CAMBRIDGE
UNIVERSITY PRESS

RESEARCH ARTICLE

Variation and determinants of early initiation of breastfeeding in high and low neonatal mortality settings in India

Jeetendra Yadav[1]*, Chander Shekhar[2] and Kusum Bharati[3]

[1]ICMR-National Institute of Medical Statistics, New Delhi, India, [2]Department of Fertility Studies, International Institute for Population Sciences (IIPS), Mumbai, India and [3]National Health Mission Uttar Pradesh, India
*Corresponding author. Email: jeetu.nims@gmail.com

Abstract

Early initiation of breastfeeding (EIBF) is considered one of the most cost-effective interventions for infant survival and well-being. This study aimed to examine the variations in, and determinants of, early initiation of breastfeeding among women in high and low neonatal mortality rate (NMR) settings in India using data from the fourth round of the National Family Health Survey conducted in 2015–16. At 35%, EIBF was found to be disproportionately low in the high NMR group of states compared with 52% in the low NMR group, with the national average being 44%. The chance of EIBF significantly increased if childbirth was vaginal, delivery took place in a health institution, the mother received breastfeeding advice and the birth was a planned one in both high and low NMR settings. In the high NMR group of states, the probability of initiating breastfeeding immediately after birth improved to a great extent if childbirth was assisted by a trained person and if the mother was exposed to any type of mass media. There is an urgent need to increase the access of mothers to breastfeeding advice during pregnancy and to increase their exposure to mass media, particularly in high NMR states. In addition, achieving universal access to institutional deliveries and deliveries assisted by a skilled birth attendant, especially in high NMR settings, and promoting early breastfeeding, especially in the case of Caesarean deliveries, would further improve the level of EIBF in the country as a whole. These interventions can potentially increase the prevalence of early initiation of breastfeeding and help India attain the neonatal mortality rate target of Sustainable Development Goal 3.

Keywords: Early initiation of breastfeeding; Neonatal mortality; India

Introduction

The under-five mortality rate is considered one of the most sensitive barometers of child well-being, indicating health and nutrition status in early childhood. It is also used as a critical indicator to assess ongoing child health interventions and a country's human development level (Usmani & Ahmad, 2017). India has fixed neonatal and child survival as one of the top priorities under Sustainable Development Goal (SDG) 3, but the latest Sample Registration System (SRS) report shows that the neonatal mortality rate still stands at 23 and under-five mortality at 36 per 1000 live births (United Nations Department of Economic and Social Affairs, 2015; Office of the Registrar General and Census Commissioner (2018) Sample Registration System Statistical Reports, 2018). It clearly shows that the country is far from achieving the goals. One can also easily infer from the recent SRS estimates for childhood mortality that infant deaths constitute nearly 89 per cent of the under-five mortality rate, while neonatal deaths constitute nearly 70 per cent of the total infant deaths at the national level (Sample Registration System Statistical Reports for 2018; Office of the

Registrar General & Census Commissioner, 2018). Hence, decline in the under-five mortality can be efficiently achieved by significantly reducing the neonatal mortality rate.

Previous studies have clearly established that early initiation of breastfeeding reduces the risk of neonatal mortality and also saves the child from chronic diseases (Sen *et al.*, 2020). Studies have also highlighted that breastfeeding initiation within one hour of birth and exclusive breastfeeding in the first six months of life significantly decrease neonatal and under-five mortality (Ballard & Morrow, 2013; Oot *et al.*, 2015). The World Health Organization (WHO) classifies the initiation of breastfeeding of newborns within one hour of birth at the rate of 0–29% as poor, 30–49% as fair, 50–89% as good and 90–100% as very good (WHO, 2003). It also says that while breastfeeding is a natural act, it is also a learned behaviour. Breastmilk contains all the nutrients an infant needs in the first 6 months of life, contributes to the child's immunological defence system and increases its disease resistance. Non-breastfed children in developing countries are six times more likely to die before the age of one month than children who receive at least some breastmilk (WHO, 2013). According to the Pan American Health Organization (PAHO), encouraging appropriate infant feeding practices, such as early initiation of breastfeeding and exclusive breastfeeding for 6 months, is the single most effective preventive intervention for improving the survival and health of children (PAHO, 2011) and is also a key to sustainable development.

Colostrum, which is the first milk produced after birth, is a baby's first immunization. It has high levels of antibodies, vitamin A and other protective constituents and strengthens the child's immune system, reducing the chances of death in the neonatal period (Kroeger, 2003; Edmond *et al.*, 2006). The evidence drawn from a meta-analysis from over 63 developing countries shows that early initiation of breastfeeding prevents infections among newborns and averts death due to sepsis, pneumonia, diarrhoea and hypothermia; besides, it facilitates sustained breastfeeding (Kramer *et al.*, 2001; Jones *et al.*, 2003; Stanley *et al.*, 2007). Early and exclusive breastfeeding is crucial in developing countries where limited access to clean water increases the risk of diarrhoeal disease and respiratory tract infections (Aarts *et al.*, 2000; Mihrshahi *et al.*, 2008).

Provision of mother's breastmilk to an infant within one hour of birth is referred to as 'early initiation of breastfeeding' (EIBF) and ensures that the infant receives the colostrum, or 'first milk'. Initiation of breastfeeding as early as possible has become mandatory in baby-friendly initiatives because it serves multiple purposes for the growing baby, the mother and the entire family (Kamath *et al.*, 2016).

According to a United Nations International Children's Emergency Fund (UNICEF) report, only 41% of newborns are breastfed within one hour of birth in South Asia. Several South Asian countries have some of the worst early initiation breastfeeding practices in the world; the rate is low in Pakistan (29%), India (41%), Bangladesh (45%) and Nepal (47%) (UNICEF, 2014). Patel *et al.* (2013) found that India ranked the lowest in breastfeeding practices among Afghanistan, Bangladesh, India and Sri Lanka, with only 44% of women breastfeeding their babies within one hour of delivery.

Studies have identified various factors that negatively influence the breastfeeding of children in the early hours of life (Patel *et al.*, 2013). These include lack of knowledge among mothers about the health benefits of early breastfeeding (Ochola, 2008; Nguyen & Hawkins, 2013) and inadequate antenatal counselling on breastfeeding (Dhandapany *et al.*, 2008; Blixt *et al.*, 2019; Sehhatie *et al.*, 2020). Clinical trials and quasi-experimental studies have shown that scientifically appropriate advice with high-level sensitivity and support from front-line health workers can significantly improve early initiation of breastfeeding (Blixt *et al.*, 2019; Azimi & Nasiri, 2020; Naroee *et al.*, 2020). Also, an expectant mother should be trained well before childbirth about the right latching technique and the health benefits of early breastfeeding to the mother and child (Kronborg *et al.*, 2015).

Early initiation of breastfeeding has been shown to be associated with the economic status of the family, mother's age, education, occupation, place of residence and health care utilization such as antenatal care (ANC) visits and place of delivery (Xu *et al.*, 2007; Senarath *et al.*, 2010; Agho

Table 1. Neonatal mortality rates in India and its major states, 2014–2018

States	NMR (per 1000 live births)				
	2014	2015	2016	2017	2018
High NMR states					
Bihar	27	28	27	28	25
Chhattisgarh	28	27	26	26	29
Madhya Pradesh	35	34	32	33	35
Odisha	36	35	32	32	31
Rajasthan	32	30	28	27	26
Uttar Pradesh	32	31	30	30	32
Low NMR states					
Andhra Pradesh	26	24	23	23	21
Assam	26	25	23	22	21
Delhi	13	14	12	14	10
Gujarat	24	23	21	21	19
Haryana	23	24	22	21	22
Jammu & Kashmir	26	20	18	17	17
Jharkhand	25	23	21	20	21
Karnataka	20	19	18	18	16
Kerala	6	6	6	5	5
Maharashtra	16	15	13	13	13
Punjab	14	13	13	13	13
Tamil Nadu	14	14	12	11	10
West Bengal	19	18	17	17	16
All India	**26**	**25**	**24**	**23**	**23**

Source: Office of the Registrar General and Census Commissioner (2014–2018): Sample Registration System Reports for 2014, 2015, 2016, 2017 and 2018.

et al., 2011; Tan, 2011). Although breastfeeding is quite widespread in India, considerable differences exist in breastfeeding and weaning practices across states and socioeconomic groups (Sen *et al.*, 2002; Dwivedi, 2010).

In India there are obvious wide disparities in neonatal mortality rates across states, as noted in the latest five SRS reports (Table 1). Of the nineteen major Indian states, Bihar, Chhattisgarh, Madhya Pradesh, Odisha, Rajasthan and Uttar Pradesh have shown much higher neonatal mortality rates (NMR) than the national average for the past several years. Interestingly, all these six states belong to the Empowered Action Group (EAG) of states that lags in multiple socio-demographic, maternal and child health indicators (IIPS & ICF, 2017). There have been consistent efforts under the National Health Mission to improve infant and child survival in states with high infant and child mortality rates. However, none of these six states has been able to reduce their neonatal mortality rates below the national average, at least in the recent past. According to the available literature, early initiation of breastfeeding does have reducing effects on mortality rates in early infancy. Therefore, it becomes imperative to see whether there is a significant difference in the early initiation of breastfeeding and the factors determining it between the states showing

NMR above the national average and the remaining thirteen major states (including the National Capital Territory (NCT) of Delhi). Hereafter, the states showing NMR above the national average may be referred to as 'high NMR states' and the rest as 'low NMR states'. The high NMR states have greater programmatic significance, given that the latest civil registration system report for the year 2018 suggests that they contribute half of the total annual live births in India (Office of the Registrar General, 2018).

Many studies have been carried out to understand the factors associated with the practice and advantages of breastfeeding. However, to the authors' knowledge, no previous study has examined the differentials in the early initiation of breastfeeding and its associated factors segregated by low and high NMR states in the Indian context. The present study formulates a research hypothesis to test whether giving breastfeeding advice regarding EIBF to pregnant women during antenatal care service significantly improves their chances of early initiation of breastfeeding.

Methods

Data

The present study analysed a unit-level dataset of the National Health and Family Survey (NFHS-4) conducted in 2015–16. The Sample Registration System reports from 2014 to 2018 were used to identify low and high NMR states. The NFHS-4 sample was designed to estimate key socio-demographic and health indicators at the district, state and national levels. It successfully interviewed a total of 699,686 eligible women aged 15–49 from 601,509 surveyed households. Data available in the Child data file containing socioeconomic and demographic information on women, and children born to them, in the 5 years prior to the survey date were analysed. The file provides vital information on date of birth, date of death, birth weight, place of delivery, childhood vaccination and health check-ups, initiation and duration of breastfeeding and other characteristics of the children (IIPS & ICF, 2017). The sample for this study was restricted to each woman's most recent surviving child, provided that child was born during the 2 years preceding the survey date, with the aim of minimizing recall lapse among mothers. Thus, the eventual sample of children in the analysis was 43,529 and 41,643 for high and low NMR states, respectively.

Outcome variable

The study outcome variable was 'early initiation of breastfeeding' (EIBF) of the youngest surviving child born to a woman in the 2 years prior to the survey date. In NFHS-4, the following two questions were posed to women who had had at least one live birth since January 2011: 1) Did you ever breastfeed [Name]?; 2) How long after birth did you first put [Name] to the breast? The second question was only canvassed for the last surviving child. The responses were recorded as either 'immediately' or in terms of number of hours/days. The response 'less than one hour' was re-coded as 'immediately'. Hence, early initiation of breastfeeding (EIBF) was defined as a child being put to the breast immediately after birth.

Independent variables

Maternal socio-demographic characteristics and health care seeking behaviours were selected based on the availability of variables in the dataset and their importance to EIBF in the literature (Buckles & Kolka, 2014; Kalisa *et al.*, 2015; Lakew *et al.*, 2015; Singh *et al.*, 2017; Ndirangu *et al.*, 2018). Mother's age at the time of childbirth was grouped as: 15–24 years, 25–34 years and 35–49 years. Place of residence was categorized into rural and urban. Household economic status was measured using wealth quintiles based on the sum of scores on the ownership of household assets and consumer goods, taking into consideration the *de jure* household population: poorest, poorer,

middle wealth, richer and richest. Mother's education level had five categories: non-literate, literate but below primary, primary but below middle, completed middle, and high school and above.

Other variables found to be associated with EIBF in the literature, and therefore included in the analysis, were: sex of the child (male, female); whether a birth was planned ('type of birth') (planned, unplanned); place of delivery (home, health institution); type of delivery (vaginal, Ceasarean); delivery by a trained person (yes, no); mother advised on breastfeeding during pregnancy (yes, no); mother's exposure to mass media (exposed, not exposed); and religion (Hindu, non-Hindu). There variables were all dichotomous in the study. The index child's birth order was divided into three groups:1st order, 2nd–3rd order and 4th + order.

Caste/tribe has significant relevance in the Indian context for any social and health indicator, including EIBF. Under the *varna* system, people are divided into four classes. The lowest rung of this system includes Scheduled Castes/Tribes, who were allowed to do derogatory and scavenging work only. People from these strata lack access to information and health services. The Other Backward Classes (OBC) include those deprived of health services primarily due to social and economic constraints. The 'other' category comprises those not included in any of the above categories.

Statistical analysis

Bivariate and multivariate analyses were performed to examine the practice and determinants of EIBF in low and high NMR groups of states (Table 1). First the prevalence of EIBF at individual state, NMR group and national levels was estimated. Thereafter, the prevalence was estimated by the selected variables separately for low and high NMR states. Finally, the chi-squared test was applied to rule out any association, merely by chance, between the EIBF prevalence and a particular background.

A variance inflation factor (VIF) diagnostic test statistic was applied to assess multicollinearity among the chosen independent variables. Multicollinearity occurs when two or more predictors in the model are highly correlated (that is, when the value of VIF>5; Yoo *et al.*, 2014), and can provide redundant information regarding the effects of an independent variable on the response. The interpretation of the results is often misleading in the presence of high VIF. The VIF of all the study predictors was less than 5 in the low as well as the high NMR group indicating that there was no multicollinearity among the predictors used in the multivariate binary logistics regression analysis to examine their independent effects on EIBF.

Finally, a multivariate logistic regression analysis was conducted to examine each background characteristic's independent influence on EIBF practice separately for high and low NMR states. Adjusted odds ratios (AORs) were generated and tested for statistical significance using *p*-values and 95% confidence intervals (95% CIs). STATA 13.1 (Stata Corp, 2013) was used for all the statistical analyses. In order to take into account the survey design, the *svyset* and *svy* prefix commands available in STATA 13.1 were used (Korn & Graubard, 1990).

Results

Differentials in early initiation of breastfeeding

Table 2 shows a clear demarcation in the early initiation of breastfeeding between high and low NMR states. Only 35% of children born in the 2 years prior to the survey date in high NMR states were put to the breast immediately after birth compared with 52% in low NMR states. The low proportion of children put to the breast immediately after birth in Uttar Pradesh (27%), Rajasthan (29%), Madhya Pradesh (36%) and Bihar (37%) pulled down the overall proportion in the high NMR group of states. In this group, the level of EIBF was found to be highest in Odisha (71%),

Table 2. Prevalence of early initiation of breastfeeding among surveyed children under 2 years in high and low NMR states, India, 2015–16

States	Early initiation of breastfeeding	
	%	*n*
High NMR states		
Bihar	36.7	9104
Chhattisgarh	48.5	3502
Madhya Pradesh	36.0	8753
Odisha	70.6	4074
Rajasthan	29.3	6055
Uttar Pradesh	26.7	14,747
Total	*35.3*	*43,529*
Low NMR states		
Andhra Pradesh	40.7	1147
Assam	69.3	3709
Delhi	31.6	563
Gujarat	51.7	2765
Haryana	44.2	2922
Jammu & Kashmir	50.8	2948
Jharkhand	33.9	4543
Karnataka	64.6	2828
Kerala	64.0	895
Maharashtra	58.9	3366
Punjab	31.6	1914
Tamil Nadu	58.5	2823
West Bengal	49.0	2015
Total	*52.2*	*41,643*
All India	**43.5**	**85,172**

Source: authors' estimates, NFHS-4 (2015–16). State weights were used to get state-level prevalence, but the state-specific samples (*n*) were unweighted. National weights were used to generate group and national-level prevalence and sample (*n*).

followed by Chhattisgarh (49%). On the other hand, the EIBF level varied from 32% each in Punjab and the National Capital Territory (NCT) Delhi to 69% in Assam in the low NMR group.

Socio-demographic and maternal health care situation in high and low NMR settings

Table 3 shows the percentage distribution of newborns across background characteristics that have a direct bearing on early initiation of breastfeeding in the high and low NMR states. The high NMR states had a lower proportion of first order births (33% vs 43%), a higher proportion of home deliveries (24% vs 11%), a lower proportion of Caesarean deliveries (10% vs 27%) and a higher proportion of deliveries not assisted by trained personnel (21% vs 10%) than the low NMR states. Only 35% of mothers received advice on breastfeeding during the last 3 months of pregnancy in the high NMR states compared with nearly half (49%) of mothers in the low NMR states.

Table 3. Percentage distribution of surveyed children under 2 years by background characteristics in high and low NMR states, India, 2015–16

Background characteristics	High NMR states		Low NMR states	
	%	*n*	%	*n*
Birth order of child				
1	32.5	14,147	43.1	17,929
2–3	47.7	20,740	49.9	20,773
4 and above	19.9	8643	7.1	2942
Sex of child				
Male	52.9	23,023	52.0	21,660
Female	47.1	20,506	48.0	19,984
Type of birth				
Planned birth	88.7	38,597	93.2	38,798
Unplanned birth	11.3	4932	6.8	2845
Place of delivery				
Home	23.7	10,301	11.4	4728
Health institution	76.3	33,228	88.7	36,916
Type of delivery				
Vaginal	89.9	39,111	73.5	30,598
Caesarean	10.2	4418	26.5	11,045
Delivery by trained person				
No	21.3	9250	9.9	4128
Yes	78.8	34,279	90.1	37,516
Mother advised on breastfeeding				
No	65.3	28,413	50.8	21,163
Yes	34.7	15,116	49.2	20,481
Mother's age at time of birth				
15–24	49.9	21,722	55.1	22,936
25–34	44.8	19,481	41.7	17,371
35–49	5.3	2,326	3.2	1336
Mother's education				
Non-literate	39.2	17,045	15.6	6494
Literate but below primary	5.5	2394	5.9	2475
Primary but below middle	9.5	4133	6.1	2520
Middle complete	30.1	13,096	45.8	19,082
High school and above	15.8	6860	26.6	11,072
Mother's mass media exposure				
No exposure	38.5	16,746	14.7	6121
Any exposure	61.5	26,783	85.3	35,523

(*Continued*)

Table 3. (*Continued*)

Background characteristics	High NMR states		Low NMR states	
	%	*n*	%	*n*
Religion				
Hindu	84.3	36,695	73.2	30,466
Non-Hindu	15.7	6834	26.8	11,178
Caste/Tribe				
Scheduled Tribe	10.6	4575	10.7	4164
Scheduled Caste	22.2	9581	23.2	9007
Other Backward Class	51.7	22,363	39.6	15,345
Other	15.6	6728	26.5	10,287
Wealth quintile				
Poorest	37.0	16,123	13.3	5517
Poorer	24.3	10,573	19.7	8191
Middle	16.5	7177	23.6	9826
Richer	12.4	5380	23.6	9843
Richest	9.8	4277	19.9	8266
Place of residence				
Urban	18.2	7922	36.5	15,202
Rural	81.8	35,607	63.5	26,441
Total	100	43,529	100	41,643

Source: authors' estimates, NFHS-4 (2015–16). Sample and percentage distributions generated using national weights.

The proportion of mothers not exposed to any kind of mass media was higher (39%) in the high NMR states than the low NMR states (15%). Other unfavourable background characteristics of newborns in the high NMR group included: belonging to rural areas (82%), belonging to the poorest wealth quintile (37%) and born to non-literate mothers (39%); the corresponding figures for newborns in the low NMR group were 64%, 13% and 16%.

Factors associated with early initiation of breastfeeding

Table 4 shows the prevalence of early initiation of breastfeeding by socio-demographic, economic and maternal care characteristics separately for low and high NMR states. Early initiation of breastfeeding was much higher for low NMR states than high NMR states across all the selected characteristics. The chi-squared test indicated that most of selected characteristics were significantly associated with early initiation of breastfeeding, except for mother's age at birth and caste/tribe in the low NMR group of states and sex of child in both groups.

In the high NMR group, breastfeeding initiation immediately after birth was least common (22%) among children whose mothers underwent a Caesarean section (C-section). Early initiation of breastfeeding was relatively high among children whose mothers were advised on breastfeeding during ANC visits or those who belonged to Scheduled Tribes (42% each). In the case of the low NMR group, the highest proportion of early initiation of breastfeeding (57%) was observed among children whose mother had a vaginal (normal) delivery, whereas the lowest proportion was among

Table 4. Estimated level of early initiation of breastfeeding among surveyed children under 2 years by background characteristics in high and low NMR states, India, 2015–16

Background characteristics	Early initiation of breastfeeding (%)					
	High NMR states			Low NMR states		
	%	95% CI	χ^2	%	95% CI	χ^2
Birth order of child						
1	33.9	[33.1–34.7]	34.763 $p<0.001$	50.3	[49.6–51.0]	24.388 $p<0.001$
2–3	36.8	[36.1–37.5]		53.6	[52.9–54.3]	
4 and above	34.2	[33.2–35.2]		54.1	[52.2–55.9]	
Sex of child						
Male	35.4	[34.8–36.0]	0.5305 $p=$ns	52.4	[51.7–53.1]	1.986 $p=$ns
Female	35.2	[34.6–35.9]		52.0	[51.3–52.7]	
Type of birth						
Planned birth	35.7	[35.2–36.2]	25.962 $p<0.001$	52.5	[52.0–53.0]	11.198 $p<0.001$
Unplanned birth	32.7	[31.4–34.0]		48.2	[46.3–50.1]	
Place of delivery						
Home	29.8	[28.9–30.7]	193.069 $p<0.001$	48.7	[47.3–50.2]	31.911 $p<0.001$
Health institution	37.1	[36.5–37.6]		52.7	[52.2–53.2]	
Type of delivery						
Vaginal	36.8	[36.2–37.3]	354.806 $p<0.001$	56.5	[47.3–50.4]	455.484 $p<0.001$
Caesarean	22.4	[21.1–23.6]		40.3	[52.1–53.1]	
Delivery by trained person						
No	29.6	[28.7–30.6]	188.045 $p<0.001$	48.9	[56.0–57.1]	20.424 $p<0.001$
Yes	36.9	[36.4–37.4]		52.6	[39.3–41.2]	
Mother advised on breastfeeding						
No	32.0	[31.5–32.6]	629.52 $p<0.001$	50.9	[50.2–51.6]	38.803 $p<0.001$
Yes	41.5	[40.7–42.3]		53.5	[52.8–54.2]	
Mother's age at time of birth						
15–24	35.0	[34.3–35.6]	10.601 $p<0.01$	52.7	[52.0–53.4]	0.786 $p=$ns
25–34	36.1	[35.5–36.8]		51.9	[51.1–52.7]	
35–49	32.2	[30.3–34.2]		48.2	[45.5–51.0]	
Mother's education						
Non-literate	34.4	[33.7–35.2]	113.643 $p<0.001$	49.2	[47.9–50.4]	52.005 $p<0.001$
Literate but below primary	36.9	[35.0–38.9]		51.8	[49.8–53.8]	
Primary but below middle	33.9	[32.4–35.3]		52.3	[50.3–54.3]	
Middle complete	38.1	[37.3–39.0]		54.4	[53.7–55.1]	
High school and above	32.6	[31.4–33.7]		50.3	[49.4–51.3]	
Mother's mass media exposure						
No exposure	34.8	[34.0–35.5]	8.2320 $p<0.01$	51.9	[50.7–53.2]	7.892 $p<0.01$
Any exposure	35.7	[35.1–36.3]		52.3	[51.7–52.8]	

(*Continued*)

Table 4. (*Continued*)

Background characteristics	Early initiation of breastfeeding (%)					
	High NMR states			Low NMR states		
	%	95% CI	χ^2	%	95% CI	χ^2
Religion						
Hindu	36.3	[35.8–36.8]	113.722	52.4	[51.8–52.9]	9.215
Non-Hindu	30.4	[29.3–31.5]	$p<0.001$	51.9	[50.9–52.8]	$p<0.01$
Caste/Tribe						
Scheduled Tribe	41.5	[40.0–42.9]	201.926	53.2	[51.6–54.7]	6.475
Scheduled Caste	35.3	[34.3–36.3]	$p<0.001$	52.3	[51.3–53.3]	$p=$ns
Other Backward Class	34.9	[34.3–35.6]		52.5	[51.7–53.3]	
Other	32.3	[31.2–33.4]		50.2	[49.2–51.2]	
Wealth quintile						
Poorest	36.9	[36.2–37.7]	161.209	52.6	[51.2–53.9]	144.664
Poorer	37.1	[36.2–38.0]	$p<0.001$	53.3	[52.2–54.4]	$p<0.001$
Middle	35.0	[33.9–36.1]		53.6	[52.5–54.5]	
Richer	32.1	[30.9–33.4]		53.9	[52.9–54.9]	
Richest	29.7	[28.3–31.1]		47.4	[46.3–48.5]	
Place of residence						
Urban	32.3	[31.3–33.4]	51.835	52.0	[51.2–52.9]	12.488
Rural	36.0	[35.5–36.5]	$p<0.001$	52.3	[51.7–52.9]	$p<0.001$
Total	35.3	[34.7–36.0]		52.2	[51.3–53.1]	

Source: authors' estimates, NFHS-4 (2015–16); ns=not significant.

those who underwent a C-section (40%). The level of EIBF was also low among children belonging to the richest wealth quintile (47%), followed by those born of an unplanned pregnancy (48%).

Two factors – type of delivery and advice on breastfeeding during ANC visits – showed significant difference with respect to the reference group in the low as well as the high NMR groups (16 and 15 percentage points respectively), but the latter created a stronger difference in the prevalence of EIBF (10 percentage points) in the high NMR group than in the low NMR group (3 percentage points). Interestingly, no rural–urban and religious differentials appeared in the proportion of children put to the breast immediately after birth in the low NMR group, whereas rural and Hindu children had an advantage over their counterparts by 4 and 6 percentage points, respectively, in the high NMR group.

Determinants of early initiation of breastfeeding in low and high NMR settings

Table 5 illustrates the results of the logistic regression analysis, predicting the adjusted odds ratios (AOR) of immediate initiation of breastfeeding. Type of delivery (vaginal/Caesarean) and place of delivery (home/institution) had large independent effects on EIBF in both NMR groups of states. Caesarean section delivery, compared with vaginal delivery, reduced the odds of EIBF by half (AOR=0.475, 95% CI=0.439–0.514 in the high NMR group; AOR=0.494, 95% CI=0.470–0.519 in the low NMR group). Children born in health institutions had significantly higher adjusted odds of early breastfeeding than those born at home: 30% (AOR=1.297;

Table 5. Adjusted odds ratios (AOR) for early initiation of breastfeeding among surveyed children under 2 years in high and low NMR states, India, 2015–16

Background characteristics	High NMR states			Low NMR states		
	AOR	*p*-value	95 % CI	AOR	*p*-value	95 % CI
Birth order of child						
1 (Ref.)						
2–3	1.118	<0.001	[1.063–1.176]	1.147	<0.001	[1.096–1.201]
4 and above	1.039	ns	[0.963–1.12]	1.21	<0.001	[1.097–1.334]
Sex of child						
Male (Ref.)						
Female	0.996	ns	[0.957–1.037]	0.97	ns	[0.931–1.011]
Type of birth						
Planned birth (Ref.)						
Unplanned birth	0.879	<0.001	[0.823–0.939]	0.826	<0.001	[0.758–0.899]
Place of delivery						
Home (Ref.)						
Health institution	1.297	<0.001	[1.193–1.41]	1.412	<0.001	[1.28–1.558]
Type of delivery						
Vaginal (Ref.)						
Caesarean	0.475	<0.001	[0.439–0.514]	0.494	<0.001	[0.47–0.519]
Delivery by trained person						
No (Ref.)						
Yes	1.176	<0.001	[1.078–1.282]	1.029	ns	[0.931–1.138]
Mother advised on breastfeeding						
No (Ref.)						
Yes	1.410	<0.001	[1.351–1.471]	1.117	<0.001	[1.071–1.166]
Mother's age at time of birth						
15–24 (Ref.)						
25–34	1.107	<0.001	[1.054–1.162]	1.007	ns	[0.961–1.054]
35–49	1.018	ns	[0.916–1.131]	0.935	ns	[0.824–1.061]
Mother's education						
Non-literate (Ref.)						
Literate but below primary	1.079	ns	[0.984–1.183]	1.122	<0.05	[1.015–1.241]
Primary but below middle	0.961	ns	[0.891–1.037]	1.195	<0.001	[1.081–1.321]
Middle complete	1.189	<0.001	[1.123–1.258]	1.333	<0.001	[1.245–1.426]
High school and above	1.090	<0.05	[1.01–1.177]	1.311	<0.001	[1.21–1.421]
Mother's mass media exposure						
No exposure (Ref.)						
Any exposure	1.086	<0.01	[1.031–1.143]	1.029	ns	[0.958–1.106]

(*Continued*)

Table 5. (*Continued*)

Background characteristics	High NMR states			Low NMR states		
	AOR	*p*-value	95 % CI	AOR	*p*-value	95 % CI
Religion						
Hindu (Ref.)						
Other	0.876	<0.001	[0.824–0.932]	0.937	<0.05	[0.891–0.985]
Caste/Tribe						
Scheduled Tribe (Ref.)						
Scheduled Caste	0.826	<0.001	[0.767–0.89]	1.053	ns	[0.974–1.138]
Other Backward Class	0.867	<0.001	[0.809–0.929]	1.048	ns	[0.992–1.107]
Other	0.855	<0.001	[0.785–0.932]	0.985	ns	[0.927–1.046]
Wealth quintile						
Poorest (Ref.)						
Poorer	0.923	<0.01	[0.873–0.976]	0.959	ns	[0.886–1.038]
Middle	0.815	<0.001	[0.761–0.873]	0.974	ns	[0.897–1.058]
Richer	0.731	<0.001	[0.673–0.794]	0.967	ns	[0.885–1.056]
Richest	0.680	<0.001	[0.615–0.753]	0.77	<0.001	[0.698–0.849]
Place of residence						
Urban (Ref.)						
Rural	0.962	ns	[0.903–1.024]	0.864	<0.001	[0.823–0.907]
Constant	0.413	<0.001	[0.371–0.461]	0.768	<0.001	[0.682–0.864]

Source: authors' estimates, NFHS-4 (2015–16).
Ref.=reference category; AOR=Adjusted Odds Ratio; ns=not significant.

95% CI=1.193–1.410) in the high NMR group and 41% (AOR=1.412; 95% CI=1.280–1.558) in the low NMR group.

Newborns born to mothers who had received advice on breastfeeding from frontline health workers during the last trimester of pregnancy had 1.4 times (AOR=1.410; 95% CI=1.351–1.471) and 1.2 times (AOR=1.117; 95% CI=1.071–1.166) higher odds of having EIBF in the high and the low NMR groups respectively. In both groups of states, children born of an unplanned pregnancy had at least a 12% lower chance of EIBF than those born of a planned pregnancy. Births of orders 2–3 had 12–15% higher odds of being breastfed early than did first births.

In the case of the high NMR group, two other potential programme variables, namely the type of person who performed the delivery and mother's mass media exposure, had a considerable influence on EIBF, with 18% (AOR=1.176; 95% CI=1.078–1.282) and 9% (AOR=1.086; 95% CI=1.031–1.143) higher odds, respectively, compared with their counterparts in the reference group. In the high NMR settings, children born to mothers aged 25–34 years had 11% higher odds (AOR=1.107; 95% CI=1.054–1.162) of being breastfed early than did children born to mothers aged 15–24 years.

Mother's educational attainment and household wealth quintile were two cogent socioeconomic characteristics associated with early initiation of breastfeeding. Mothers who had completed middle level of schooling yielded the maximum independent influence on EIBF in both NMR settings (AOR=1.189, 95% CI=1.113–1.258; and AOR=1.333, 95% CI=1.1245–1.426, in

the high and low NMR groups, respectively). On the other hand, the adjusted odds of EIBF decreased significantly with increasing household wealth quintile, as seen from the AOR being only 0.68 times that of the poorest quintile for the richest quintile in the high NMR group. In the case of the low NMR group, children born in the richest households had significantly lower odds of receiving EIBF (AOR=0.770; 95% CI=0.698–0.849) than their counterparts from the poorest households.

In both groups of states, non-Hindu children had more disadvantages in EIBF compared with Hindu children, and more so in the high NMR group (AOR=0.876; 95% CI=0.824–0.932). Caste/tribe background of a newborn played a significantly role in being breastfed early in the high NMR group but not in the low NMR group. Babies born to all other caste groups had significantly lower odds of EIBF than babies born in Scheduled Tribes. In contrast, in the low NMR group, a rural newborn had 14% lower odds of having EIBF (AOR=0.864; 95% CI=0.823–0.907) compared with its urban counterparts.

Discussion

This study highlights that the practice of breastfeeding immediately after birth is low in India, irrespective of an area's NMR level. The estimates of prevalence of EIBF in 2015–16 indicate that only 44% of children received breastmilk immediately after birth, which is similar to the rates documented for India in the past (Patel *et al.*, 2013; UNICEF, 2014). India as a whole lags behind Bangladesh (45%) and Nepal (47%) in early initiation of breastfeeding, and rates are dismally low (35%) in states with high NMR levels. The burgeoning literature on the linkages between early initiation of breastfeeding and newborn survival and well-being (Horta *et al.*, 2013; Radmcher & Adamkin, 2017) suggests that it is imperative for these states to improve their levels of early initiation of breastfeeding. Some states in the low NMR group, namely NCT Delhi, Punjab, Jharkhand, Andhra Pradesh and Haryana, also need to make substantial improvements in EIBF. The findings indicate that further research is needed in the case of Odisha, where neonatal mortality is high despite a relatively high level of early initiation of breastfeeding (71%). Here, other factors could affect neonatal mortality, such as cord care, birth defects, environmental and sanitation factors, treatment-seeking in the case of acute respiratory and diarrhoeal infections and availability of quality emergency newborn care services (Yadav *et al.*, 2020).

The study analysis revealed that having a C-section delivery and receiving advice on breastfeeding during pregnancy had the largest independent effects on the odds of early initiation of breastfeeding across all backgrounds in high and low NMR settings. However, these two factors differed in the direction of their effects, the former suppressing the chance of EIBF significantly, and the latter improving it with equal intensity. Some previous studies have documented the unnecessary and unethical practice of C-section and its huge out-of-pocket burden on families in India and neighbouring developing countries (Mohanty & Srivastava, 2013; Joshi *et al.*, 2014). The present study suggests that the unnecessary use of C-section delivery negatively impacts early initiation of breastfeeding. A C-section delivery may make a child more susceptible to life-threatening infections, especially when the delivery takes place in poor hygienic conditions and without basic health infrastructure (Hanson & Korotkova, 2002; Patel *et al.*, 2013; Buckles & Kolka, 2014; Ekubay *et al.*, 2018). However, the widespread practice of prescribing formula milk for neonates is not only limited to C-section deliveries but is also common in the case of normal deliveries in for-profit private institutions (Karim *et al.*, 2018). A recent study conducted using Ethiopian Demographic and Health Survey data found that the odds of EIBF were significantly lower (AOR=0.10; 95% CI=0.06–0.15) in the case of normal deliveries compared with C-section deliveries in Ethiopia (Woldeamanuel, 2020).

The hypothesis that mother receiving advice on breastfeeding during the last trimester of the pregnancy has a significant effect on the early initiation of breastfeeding was confirmed by the

results of this study. That providing counselling or support to mothers makes a positive change in their breastfeeding behaviour has been found to be true in both developing and developed country settings in separate clinical trials (Dhandapany *et al.*, 2008; Blixt *et al.*, 2019; Sehhatie *et al.*, 2020). Hence, improvements in the proportion of mothers advised on breastfeeding during ANC visits in India from the current one-third to the entire pregnant women's cohort could substantially increase early breastfeeding initiation, particularly in high NMR settings.

Recent literature cites breastfeeding pain, perception of lack of sufficient milk, inappropriate latching and the child's inability to suckle as prominent barriers to the early initiation of breast-feeding in India (Wagner *et al.*, 2013; Kronborg, *et al.*, 2015; Naroee *et al.*, 2020). India's pro-gramme managers at the local level should first assess the need for counselling and build the capacity of frontline workers to offer high-quality counselling and support to women on early initiation and exclusive breastfeeding. This study also indicated that first-time mothers need additional support to encourage them to start breastfeeding early. Programmes aimed at increasing the prevalence of EIBF among mothers should aim to promote colostrum intake and 6-month exclusive breastfeeding and discourage the use of formula milk. Nulliparous pregnant women require special attention because the odds of putting the child to the breast immediately after birth were lower among primiparous mothers than others in both NMR settings. Other studies have made similar observations (Kronborg *et al.*, 2015; Woldeamanuel, 2020).

Another significant finding of this study was that women who had non-institutional deliveries had higher odds of delaying breastfeeding compared with those who had institutional deliveries – 30% higher in the high NMR group and 41% higher in the low NMR group. Other studies have also found that institutional delivery has a positive and independent effect on early initiation of breastfeeding (Edmond *et al.*, 2006; Senarath *et al.*, 2007). This study also shows that delivery by a trained person can also improve EIBF by 18% in high NMR settings. Therefore, achieving universalization of institutional and trained person assisted delivery, especially in high NMR states, is expected to yield higher returns on EIBF.

Son preference is a long-standing social and public health issue in India. Prior studies have documented that son preference remains instrumental in childhood mortality and fertility preferences, and varies in intensity across the country (Arnold, 2008; Ahmed & Ray, 2014). However, neither of the NMR groups in this study showed any sex difference in EIBF. This finding is supported by a previous Indian study, which found no sex difference in colostrum breastfeeding too (Dwivedi, 2010). Furthermore, the present study indicated that the children of unplanned births had 13–17% less chance of being put to the breast early compared with those of planned pregnancies in both NMR groups. Unplanned births have a high risk of early death, and a plausible pathway for this could be the delayed initiation of breastfeeding.

Mother's education did not predict a clear trend of effects on EIBF in the high NMR group but there was a general effect of increasing education being associated with a higher odds of EIBF. It could be because the proportion of no or low educational attainment among women aged 15–49 years was much higher (54%) in the former than the latter group (28%). Therefore, this study hints that a minimum educational attainment of up to middle level is needed to enhance mothers' self-efficacy in early initiation of breastfeeding and to help them realize its advantages for the child's as well as their own health (Amstrong & Reilly, 2002; Chudasam *et al.*, 2009; Lamberti *et al.*, 2011). In the absence of such a threshold, increasing the proportion of women exposed to mass media from 39% to universal exposure could greatly help build the required capacity to avoid the delay in early initiation of breastmilk, particularly in the high NMR group.

The study also found that household wealth was significantly associated with putting children to the breast early. The probability of early breastfeeding initiation decreased as households moved from the poorest to the richest quintile in the high NMR group and from the richer to the richest quintile in the low NMR group. This pattern may be related to the availability of alternative food and formula food to well-off children and the type of advice and counselling received by mothers from health providers. The myth of body disfiguration after breastfeeding among economically more

prosperous women may also be a reason (Joshi *et al.*, 2014; Ogbo *et al.*, 2019). Previous studies have also shown an association between household economic status and breastfeeding practices in India and Bangladesh (Dwivedi, 2010; Joshi *et al.*, 2014). The higher EIBF among the poorer households could also be due to their exposure to the government-run Integrated Child Development Scheme (ICDS), aimed at poor women, predominantly those in rural areas, to promote safe motherhood and child survival. With their participation in the ICDS, poor mothers may be taking full advantage of the scheme in the absence of their own resources (Tiwari *et al.*, 2009).

Place of residence of mothers was only associated with early initiation of breastfeeding in the low NMR group of states, but the positive independent effects of urbanization (14%) on early initiation of breastfeeding were not in the same direction as found by Woldeamanuel (2020) in Ethiopia (29% lower in the urban area).

Non-Hindu children and children other than those from Scheduled Tribes in the high NMR groups were significantly more likely to be deprived of early breastfeeding. In the case of religion, a particularly large sect of the Hindu religion portrays mother–child affection and bonding through pictures and religious folkloric stories of the mother breastfeeding the newborn child. It is likely that there is less stigma and inhibition associated with breastfeeding among Hindus, which may be one of the reasons behind their higher odds of early breastfeeding initiation. Tribal children have traditionally had an edge over others in initiating early breastfeeding, perhaps due to the unavailability of alternative food to young children in tribal communities. However, Khedkar (2020) found that in the Korku tribe of Madhya Pradesh a newborn child is culturally put to the breast after two days of birth and in the first two days of life only cow's buttermilk is applied to child's lips.

This study infers that higher levels of early breastfeeding initiation in India could be achieved by tweaking current maternal and child health care programmes and their promotional strategies. States with high NMR should be given priority as early initiation of breastfeeding is directly linked with child survival, especially as 40% of all neonatal deaths occur on the first day of life and 56% during the first 3 days (ICMR Young Infant Study Group, 2008). Achieving universal early initiation of breastfeeding could be one of the most cost-effective ways of achieving SDG-3 at the national and sub-national levels in India.

The study's core strength is the generalizability of its findings as it used nationally representative population-based survey data. To the author's knowledge, this is the first study to assess the potential determinants of early initiation of breastfeeding in low and high NMR settings in India. The study findings could help programme managers at the national level to identify unique and common priorities of the states to improve EIBF according to their neonatal mortality situation. The study shows that minor tweaks to ongoing maternal and child health care programme strategies could significantly improve early breastfeeding initiation irrespective of the neonatal mortality status of a state. However, the study had its limitations. First, the study filtered children born in the 2 years prior to the survey in order to avoid recall lapses among mothers. However, some women might not have accurately reported when the child was first time put to the breast. Secondly, in general, large-scale household surveys only collect information for children surviving on the day of the survey, which poses a challenge of self-selection bias in studying factors affecting early initiation of breastfeeding, especially in the high NMR settings.

In conclusion, this study has established that early initiation of breastfeeding is found to be low in India as a whole, and that there was a wide gap between low and the high NMR settings. It also suggests that early breastfeeding initiation can be improved significantly by ensuring access to quality counselling and support on breastfeeding to all women and enhancing mass media exposure, especially to non- or less-literate women. There should be a focused strategy to improve early breastfeeding among women who have Caesarean sections. Furthermore, especially high NMR states should focus on increasing institutional and skilled personnel assisted deliveries, and exposure to mass media messaging on the health benefits of early initiation of breastfeeding to mother and child. The Pradhan Mantri Surakshit Matritva Abhiyan (PMSMA) – a health programme launched by the Government of India in 2016 – aims to assure free-of-cost comprehensive

and quality antenatal care to all pregnant women on the 9th of every month. This study recommends including an extensive session on the necessity of the early initiation of breastfeeding during women's monthly PMSMA visits to health facilities. This will significantly increase the chance of early initiation of breastfeeding, and therefore child health and survival, in India. Finally, this study recommends that national schemes like the ICDS and India's Reproductive, Maternal, Newborn, Child and Adolescent (RMNCH+A) health strategy should urgently redesign their priorities on the early initiation of breastfeeding in laggard states.

References

Aarts C, Kylberg E, Hörnell A, Hofvander Y, Gebre-Medhin M and Greiner T (2000) How exclusive is exclusive breastfeeding? A comparison of data since birth with current status data. *International Journal of Epidemiology* **29**(6), 1041–1046.

Agho KE, Dibley MJ, Odiase JI and Ogbonmwan SM (2011) Determinants of exclusive breastfeeding in Nigeria. *BMC Pregnancy and Childbirth* **11**, 2–10.

Ahmed S and Ray R (2014) Determinants of pregnancy and induced and spontaneous abortion in a jointly determined framework: evidence from a country-wide, district-level household survey in India. *Journal of Biosocial Science* **46**(4), 480–517.

Armstrong J and Reilly JJ (2002) Breastfeeding and lowering the risk of childhood obesity. *The Lancet Series* **359**(9322), 2003–2004.

Arnold LD (2008) US health policy and access to banked donor human milk. *Breastfeeding Medicine* **3**(4), 221–229.

Azimi N and Nasiri A (2020) The effect of peer counseling on breastfeeding behavior of primiparous mothers: a randomized controlled field trial. *Public Health Nursing* **37**(3), 446–452.

Ballard O and Morrow AL (2013) Human milk composition: nutrients and bioactive factors. *Pediatric Clinics* **60**(1), 49–74.

Blixt I, Johansson M, Hildingsson I, Papoutsi Z and Rubertsson C (2019) Women's advice to healthcare professionals regarding breastfeeding: "offer sensitive individualized breastfeeding support" – an interview study. *International Breastfeeding Journal* **14**(1), 51.

Buckles K and Kolka S (2014) Prenatal investments, breastfeeding, and birth order. *Social Science & Medicine* **118**, 66–70.

Chudasama RK, Patel PC and Kavishwar AB (2009) Determinants of exclusive breastfeeding in south Gujarat region of India. *Journal of Clinical Medicine Research* **1**(2), 102–108.

Dhandapany G, Bethou A, Arunagirinathan A and Ananthakrishnan S (2008) Antenatal counseling on breastfeeding-is it adequate? A descriptive study from Pondicherry, India. *International Breastfeeding Journal* **3**(5), doi.org/10.1186/1746-4358-3-5.

Dwivedi LK (2010) Breastfeeding and its demographic and health implications in India. PhD Dissertation, International Institute for Population Sciences, Mumbai.

Edmond KM, Zandoh C, Quigley MA, Amenga-Etego S, Owusu-Agyei S and Kirkwood BR (2006) Delayed breastfeeding initiation increases risk of neonatal mortality. *Pediatrics* **117**(3), e380–e386.

Ekubay M, Berhe A and Yisma E (2018) Initiation of breastfeeding within one hour of birth among mothers with infants younger than or equal to 6 months of age attending public health institutions in Addis Ababa, Ethiopia. *International Breastfeeding Journal* **13**(1), 4.

Hanson LÅ and Korotkova M (2002) The role of breastfeeding in prevention of neonatal infection. *Seminars in Neonatology* **7**(4), 275–281.

Horta BL, Victora CG and World Health Organization (2013) *Short-Term Effects of Breastfeeding: A Systematic Review on the Benefits of Breastfeeding on Diarrhoea and Pneumonia Mortality*. World Health Organization, Geneva. URL: https://www.who.int/maternal_child_adolescent/documents/breastfeeding_short_term_effects/en/ (accessed 12th November 2020).

ICMR Young Infant Study Group (2008) Age profile of neonatal deaths. *Indian Pediatrics* **45**(12), 991–994.

IIPS and ICF (2017) *National Family Health Survey (NFHS-4), 2015–16*. International Institute for Population Sciences, Mumbai India.

Jones G, Steketee RW, Black RE, Butta ZA, Morris SS and **Bellagio Child Survival Study Group** (2003) How many child deaths can we prevent this year? *The Lancet* **362**(9377), 65–71.

Joshi PC, Angdembe MR, Dae SK, Ahmed S, Faruque AR and Ahmed T (2014) Prevalence of exclusive breastfeeding and associated factors among mothers in rural Bangladesh: a cross-sectional study. *International Breastfeeding Journal* 9, 4358-9-7.

Kalisa R, Malande O, Nankunda J and Tumwine JK (2015) Magnitude and factors associated with delayed initiation of breastfeeding among mothers who deliver in Mulago hospital, Uganda. *African Health Sciences* **15**(4), 1130–1135.

Kamath SP, Garg D, Khan M, Jain A and Baliga BS (2016) Perceptions and practices regarding breastfeeding among post-natal women at a District Tertiary Referral Government Hospital in Southern India. *Scientifica*, doi: 10.1155/2016/5430164.

Karim F, Billah SM, Chowdhury MAK, Zaka N, Manu A, Arifeen SE and Khan ANS (2018) Initiation of breastfeeding within one hour of birth and its determinants among normal vaginal deliveries at primary and secondary health facilities in Bangladesh: a case-observation study. *PloS One* **13**(8), e0202508.

Khedkar Ashwini (2020) Modern education, sociocultural change and development among Korku tribe of Burhanpur with special reference to Khaknar clock, Madhya Pradesh. PhD thesis, Tata Institute of Social Sciences, Mumbai, India.

Korn EL and Graubard BI (1990) Simultaneous testing of regression coefficients with complex survey data: use of Bonferroni *t* statistics. *The American Statistician* **44**(4), 270–276.

Kramer MS, Chalmers B, Hodnett ED, Sevkovskaya Z, Dzikovich I, Shapiro S and Shishko G (2001) Promotion of Breastfeeding Intervention Trial (PROBIT): a randomized trial in the Republic of Belarus. *JAMA* **285**(4), 413–420.

Kroeger M (2003) *Facts for Feeding: Birth, Initiation of Breastfeeding, and the First Seven Days After Birth. LINKAGES project*, Academy for Educational Development. URL: www.linkagesproject.org.

Kronborg H, Harder I and Hall EOC (2015) First time mothers' experiences of breastfeeding their newborn. *Sexual & Reproductive Healthcare* **6**(2), 82–87.

Lakew Y, Tabar L and Haile D (2015) Socio-medical determinants of timely breastfeeding initiation in Ethiopia: evidence from the 2011 nation-wide Demographic and Health Survey. *International Breastfeeding Journal* **10**(1), 24.

Lamberti LM, Walker CLF, Noiman A, Victora C and Black RE (2011) Breastfeeding and the risk for diarrhea morbidity and mortality. *BMC Public Health* **11**(3), 1–12.

Mihrshahi S, Oddy WH, Peat JK and Kabir I (2008) Association between infant feeding patterns and diarrhoeal and respiratory illness: a cohort study in Chittagong, Bangladesh. *International Breastfeeding Journal* 3(28), doi: 10.1186/1746-4358-3-28.

Mohanty SK and Srivastava A (2013) Out-of-pocket expenditure on institutional delivery in India. *Health Policy and Planning* **28**(3), 247–262.

Naroee H, Rakhshkhorshid M, Shakiba M and Navidian A (2020) The effect of motivational interviewing on self-efficacy and continuation of exclusive breastfeeding rates: a quasi-experimental study. *Breastfeeding Medicine* **15**(8), 522–527.

Ndirangu MN, Gatimu SM, Mwinyi HM and Kibiwott DC (2018) Trends and factors associated with early initiation of breastfeeding in Namibia: analysis of the demographic and health surveys 2000–2013. *BMC Pregnancy and Childbirth* **18**(1), 171.

Nguyen TT and Hawkins SS (2013) Current state of US breastfeeding laws. *Maternal & Child Nutrition* **9**(3), 350–358.

Ochola SA (2008) Evaluation of two counseling strategies improving exclusive breastfeeding among HIV-negative mothers in Kibera Slum, Nairobi, Kenya: a randomized controlled trial. Doctoral dissertation, Stellenbosch Universit, Stellenbosch.

Office of the Registrar General (2018) *Vital Statistics of India Based on the Civil Registration System 2018*. Ministry of Home Affairs, Government of India, New Delhi.

Office of the Registrar General and Census Commissioner (2014–2018) *Sample Registration System Statistical Reports for 2014, 2015, 2016, 2017 and 2018*. Ministry of Home Affairs, Government of India, New Delhi.

Ogbo FA, Dhami MV, Awosemo AO, Olusanya BO, Olusanya J, Osuagwu UL et al. (2019) Regional prevalence and determinants of exclusive breastfeeding in India. *International Breastfeed Journal* **14**(20), doi. 10.1186/s13006-019-0214-0.

Oot L, Sommerfelt A, Sethuraman K and Ross J (2015) *Estimating the Effect of Suboptimal Breastfeeding Practices on Child Mortality: A Model in Profiles for Country-Level Advocacy*. FHI 360, Washington, DC.

PAHO (2011) *Early Initiation of Breastfeeding: The Key to Survival and Beyond*. Pan American Health Organization.

Patel A, Banerjee A and Kaletwad A (2013) Factors associated with prelacteal feeding and timely initiation of breastfeeding in hospital-delivered infants in India. *Journal of Human Lactation* **29**(4), 572–578.

Radmacher PG and Adamkin DH (2017) Fortification of human milk for preterm infants. *Seminars in Fetal and Neonatal Medicine* **22**(1), 30–35.

Sehhatie FS, Mirghafourvand M and Havizari S (2020) Effect of prenatal counseling on exclusive breastfeeding frequency and infant weight gain in mothers with previous unsuccessful breastfeeding: a randomized controlled clinical trial. *Journal of Maternal-Fetal & Neonatal Medicine* **33**(21), 3571–3578.

Sen G, George A and Stalin P (eds) (2002) *Engendering International Health: The Challenge of Equity*. Cambridge MA:MIT Press.

Sen KK, Mallick TS and Bari W (2020) Gender inequality in early initiation of breastfeeding in Bangladesh: a trend analysis. *International Breastfeeding Journal* **15**(1), 1–11.

Senarath U, Dibley MJ and Agho KE (2010) Factors associated with nonexclusive breastfeeding in five East and Southeast Asian countries: a multilevel analysis. *Journal of Human Lactation* **26**(3), 248–257.

Senarath U, Fernando DN and Rodrigo I (2007) Newborn care practices at home: effect of a hospital-based intervention in Sri Lanka. *Journal of Tropical Pediatrics* **53**(2), 113–118.

Singh K, Khan SM, Carvajal-Aguirre L, Brodish P, Amouzou A and Moran A (2017) The importance of skin-to-skin contact for early initiation of breastfeeding in Nigeria and Bangladesh. *Journal of Global Health* **7**(2), doi: 10.7189/jogh.07.020505.

Stanley L, Mei C, Gowri R, Priscilla C, Maqula N, Deirdre D and Joseph L (2007) *Breastfeeding and Maternal and Infant Health Outcomes in Developed Countries*. AHRQ Publication No. 07-E007, Rockville.

StataCorp (2013) *Stata Statistical Software: Release 13*. StataCorp LP, College Station, TX.

Tan KL (2011) Factors associated with exclusive breastfeeding among infants under six months of age in peninsular Malaysia. *International Breastfeed Journal* **6**(1), 210.

Tiwari R, Mahajan PC and Lahariya C (2009) The determinants of exclusive breast feeding in urban slums: a community-based study. *Journal of Tropical Pediatric* **55**(1), 49–54

UNICEF (2014) *State of the World's Children 2014: Every Child Counts*. United Nations International Children Emergency Fund (UNICEF), New York.

United Nations Department of Economic and Social Affairs (2015) *Transforming our World: The 2030 Agenda for Sustainable Development*. United Nations, New York.

Usmani G and Ahmad N (2017) Health status of children in India. *Journal of Preoperative and Critical Intensive Care Nursing* 3(1), doi: 10.4172/2471-9870.1000138.

Wagner EA, Chantry CJ, Dewey KG and Nommsen-Rivers LA (2013) Breastfeeding concerns at 3 and 7 days postpartum and feeding status at 2 months. *Pediatrics* **132**(4), e865–e875.

Woldeamanuel BT (2020) Trends and factors associated to early initiation of breastfeeding, exclusive breastfeeding and duration of breastfeeding in Ethiopia: evidence from the Ethiopia Demographic and Health Survey 2016. *International Breastfeeding Journal* **15**(1), 1–13.

WHO (2003) *Infant and Young Child Feeding: A Tool for Assessing National Practices, Policies and Programmes*. World Health Organization, Geneva. URL: https://www.who.int/nutrition/publications/infantfeeding/9241562544/en/ (accessed 17th November 2020).

WHO (2013) *Strategic Directions for Improving the Health and Development of Children and Adolescents*, Department of Child and Adolescent Health and Development, World Health Organization, Geneva.

Xu F, Binns C, Zheng S, Wang Y, Zhao Y and Lee A (2007) Determinants of exclusive breastfeeding duration in Xinjiang, PR China. *Asia Pacific Journal of Clinical Nutrition* **16**(2), 316–321.

Yadav J, Menon GR, Mitra M, Allarakha S and John, D (2020) Burden and cost of communicable, maternal, perinatal and nutrition deficiency diseases in India. *Journal of Public Health*, https://doi.org/10.1093/pubmed/fdaa173

Yoo W, Mayberry R, Bae S, Singh K, He QP and Lillard JJW (2014) A study of effects of multicollinearity in the multivariable analysis. *International Journal of Applied Science and Technology* **4**(5), 9.