improve breastfeeding practices,  
225 Armenia revised numerous policies and practices to promote breastfeeding, including the  
226 implementation of the Baby Friendly Hospital Initiative (BFHI), the Baby Friendly Polyclinics Initiative  
227 (BFPI), the Breastfeeding Promotion and Regulation of Marketing of Baby Food law, and the  
228 Improving health and nutrition of infants and young children educational project (Harutyunyan,  
229 2015). The strong political efforts in Armenia may explain the high coverage of early postnatal  
230 breastfeeding support while these external contextual and historical factors may continue to explain  
231 the low breastfeeding practices.

232 Devastation from civil war in Burundi from 1993 to 2000 included disruption to the health system.  
233 Challenges in the health sector include insufficient and poorly trained staff, concentration of staff in  
234 the capital, poor quality health services, and lack of reliable health information (World Health  
235 Organization, 2015). To improve maternal and child mortality rates, a policy of free health care for  
236 children under five and access to facility deliveries was adopted in Burundi in 2006. Utilization of  
237 health services rose substantially and increased pressure on understaffed and underequipped  
238 facilities. Further changes to the health system, particularly performance-based financing, have  
239 contributed to more recent improvements in the stability of health personnel and quality of services  
240 (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-

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

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

283 In addition to provider training and education, the country policy environment must be supportive  
284 of breastfeeding practices. Drafting, monitoring, and enforcing local regulations can improve  
285 compliance with the International Code of Marketing of Breast-milk Substitutes (Barennes, Slesak,  
286 Goyet, Aaron, & Srour, 2016), as seen in Armenia (Harutyunyan, 2015). However, policy must also  
287 support maternity leave and workplace breastfeeding provisions (Save the Children, 2013).

288 Additionally, context and cultural preferences might explain variability in breastfeeding support  
289 effectiveness (Sudfeld, Fawzi, & Lahariya, 2012). Health practice, education, research and policy

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

## 292 [Strengths and limitations](#)

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

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

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

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

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

327 As this is a cross-sectional study, causation cannot be inferred. While early postnatal breastfeeding  
328 support was associated with early initiation of breastfeeding, it may not be causally linked. Where  
329 early postnatal breastfeeding support is provided, cultural, political and promotion environments  
330 may also be conducive to supporting breastfeeding (Lindsay Mallick, Benedict, & Wang, 2019; Pérez-  
331 Escamilla, Curry, Minhas, Taylor, & Bradley, 2012). Improvement of breastfeeding outcomes has  
332 been successful in settings where goals, coordination, and monitoring have been aligned across  
333 multiple domains including political will, policy, research and promotion (Pérez-Escamilla et al.,  
334 2012).

### 335 Conclusion

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



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

346

## 347 References

- 348 Abazyan, A. (2009). *Breastfeeding trends in Yerevan: Relationship between maternal knowledge and*  
349 *breastfeeding practices*. (Master of Public Health Integrating Experience Project, Professional  
350 Publication Framework, American University of Armenia). Retrieved from  
351 <http://aua.am/chsr/PDF/MPH/2009/Abazyan,%20Anna.pdf>
- 352 Assaf, S., Wang, W., & Mallick, L. (2016). *Provider counseling and knowledge transfer in health*  
353 *facilities of Haiti, Malawi, and Senegal*. Retrieved from ICF International website:  
354 <http://dhsprogram.com/pubs/pdf/AS60/AS60.pdf>
- 355 Barennes, H., Slesak, G., Goyet, S., Aaron, P., & Srour, L. M. (2016). Enforcing the International Code  
356 of Marketing of Breast-milk Substitutes for Better Promotion of Exclusive Breastfeeding: Can  
357 Lessons Be Learned? *Journal of Human Lactation*, 32(1), 20–27.  
358 <https://doi.org/10.1177/0890334415607816>
- 359 Bhattacharya, A. A., Allen, E., Umar, N., Usman, A. U., Felix, H., Audu, A., ... Marchant, T. (2019).  
360 Monitoring childbirth care in primary health facilities: A validity study in Gombe State,  
361 northeastern Nigeria. *Journal of Global Health*, 9(2), 020411.  
362 <https://doi.org/10.7189/jogh.09.020411>
- 363 Blanc, A. K., Diaz, C., McCarthy, K. J., & Berdichevsky, K. (2016). Measuring progress in maternal and  
364 newborn health care in Mexico: Validating indicators of health system contact and quality of  
365 care. *BMC Pregnancy and Childbirth*, 16(1), 255. <https://doi.org/10.1186/s12884-016-1047-0>
- 366 Blanc, A. K., Warren, C., McCarthy, K. J., Kimani, J., Ndwiga, C., & RamaRao, S. (2016). Assessing the  
367 validity of indicators of the quality of maternal and newborn health care in Kenya. *Journal of*  
368 *Global Health*, 6(1). <https://doi.org/10.7189/jogh.06.010405>
- 369 Bradley, E. H., Curry, L. A., Taylor, L. A., Pallas, S. W., Talbert-Slagle, K., Yuan, C., ... Pérez-Escamilla, R.  
370 (2012). A model for scale up of family health innovations in low-income and middle-income  
371 settings: A mixed methods study. *BMJ Open*, 2(4). [https://doi.org/10.1136/bmjopen-2012-](https://doi.org/10.1136/bmjopen-2012-000987)  
372 000987

373 Chopra, M., Sharkey, A., Dalmiya, N., Anthony, D., & Binkin, N. (2012). Strategies to improve health  
374 coverage and narrow the equity gap in child survival, health, and nutrition. *The Lancet*,  
375 *380*(9850), 1331–1340. [https://doi.org/10.1016/S0140-6736\(12\)61423-8](https://doi.org/10.1016/S0140-6736(12)61423-8)

376 Croft, T., Marshall, A., & Allen, C. (2018). *Guide to DHS Statistics*. Retrieved from ICF website:  
377 [https://dhsprogram.com/pubs/pdf/DHSG1/Guide\\_to\\_DHS\\_Statistics\\_DHS-7.pdf](https://dhsprogram.com/pubs/pdf/DHSG1/Guide_to_DHS_Statistics_DHS-7.pdf)

378 Daglas, M., & Antoniou, E. (2012). Cultural views and practices related to breastfeeding. *Health*  
379 *Science Journal*, *6*(2), 9.

380 DHS. (2015). *DHS Model Questionnaire—Phase 7*. Retrieved from ICF website:  
381 [https://dhsprogram.com/publications/publication-dhsq7-dhs-questionnaires-and-](https://dhsprogram.com/publications/publication-dhsq7-dhs-questionnaires-and-manuals.cfm)  
382 [manuals.cfm](https://dhsprogram.com/publications/publication-dhsq7-dhs-questionnaires-and-manuals.cfm)

383 Edmond, K. M., Zandoh, C., Quigley, M. A., Amenga-Etego, S., Owusu-Agyei, S., Kirkwood, B. R., ...  
384 Kirkwood, B. R. (2006). Delayed breastfeeding initiation increases risk of neonatal mortality.  
385 *Pediatrics*, *117*, e380--6.

386 Haroon, S., Das, J. K., Salam, R. A., Imdad, A., & Bhutta, Z. A. (2013). Breastfeeding promotion  
387 interventions and breastfeeding practices: A systematic review. *BMC Public Health*, *13 Suppl*  
388 *3*, S20. <https://doi.org/10.1186/1471-2458-13-S3-S20>

389 Harutyunyan, S. (2015). *WBTi Armenia Assessment Report*. Retrieved from Confidence Health NGO  
390 website: [http://worldbreastfeedingtrends.org/GenerateReports/report/WBTi-Armenia-](http://worldbreastfeedingtrends.org/GenerateReports/report/WBTi-Armenia-report-2015.pdf)  
391 [report-2015.pdf](http://worldbreastfeedingtrends.org/GenerateReports/report/WBTi-Armenia-report-2015.pdf)

392 ICF International. (2012a). *Demographic and Health Survey Sampling and Household Listing Manual*.  
393 Calverton, Maryland, USA: ICF International: MEASURE DHS.

394 ICF International. (2012b). *Survey Organization Manual for Demographic and Health Surveys*.  
395 Retrieved from MEASURE DHS website: [https://dhsprogram.com/publications/publication-](https://dhsprogram.com/publications/publication-dhsm10-dhs-questionnaires-and-manuals.cfm)  
396 [dhsm10-dhs-questionnaires-and-manuals.cfm](https://dhsprogram.com/publications/publication-dhsm10-dhs-questionnaires-and-manuals.cfm)

397 Imdad, A., Yakoob, M. Y., & Bhutta, Z. A. (2011). Effect of breastfeeding promotion interventions on  
398 breastfeeding rates, with special focus on developing countries. *BMC Public Health*, 11(Suppl  
399 3), S24. <https://doi.org/10.1186/1471-2458-11-S3-S24>

400 Kim, S. K., Park, S., Oh, J., Kim, J., & Ahn, S. (2018). Interventions promoting exclusive breastfeeding  
401 up to six months after birth: A systematic review and meta-analysis of randomized  
402 controlled trials. *International Journal of Nursing Studies*, 80, 94–105.  
403 <https://doi.org/10.1016/j.ijnurstu.2018.01.004>

404 Knippenberg, R., Lawn, J. E., Darmstadt, G. L., Begkoyian, G., Fogstad, H., Walelign, N., & Paul, V. K.  
405 (2005). Systematic scaling up of neonatal care in countries. *The Lancet*, 365(9464), 1087–  
406 1098. [https://doi.org/10.1016/s0140-6736\(05\)74233-1](https://doi.org/10.1016/s0140-6736(05)74233-1)

407 Larson, E., Leslie, H. H., & Kruk, M. E. (2017). The determinants and outcomes of good provider  
408 communication: A cross-sectional study in seven African countries. *BMJ Open*, 7(6),  
409 e014888. <https://doi.org/10.1136/bmjopen-2016-014888>

410 Lumley, T. (2010). *Complex surveys: A guide to analysis using R*. Hoboken, N.J: John Wiley.

411 Lumley, T. (2018). survey: Analysis of Complex Survey Samples (Version 3.33-2). Retrieved from  
412 <https://CRAN.R-project.org/package=survey>

413 Mallick, L., Benedict, R. K., & Wang, W. (2019). *Examining the role of health facilities in supporting*  
414 *early breastfeeding in Haiti and Malawi*. Retrieved from ICF website:  
415 <http://dhsprogram.com/pubs/pdf/WP161/WP161.pdf>

416 Mallick, L., Temsah, G., & Benedict, R. K. (2018). *Facility-based nutrition readiness and delivery of*  
417 *maternal and child nutrition services using service provision assessment surveys*. Retrieved  
418 from ICF website: <http://dhsprogram.com/pubs/pdf/CR49/CR49.pdf>

419 McCarthy, K. J., Blanc, A. K., Warren, C. E., Kimani, J., Mdawida, B., & Ndwidga, C. (2016). Can surveys  
420 of women accurately track indicators of maternal and newborn care? A validity and  
421 reliability study in Kenya. *Journal of Global Health*, 6(2), 020502.  
422 <https://doi.org/10.7189/jogh.06.020502>

423 Morrow, A., Guerrero, M., Shults, J., Calva, J., Lutter, C., Bravo, J., ... Butterfoss, F. (1999). *Efficacy of*  
424 *home-based peer counselling to promote exclusive breastfeeding: A randomised controlled*  
425 *trial* (Vol. 353). Retrieved from  
426 <http://onlinelibrary.wiley.com/o/cochrane/clcentral/articles/329/CN-00162329/frame.html>

427 Parker, M., Leroy, J. L., Olney, D., Harris, J., & Ruel, M. (2012). *Renforcement et évaluation de*  
428 *l'approche Prévention de la Malnutrition chez les enfants de moins de 2 ans (PM2A) au*  
429 *Burundi: Rapport initial* (p. 131). Washington, DC: FHI 360/FANTA.

430 Patil, C. L., Turab, A., Ambikapathi, R., Nesamvuni, C., Chandyo, R. K., Bose, A., ... on behalf of the  
431 MAL-ED network. (2015). Early interruption of exclusive breastfeeding: Results from the  
432 eight-country MAL-ED study. *Journal of Health, Population and Nutrition*, 34(1), 10.  
433 <https://doi.org/10.1186/s41043-015-0004-2>

434 Pérez-Escamilla, R., Curry, L., Minhas, D., Taylor, L., & Bradley, E. (2012). Scaling Up of Breastfeeding  
435 Promotion Programs in Low- and Middle-Income Countries: The “Breastfeeding Gear”  
436 Model. *Advances in Nutrition*, 3(6), 790–800. <https://doi.org/10.3945/an.112.002873>

437 Proctor, E., Luke, D., Calhoun, A., McMillen, C., Brownson, R., McCrary, S., & Padek, M. (2015).  
438 Sustainability of evidence-based healthcare: Research agenda, methodological advances,  
439 and infrastructure support. *Implementation Science : IS*, 10. [https://doi.org/10.1186/s13012-](https://doi.org/10.1186/s13012-015-0274-5)  
440 [015-0274-5](https://doi.org/10.1186/s13012-015-0274-5)

441 R Core Team. (2018). *R: A Language and Environment for Statistical Computing*. Retrieved from  
442 <http://www.R-project.org/>

443 Sankar, M. J., Sinha, B., Chowdhury, R., Bhandari, N., Taneja, S., Martinez, J., & Bahl, R. (2015).  
444 Optimal breastfeeding practices and infant and child mortality: A systematic review and  
445 meta-analysis. *Acta Paediatrica*, 104, 3–13. <https://doi.org/10.1111/apa.13147>

446 Save the Children. (2013). *Superfood for babies: How overcoming barriers to breastfeeding will save*  
447 *children’s lives*. Retrieved from

448 [https://www.savethechildren.org.uk/content/dam/global/reports/health-and-](https://www.savethechildren.org.uk/content/dam/global/reports/health-and-nutrition/superfood-for-babies-UK-version.pdf)  
449 [nutrition/superfood-for-babies-UK-version.pdf](https://www.savethechildren.org.uk/content/dam/global/reports/health-and-nutrition/superfood-for-babies-UK-version.pdf)

450 Sinha, B., Chowdhury, R., Upadhyay, R. P., Taneja, S., Martines, J., Bahl, R., & Sankar, M. J. (2017).  
451 Integrated Interventions Delivered in Health Systems, Home, and Community Have the  
452 Highest Impact on Breastfeeding Outcomes in Low- and Middle-Income Countries. *The*  
453 *Journal of Nutrition*, 147(11), 2179S-2187S. <https://doi.org/10.3945/jn.116.242321>

454 Stanton, C. K., Rawlins, B., da Luz Vaz Drake dos Anjos, M., da Luz Vaz Drake dos Anjos, M., Cantor,  
455 D., Chavane Chongo, L., ... Ricca, J. (2013). Measuring coverage in MNCH: testing the validity  
456 of women's self-report of key maternal and newborn health interventions during the  
457 peripartum period in Mozambique. *Plos One*, 8, e60694.

458 Sudfeld, C. R., Fawzi, W. W., & Lahariya, C. (2012). Peer Support and Exclusive Breastfeeding  
459 Duration in Low and Middle-Income Countries: A Systematic Review and Meta-Analysis.  
460 *PLOS ONE*, 7(9), e45143. <https://doi.org/10.1371/journal.pone.0045143>

461 Swanson, R. C., Cattaneo, A., Bradley, E., Chunharas, S., Atun, R., Abbas, K. M., ... Best, A. (2012).  
462 Rethinking health systems strengthening: Key systems thinking tools and strategies for  
463 transformational change. *Health Policy and Planning*, 27(suppl\_4), iv54–iv61.  
464 <https://doi.org/10.1093/heapol/czs090>

465 Victora, C. G., Bahl, R., Barros, A. J. D., França, G. V. A., Horton, S., Krasevec, J., ... Lancet  
466 Breastfeeding Series Group. (2016). Breastfeeding in the 21st century: Epidemiology,  
467 mechanisms, and lifelong effect. *Lancet (London, England)*, 387(10017), 475–490.  
468 [https://doi.org/10.1016/S0140-6736\(15\)01024-7](https://doi.org/10.1016/S0140-6736(15)01024-7)

469 Wiltsey Stirman, S., Kimberly, J., Cook, N., Calloway, A., Castro, F., & Charns, M. (2012). The  
470 sustainability of new programs and innovations: A review of the empirical literature and  
471 recommendations for future research. *Implementation Science*, 7(1), 17.  
472 <https://doi.org/10.1186/1748-5908-7-17>

473 World Health Organization. (2014). *WHO recommendations on postnatal care of the mother and*  
474 *newborn*. Retrieved from <http://www.who.int/iris/handle/10665/97603>

475 World Health Organization. (2015). *Improving health system efficiency: Burundi: performance based*  
476 *financing of priority health services* (Technical Documents No.  
477 WHO/HIS/HGF/CaseStudy/15.1). Retrieved from World Health Organization website:  
478 <http://apps.who.int/iris/handle/10665/186474>

479 Yoder, P. S., Risato, M., Mahmud, R., Fort, A., Rahman, F., Armstrong, A., & Rubayet, S. (2010).  
480 *Women's recall of delivery and neonatal care in Bangladesh and Malawi: A study of terms,*  
481 *concepts, and survey questions*. Retrieved from ICF Macro website:  
482 <http://dhsprogram.com/pubs/pdf/QRS17/QRS17.pdf>

483

## Tables and Figures

Table 1 Breastfeeding practices and support, definitions and populations

Practice/Support	Definition	Survey question	Population
<b>Early initiation of breastfeeding</b>	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
<b>Prelacteal feeding</b>	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
<b>Exclusive breastfeeding</b>	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
<b>Breastfeeding counselling</b>	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
<b>Breastfeeding observation</b>	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
<b>Newborn postnatal check</b>	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
<b>Both early breastfeeding support interventions</b>	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

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

<sup>a</sup> In Zimbabwe and Burundi, information on immediate skin-to-skin contact was only collected for facility births

485

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 <sup>a</sup>	5263	664	5348	4210	2370	6549	1956	2810	4081	5765	2415	41431 (350.57)
National total, <6 months <sup>a</sup>	1465	173	1247	1175	672	1653	443	743	992	1451	622	10636 (131.5)
Pooled total, <24 months <sup>b</sup>	3766	3766	3766	3766	3766	3766	3766	3766	3766	3766	3766	41431 (387.49) <sup>c</sup>
Pooled total, <6 months <sup>b</sup>	967	967	967	967	967	967	967	967	967	967	967	10636 (131.06) <sup>c</sup>

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

490

Characteristic	Early breastfeeding model (n=37,807)				Absence of prelacteal feeding model (n=39,601)				Exclusive breastfeeding model (n=9,920)			
	COR <sup>a</sup>	95% CI	AOR <sup>b</sup>	95% CI	COR	95% CI	AOR	95% CI	COR	95% CI	AOR	95% CI
<b>Breastfeeding assistance (ref= one or no interventions)</b>												
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)
<b>Country (ref=Angola)</b>												
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)
<b>Residence (ref=rural)</b>												
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)
<b>Mode of delivery (ref= vaginal, skilled attendant)</b>												
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)
<b>Education (ref=primary or none)</b>												
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)
<b>Wealth (ref= poorest)</b>												
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)
<b>Birth interval (ref=First birth)</b>												
<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)

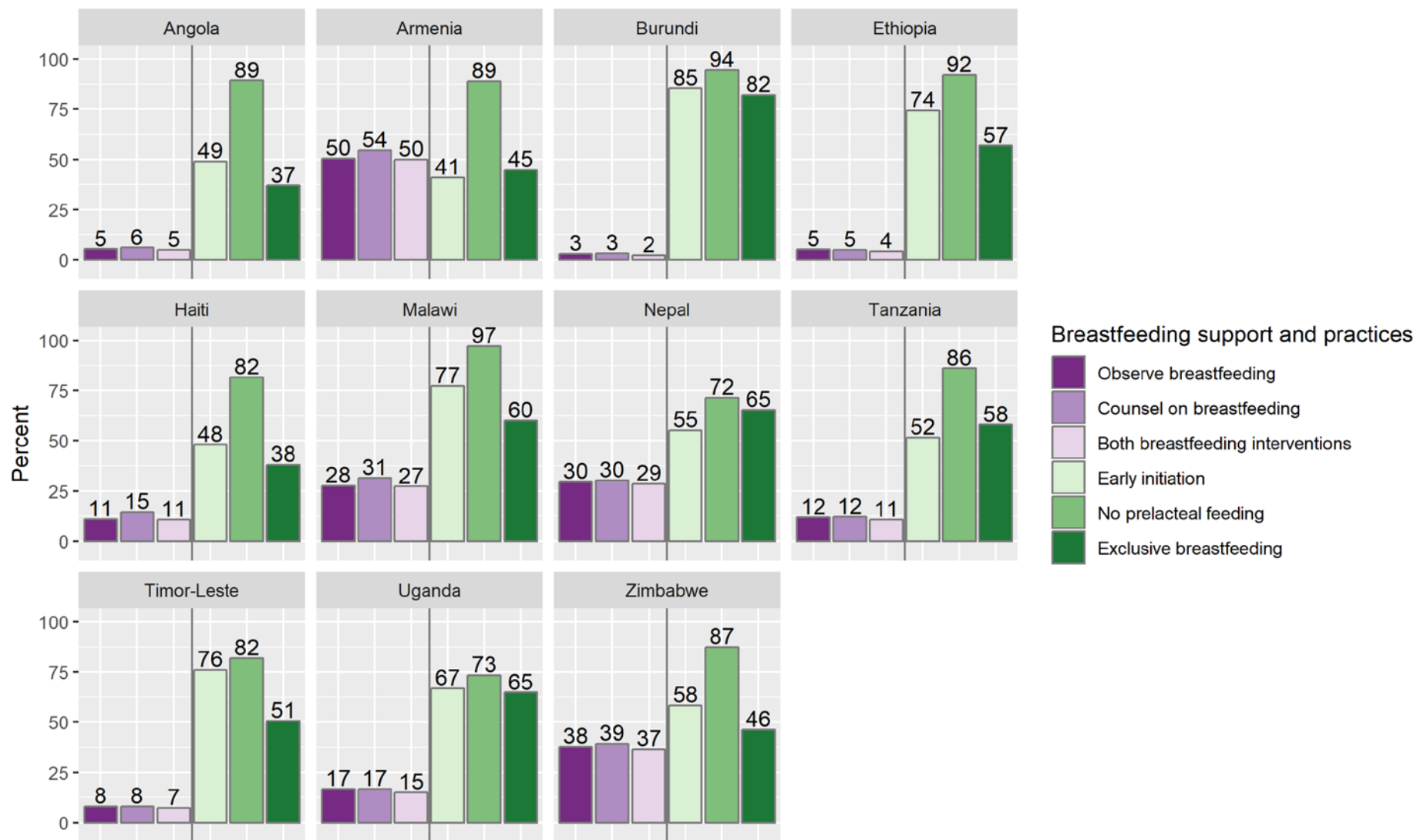
2+ years	1.41	(1.31,1.52)	1.29	(1.16,1.42)	1.4	(1.26,1.54)	1.34	(1.17,1.53)	1.04	(0.95,1.14)	0.88	(0.78,1.00)
<b>Sex of baby (ref=male)</b>												
Female	1.05	(0.99,1.12)	1.05	(0.98,1.12)	1.04	(0.96,1.13)	1.02	(0.93,1.11)	1.08	(1.00,1.16)	1.09	(1.01,1.19)
<b>Size of baby (ref= average, large, or very large)</b>												
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)
<b>Maternal age at delivery (ref= less than 20 years)</b>												
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)
<b>Antenatal care (ref=4+ ANC visits)</b>												
<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)
<b>Immediate skin-to-skin (ref= yes)</b>												
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)
<b>Employed (ref= Not in formal employment)</b>												
Formal employment	--	--	--	--	--	--	--	--	1.02	(0.94,1.11)	0.97	(0.89,1.07)

<sup>a</sup> COR=Crude odds ration; <sup>b</sup> AOR=Adjusted odds ratio

492

493

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



496  
497

## Supplementary table

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

Country	Survey year	Number of women interviewed <sup>a</sup>
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

<sup>a</sup>Weighted, from ICF International (2015)

498  
499  
500  
501

### Author contribution statement

502 Kimberly Peven: Conceptualisation, Formal analysis, Visualization, Writing - Original Draft  
503 Edward Purssell: Conceptualisation, Supervision, Writing - Review & Editing  
504 Cath Taylor: Conceptualisation, Supervision, Writing - Review & Editing  
505 Debra Bick: Conceptualisation, Supervision, Writing - Review & Editing  
506 Velma K. Lopez: Conceptualisation, Methodology, Supervision, Writing - Review & Editing  
507

### Acknowledgements

We would like to acknowledge the Demographic and Health Survey Program for making the data for this study accessible and thank all of the women and families that participated in the surveys.

508  
509