Original Article

Determinants of breastfeeding practices: An analysis of the Sri Lanka Demographic and Health Survey 2006–2007

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Abstract

Identification of factors that predict a woman's infant feeding choice is important for breastfeeding promotion programmes. We analysed a subsample of children under 2 years of age from the most recent Sri Lanka Demographic and Health Survey (SLDHS) to assess breastfeeding practices and factors associated with sub-optimal practices. SLDHS 2006–2007 used a stratified two-stage cluster sample of ever-married women aged 15–49 years. Breastfeeding indicators were estimated for the last-born children ($n = 2735$). Selected indicators were examined against independent variables through cross-tabulations and multivariate analyses. Of the sample, 83.3% initiated breastfeeding within 1 h of birth. Continuation rates declined from 92.6% in first year to 83.5% in second year. Exclusive breastfeeding (EBF) rate under 6 months of age was 75.8%, with median duration being 4.8 months. Delayed initiation of breastfeeding was associated with low birthweight [odds ratio (OR) = 2.24] and caesarean delivery (OR = 3.30), but less likely among female infants (OR = 0.75), mothers from 'estate' sector (OR = 0.61) or richer wealth quintile (OR = 0.60). Non-EBF was associated with children from urban areas (OR = 1.72) and estate sector (OR = 4.48) and absence of post-natal visits by a public health midwife (OR = 1.89). A child was at risk for not currently breastfeeding if born in a private hospital (OR = 3.73), delivered by caesarean section (OR = 1.46) or lived in urban areas (OR = 2.80) or estate sector (OR = 3.23). Those living in estates (OR = 11.4) and not receiving post-natal home visits (OR = 2.62) were more likely to discontinue breastfeeding by 1 year. Breastfeeding indicators in Sri Lanka were higher compared with many countries and determined by socio-economic and health care system factors.

Keywords: breastfeeding, exclusive breastfeeding, infant and young child feeding, early initiation.

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Introduction

Sri Lanka has shown steady progress in improving breastfeeding practices over the past two decades in parallel to the national policies and programmes to promote appropriate infant and young child feeding (IYCF) practices through the government health services (Department of Census and Statistics (DCS) 1995, 2002; DCS & Ministry of Healthcare and Nutri-

tion (MOH) 2009). The national programme on breastfeeding promotion has been in operation since late 1990s, and its key intervention has been the 40-h United Nations Children's Fund (UNICEF)/World Health Organization (WHO) lactation management training for health care providers (De Silva & Wickramasuriya 2001). In collaboration with UNICEF, the government launched the Baby Friendly Hospital Initiative in 1992 (Senanayake &

Wijemanne 1992), at which time the exclusive breastfeeding (EBF) rate in infants less than 4 months of age in Sri Lanka was only 19% (DCS 1995). By 2000, the EBF rate had increased substantially to 54% (DCS 2002). Parallel improvements were also observed in other indicators in Sri Lanka such as timely first suckling and continuation of breastfeeding (DCS 1995, 2002). As at the time of Demographic and Health Survey (DHS) 2006–2007, almost 80% of deliveries in Sri Lanka took place in institutions declared as baby friendly (International Baby Food Action Network (IBFAN) Asia 2007).

Previous studies have revealed the characteristics that are consistently related to suboptimal feeding practices across many countries (Dibley *et al.* 2010). Delay in initiation of breastfeeding was associated with lack of prenatal care, delivery by caesarean section and young or first-time mothers (Chye *et al.* 1997; Dewey *et al.* 2003; Butler *et al.* 2004; Antoniou *et al.* 2005). A longer duration of EBF was linked with positive maternal attitudes towards breastfeeding and adequate family support (Isabella & Isabella 1994; Dulon *et al.* 2001; Cernadas *et al.* 2003). It has also been found that some of these associations can be inconsistent because of temporal changes or other country-specific reasons (Scott *et al.* 2006; Senarath *et al.* 2007, 2010a). For example, mothers who deliver at health facilities had lower EBF rates in Nepal, whereas the opposite was true in India (Pandey *et al.* 2010; Patel *et al.* 2010). In Indonesia, having antenatal clinic visits was related to higher EBF rates in contrast to lower rates in Philippines, according to DHS conducted during 2002–2003 (Senarath *et al.* 2010a).

The Government of Sri Lanka is committed to provide free health services to mothers during preg-

nancy, delivery and post-natal period. The public health midwife (PHM) is the frontline care provider for mothers and children in the community, through antenatal and post-partum home visits. An analysis of Sri Lanka DHS 2000 revealed that antenatal and post-natal contacts with PHM were associated with improved breastfeeding practices, while breastfeeding practices were poor in the tea estate and urban communities (Senarath *et al.* 2010b). A subnational level study revealed lower EBF rates among mothers who had worked outside home, delivered other than normal births and not received any antenatal education (Jayathilaka & Fernando 2002).

Regular identification of factors that predict a woman's infant feeding choice is important so that breastfeeding promotion interventions can be targeted at groups least likely to breastfeed. This secondary data analysis of the recent Sri Lanka DHS aimed to describe breastfeeding practices using the key indicators of breastfeeding among children under 24 months of age and to identify some of the specific factors that were associated with suboptimal practices.

Materials and methods

Study design and subjects

Sri Lanka constitutes 25 administrative districts in nine provinces. The DHS 2006–2007 covered 20 districts from eight provinces. The Northern Province was excluded because of the prevailing war in this area during the time of survey (DCS & MOH 2009). The sample of the survey was selected using a stratified two-stage cluster sampling design to represent

Key messages

- Breastfeeding practices in Sri Lanka are satisfactory when compared with many countries in the world – for example, 83.3% of children less than 2 years of age initiated breastfeeding within 1 hour of birth and 75.8% of infants under 6 months of age was exclusively breastfed, according to the recent DHS.
- Breastfeeding practices were strongly influenced by social/economic factors, like type of residence and delivery places, and by factors concerning health care system.
- Even though Sri Lanka has relatively good breastfeeding indicators, continued promotion of breastfeeding is still necessary.

the country, except the Northern Province. A cluster was defined as a *Grama Niladhari* area – the smallest administration unit at village level. The first stage of sampling involved selecting of 2500 enumeration areas (clusters) from the list of about 100 000 enumeration areas formed in the 2001 population census. Finally, information was collected from 2106 clusters from three strata: 430 from urban, 1479 from rural and 197 from the tea estate sector. The second stage of selection involved systematic sampling of 10 housing units from each cluster. All ever-married women 15–49 years living in these households ($n = 14\,692$) were interviewed using a questionnaire, with a response rate of 97.5%. Respondents were asked detailed questions about the breastfeeding status for their last-born children under 24 months, who was living with the mother. Our analysis was restricted to a total of 2735 children under 24 months, except for calculations of the median duration of breastfeeding, which used children under 36 months.

Data analysis

We applied the new and updated IYCF indicators recommended by the WHO (WHO *et al.* 2008; Daelmans *et al.* 2009) that are defined as follows:

1. *Early initiation of breastfeeding*: the proportion of children born in the last 24 months who were put to the breast within 1 h of birth. This indicator was based on long-term maternal recall of this event.
2. *Children ever breastfed*: the proportion of children born in the last 24 months who were ever breastfed. This indicator was based on long-term maternal recall.
3. *EBF*: the proportion of infants 0–5 months of age who were fed exclusively with breast milk. This was based on maternal recall of feeds given to the child on the previous day.
4. *Predominant breastfeeding*: the proportion of infants 0–5 months of age who were breastfed on the previous day but who also received other fluids such as water-based drinks, fruit juice, excluding non-human milks and food-based fluids.

5. *Current breastfeeding*: the proportion of children under 24 months of age who were fed breast milk during previous day.

6. *Continued breastfeeding at 1 year*: the proportion of children 12–15 months of age who were fed breast milk during the previous day.

7. *Continued breastfeeding at 2 years*: the proportion of children 20–23 months of age who were fed breast milk during the previous day.

8. *Duration of breastfeeding*: the median duration of breastfeeding among children less than 36 months of age, that is, the age when 50% of children 0–35 months of age did not receive breast milk during the previous day. Also the median duration of EBF was defined replacing the term ‘breastfeeding’ with ‘exclusive breastfeeding’.

The explanatory variables were classified into three levels: individual, household and community. Wealth index was constructed using principal components analysis to determine the weights for the index based on information collected about several household assets and facilities. This index was divided into five categories (quintiles), and each household was assigned to one of these categories.

Statistical analyses were performed using Stata version 10.0 (StataCorp, College Station, TX, USA), and adjustment was made for the multistage cluster sampling design to estimates of confidence intervals using ‘svy’ commands. The four most important indicators were examined against this set of independent variables, with the Chi-square tests for significance of association. Multiple logistic regression was used with a stepwise backwards elimination to model the estimates of odds ratio (OR) adjusted for independent variables. Those variables with $P < 0.05$ were retained in the final model.

Results

As shown in Table 1, the majority of mothers were in the 20–34-year age group, most had secondary or higher education, nearly all were currently married and most had not worked in the 12 months prior to interview. Almost all births took place in health institutions, with more than 80% being in larger hospitals

Table 1. Individual, household and community level characteristics of children 0–23 months of age, Sri Lanka 2006/2007 (*n* = 2735)

Characteristic	<i>n</i>	%	Characteristic	<i>n</i>	%
Individual level factors			Antenatal home visits by PHM		
Maternal working status			Yes	2170	79.4
Non-working	2186	79.9	No	565	20.6
Working (past 12 months)	549	20.1	Number of post-natal home visits by PHM		
Maternal education			None	606	22.2
Primary or no schooling	282	10.3	1	757	27.7
Secondary	1464	53.5	2	740	27.1
Higher	989	36.2	≥3	632	23.1
Father's education (<i>n</i> = 2574)			Household level factors		
Primary	329	12.8	Household wealth index		
Secondary	1429	55.5	Poorest	459	16.8
Higher	816	31.7	Poorer	558	20.4
Mother's age (years) (<i>n</i> = 2732)			Middle	562	20.6
15–19	120	4.4	Richer	593	21.7
20–34	2131	78.0	Richest	563	20.6
35–49	480	17.6	Decisions making respondents jointly		
Marital status			Mother involved	2166	79.2
Currently married	2705	98.9	Mother not involved	569	20.8
Formerly married (divorced/separated/widow)	30	1.1	Community level factors		
Maternal BMI (kg m ⁻²)			Residence		
<18.5	680	24.9	Urban	369	13.5
18.5–24.9	1450	53.0	Rural	2187	80.0
≥25	606	22.1	Estate	179	6.5
Birth order			Province		
First born	1090	39.8	Western	758	27.7
Second born	1007	36.8	Central	418	15.3
Third or higher	638	23.4	Southern	329	12.0
Preceding birth interval			Eastern	323	11.8
No previous birth (months)	1090	39.8	North Western	242	8.9
<24	178	6.5	North Central	187	6.8
≥24	1467	53.6	Uva	244	8.9
Sex of child			Sabaragamuwa	233	8.5
Male	1388	50.8	Geographical region		
Female	1347	49.2	Colombo	346	12.6
Age of child (months)			Gampaha	275	10.1
0–5	629	23.0	Kalutara	137	5.0
6–11	723	26.4	Kandy	195	7.1
12–17	703	25.7	Matale	85	3.1
18–23	681	24.9	Nuwara Eliya	138	5.1
Birthweight (g)			Galle	117	4.3
Low (<2500)	386	14.1	Matara	131	4.8
Normal (≥2500)	2349	85.9	Hambantota	81	2.9
Place of delivery			Batticaloa	102	3.7
Home	13	0.5	Ampara	136	5.0
Teaching/general/base hospital	2218	81.1	Trincomalee	86	3.1
District/rural hospital/peripheral unit/maternity home	385	14.1	Kurunegala	155	5.7
Private hospital/other	120	4.4	Puttalam	87	3.2
Mode of delivery			Anuradhapura	108	4.0
Non-caesarean	2068	75.6	Polonnaruwa	79	2.9
Caesarean section	667	24.4	Badulla	146	5.3
Antenatal clinic visits (<i>n</i> = 2698)			Monaragala	98	3.6
1–3	325	12.0	Rathnapura	136	5.0
4–6	580	21.5	Kegalle	98	3.6
≥7	1793	66.5			

BMI, body mass index; PHM, public health midwife. Weighted total was 2735 otherwise stated within brackets.

where specialist services were available. The caesarean delivery rate was high (24%). Low-birthweight (<2500 g) rate was 14%. Nearly 90% of the mothers reported having had four or more antenatal clinic

visits and close to 80% at least one antenatal home visit by a PHM. In addition, the PHM had followed up 88% of the mother–newborn pairs at their homes within the first 10 days of birth.

Table 2. Breastfeeding indicators among children 0–23 months of age, Sri Lanka 2006/2007 ($n=2735$)

Indicator	Sample size	<i>n</i>	Rate (%)	95% CI	
Early initiation of breastfeeding*	2735	2278	83.3	81.7	84.8
Children ever breastfed*	2735	2732	99.8	99.7	99.9
Exclusive breastfeeding rate [†]	628	476	75.8	72.3	79.1
Predominant breastfeeding rate [†]	628	24	3.8	2.5	5.6
Full breastfeeding rate [†]	628	500	79.6	76.1	82.7
Current breastfeeding rate*	2735	2547	93.1	91.9	94.2
Continued breastfeeding rate (1 year) [‡]	464	430	92.6	89.7	94.8
Continued breastfeeding rate (2 years) [§]	436	364	83.5	79.1	87.2
Median duration of any breastfeeding (months) [¶]			33.6		
Median duration of exclusive breastfeeding (months) [¶]			4.8		

CI, confidence interval. *0–23 months. [†]0–5 months. [‡]12–15 months. [§]20–23 months. [¶]less than 36 months. CIs have been adjusted to take into account the sampling methods.

Fig. 1. Feeding status by age of child among 0–23 months of age ($n=2735$). CF, complementary feeding; EBF, exclusive breastfeeding; non-BF, non-breastfed.

As seen in Table 2, the vast majority of mothers reported initiating breastfeeding within the first hour after birth, and almost all the children had ever been breastfed, and almost 93% were currently being breastfed. The rate of continued breastfeeding remained high in the first year (12–15 months), and although it declined in the second year (20–23 months), it was still over 80%. The EBF rate under 6 months of age was high (75.8%) and the predominant breastfeeding rate was low (3.8%), thus accounting for the nearly 80% of infants who were fully breastfed. Among children less than 36 months of age, the median duration of any breastfeeding and

EBF were 33.6 and 4.8 months, respectively. As illustrated in Fig. 1, proportion of children exclusively breastfed was around 90% in the first month of life and declined gradually from the second to the fourth months but dropped rapidly thereafter to a level around 20% by the sixth month.

Table 3 shows that the rate of early initiation of breastfeeding was significantly lower for children with low birthweight and those born by caesarean deliveries. The rates varied across the types of delivery places, from the lowest rates for newborns delivered at home and in private hospitals to the highest rates for newborns delivered in the non-specialist

Table 3. The prevalence and 95% confidence intervals (CIs) for early initiation of breastfeeding, exclusive breastfeeding, current breastfeeding and continued breastfeeding by individual, household and community characteristics, Sri Lanka 2006/2007

Characteristic	Early initiation of breastfeeding			Exclusive breastfeeding			Current breastfeeding (0–23 months)			Continued breastfeeding (12–15 months)		
	%	95% CI	P	%	95% CI	P	%	95% CI	P	%	95% CI	P
Individual level factors												
Maternal working status												
Non-working	83.7	(81.8, 85.0)		76.9	(72.9, 80.4)		93.8	(92.5, 94.9)		93.5	(90.1, 95.8)	
Working (past 12 months)	81.7	(77.9, 84.9)		69.8	(59.8, 78.2)		90.3	(87.5, 92.5)	**	89.5	(82.1, 94.0)	
Maternal education												
Primary or no education	85.3	(80.8, 88.9)		64.2	(51.0, 75.5)		89.1	(84.3, 92.6)		89.2	(80.4, 94.3)	
Secondary	83.7	(81.6, 85.6)		77.0	(72.2, 81.2)		95.1	(93.9, 96.1)		94.9	(91.7, 97.1)	
Higher	82.1	(79.6, 84.5)		76.7	(70.5, 82.0)		91.3	(89.3, 93.0)	***	90.8	(85.3, 94.4)	
Mother's age (years)												
15–19 years	78.5	(70.4, 84.8)		65.5	(50.8, 77.7)		96.5	(91.9, 98.6)		100.0	–	
20–34 years	84.4	(82.7, 85.9)		76.8	(72.9, 80.4)		93.0	(91.7, 94.2)		92.0	(88.6, 94.4)	
35–49 years	80.0	(75.6, 83.7)	*	75.6	(65.4, 83.6)		93.1	(90.3, 95.1)		94.1	(87.7, 97.3)	
Marital status												
Currently married	83.3	(81.7, 84.8)		75.8	(72.3, 79.1)		93.3	(92.1, 94.4)		92.5	(89.5, 94.7)	
Formerly married (divorced/separated/widow)	85.0	(68.2, 93.7)		72.7	(14.0, 97.8)		78.2	(61.3, 89.1)	***	100.0	–	
Mother's BMI (kg/m²)												
<18.5	84.3	(80.9, 87.3)		74.9	(66.8, 81.6)		92.9	(90.4, 94.8)		90.9	(82.7, 95.5)	
18.5–24.9	83.8	(81.5, 85.9)		77.7	(72.5, 82.2)		93.8	(92.3, 95.1)		94.0	(90.4, 96.3)	
≥25	80.9	(77.4, 83.9)		71.4	(61.8, 79.4)		91.8	(89.0, 93.9)		91.5	(85.2, 95.2)	
Birth order												
First born	80.5	(77.6, 83.1)		75.8	(69.9, 80.8)		92.4	(90.6, 93.9)		89.3	(83.7, 93.2)	
Second born	84.6	(81.9, 86.9)		76.8	(71.2, 81.6)		93.8	(91.9, 95.2)		95.9	(92.4, 97.8)	
Third or more	86.0	(81.7, 84.8)	*	68.5	(53.8, 80.3)		93.4	(90.7, 95.3)		93.1	(89.7, 94.8)	*
Preceding birth interval												
No previous birth (months)	80.5	(77.6, 83.1)		75.8	(69.9, 80.8)		92.4	(90.6, 93.9)		89.3	(83.7, 93.2)	
<24	86.3	(80.1, 90.8)		71.7	(54.2, 84.4)		90.3	(85.2, 93.8)		94.5	(79.0, 98.8)	
≥24	85.0	(82.6, 87.1)	*	76.3	(71.0, 81.0)		94.0	(92.5, 95.2)		94.9	(91.8, 96.9)	
Sex of child												
Male	81.7	(79.5, 83.7)		75.4	(70.5, 79.7)		92.6	(90.8, 94.1)		91.7	(87.2, 94.7)	
Female	84.9	(82.5, 87.0)	*	76.3	(71.0, 80.9)		93.7	(92.1, 94.9)		93.5	(89.5, 96.0)	
Birthweight (g)												
Low (<2500)	72.2	(66.8, 77.1)		79.6	(67.7, 87.9)		91.9	(88.6, 94.3)		86.3	(73.3, 93.6)	
Normal (≥2500)	85.1	(83.4, 86.7)	***	75.2	(71.6, 78.5)		93.3	(92.0, 94.5)		93.7	(91.0, 95.6)	
Place of delivery												
Home	61.9	(31.3, 85.3)		66.3	(14.0, 96.0)		100.0	–		100	–	

Teaching/general/base hospital	83.0	(81.1, 84.8)	76.6	(72.6, 80.1)	93.9	(92.6, 95.0)	93.9	(90.9, 96.0)	
District/rural hospital/peripheral unit/ maternity home	87.9	(84.3, 90.8)	76.5	(65.4, 84.8)	93.4	(90.3, 95.5)	92.5	(84.4, 96.5)	
Private hospital/other Mode of delivery	75.9	(67.6, 82.6)	**	62.1	(43.8, 77.6)	77.2	(68.0, 84.4)	64.5	(39.8, 83.3)
Non-caesarean	88.0	(86.3, 89.4)		76.2	(71.8, 80.0)	94.0	(92.7, 95.1)	94.5	(91.6, 96.3)
Caesarean section	68.8	(64.7, 72.6)	***	74.8	(67.2, 81.2)	90.5	(87.8, 92.7)	87.0	(78.5, 92.4)
Antenatal clinic visits (<i>n</i> = 2698)									*
1–3	82.7	(77.6, 86.9)		73.2	(63.5, 81.1)	93.5	(90.1, 95.8)	97.2	(83.0, 99.6)
4–6	84.4	(81.5, 86.9)		77.4	(69.2, 83.9)	91.0*	(87.9, 93.4)	91.5	(81.9, 96.2)
≥7	83.4	(81.4, 85.1)		75.7	(71.1, 79.9)	93.9	(92.4, 95.1)	92.7	(89.5, 95.0)
Antenatal home visits by PHM									
Yes	83.6	(81.9, 85.2)		77.7	(73.5, 81.4)	94.0	(92.8, 95.1)	94.0	(90.8, 96.1)
No	82.0	(78.2, 85.4)		68.3	(60.8, 74.9)	*	(87.1, 91.9)	86.5	(77.7, 92.2)
Post-natal home visits by PHM									*
No	81.5	(77.1, 85.2)		70.8	(64.0, 76.9)	90.2	(87.1, 92.6)	85.2	(75.6, 91.4)
Yes	83.8	(82.0, 85.4)		77.6	(73.1, 81.5)	94.0	(92.7, 95.0)	94.2	(91.1, 96.3)
Household level factors									**
Household wealth index									
Poorest	83.5	(79.3, 87.0)		65.7	(54.4, 75.4)	93.3	(89.9, 95.6)	92.4	(86.0, 96.0)
Poorer	83.4	(80.2, 86.1)		83.3	(74.5, 89.6)	94.3	(92.3, 95.9)	93.9	(87.2, 97.2)
Middle	81.7	(77.8, 85.1)		78.7	(70.1, 85.3)	95.0	(93.0, 96.5)	96.7	(91.3, 98.8)
Richer	87.6	(84.3, 90.2)		77.1	(69.5, 83.3)	94.6	(92.2, 96.2)	94.3	(87.5, 97.5)
Richest	80.1	(76.7, 83.0)	*	70.8	(62.5, 77.9)	*	(85.3, 91.0)	85.7	(76.3, 91.8)
Decisions making respondents jointly									*
Mother involved	83.4	(81.7, 85.0)		77.7	(74.1, 80.9)	93.3	(92.0, 94.4)	92.0	(88.6, 94.5)
Mother not involved	83.0	(79.4, 86.0)		68.9	(59.8, 76.8)	*	(90.2, 94.4)	94.6	(89.1, 97.4)
Community level factors									
Residence									
Urban	81.1	(77.4, 84.4)		66.0	(57.4, 73.6)	86.5	(83.4, 89.2)	85.6	(76.6, 91.5)
Rural	83.3	(81.3, 85.0)		79.3	(75.3, 82.8)	94.9	(93.5, 95.9)	94.9	(91.6, 97.0)
Estate	88.2	(83.0, 92.0)		57.7	(45.1, 69.3)	***	(79.6, 89.9)	76.4	(61.4, 86.9)
Province									***
Western	82.2	(79.5, 84.6)		73.6	(67.4, 79.1)	91.2	(88.6, 93.3)	88.6	(81.4, 93.2)
Central	82.7	(79.0, 85.8)		78.7	(68.7, 86.2)	93.9	(90.6, 96.1)	95.1	(89.2, 97.9)
Southern	82.2	(78.0, 85.6)		69.2	(55.3, 80.3)	94.5	(92.1, 96.2)	97.1	(89.7, 99.2)
Eastern	89.7	(85.6, 92.7)		61.1	(50.5, 70.8)	89.7	(84.5, 93.3)	91.7	(79.9, 96.8)
North Western	87.2	(80.5, 91.8)		83.7	(77.4, 88.5)	94.9	(90.2, 97.4)	95.2	(80.2, 99.0)
North Central	75.6	(68.0, 81.8)		87.0	(72.4, 94.4)	97.3	(93.7, 98.9)	100	
Uva	82.8	(76.1, 88.0)		84.1	(76.4, 89.5)	95.4	(92.6, 97.2)	93.6	(84.3, 97.5)
Sabaragamuwa	83.3	(77.9, 87.6)	*	79.2	(65.6, 88.4)	**	(88.6, 96.2)	87.7	(71.4, 95.3)

Table 3. Continued

Characteristic	Early initiation of breastfeeding			Exclusive breastfeeding			Current breastfeeding (0–23 months)			Continued breastfeeding (12–15 months)		
	%	95% CI	P	%	95% CI	P	%	95% CI	P	%	95% CI	P
Geographical region (districts)												
Colombo	81.5	(76.1, 85.9)		75.4	(67.3, 81.9)		88.0	(82.4, 92.0)		81.5	(65.7, 91.0)	
Gampaha	82.0	(78.4, 85.1)		76.4	(66.5, 84.1)		95.1	(92.3, 96.9)		94.2	(83.9, 98.1)	
Kalutara	84.4	(81.2, 87.1)		58.4	(31.3, 81.2)		91.4	(88.0, 93.9)		91.2	(80.8, 96.2)	
Kandy	83.1	(79.8, 85.9)		85.5	(74, 93.9.0)		94.8	(90.2, 97.3)		95.5	(84.3, 98.8)	
Matale	78.5	(73.7, 82.6)		89.9	(72.5, 96.8)		98.4	(95.2, 99.5)		100.0		
Nuwara Eliya	84.7	(75.8, 90.7)		57.2	(30.4, 80.4)		89.8	(84.3, 93.5)		91.4	(78.0, 96.9)	
Galle	80.9	(72.8, 87.1)		64.6	(55.0, 73.1)		95.0	(92.9, 96.6)		95.8	(74.7, 99.4)	
Matara	77.6	(74.9, 80.0)		60.6	(32.3, 83.2)		94.9	(90.3, 97.3)		97.7	(80.2, 99.8)	
Hambantota	91.4	(84.7, 95.3)		89.9	(73.5, 96.6)		93.2	(85.7, 96.9)		97.6	(76.4, 99.8)	
Batticaloa	92.3	(88.7, 94.9)		78.9	(56.8, 91.4)		88.2	(83.4, 91.7)		93.3	(74.9, 98.5)	
Anpara	84.6	(75.7, 90.6)		38.0	(23.1, 55.4)		87.9	(75.5, 94.5)		90.0	(69.2, 97.3)	
Trincomalee	94.6	(85.6, 98.1)		71.7	(45.1, 88.61)		94.3	(88.8, 97.2)		92.9	(48.5, 99.5)	
Kurunegala	92.0	(84.9, 95.9)		76.2	(68.9, 82.3)		96.1	(89.3, 98.7)		93.4	(70.6, 98.8)	
Puttalam	78.7	(69.4, 85.7)		100.0			92.8	(88.6, 95.5)		100.0		
Anuradhapura	82.0	(73.9, 88.0)		84.8	(58.8, 95.6)		97.2	(91.7, 99.1)		100.0		
Polonnaruwa	66.7	(58.9, 73.8)		89.9	(74.9, 96.4)		97.5	(90.1, 99.4)		100.0		
Badulla	86.4	(78.3, 91.8)		84.8	(71.3, 92.6)		95.5	(93.0, 97.1)		86.0	(66.6, 95.0)	
Monaragala	77.6	(71.2, 82.9)		82.9	(79.3, 86.0)		95.3	(87.8, 98.3)		100.0		
Rathnapura	77.6	(73.8, 81.0)		77.5	(58.8, 89.2)		91.3	(83.8, 95.6)		82.0	(59.0, 93.5)	
Kegalle	91.3	(81.7, 96.1)	***	81.1	(58.4, 92.9)	***	96.1	(89.2, 98.6)	**	96.3	(69.2, 99.7)	

BMI, body mass index; PHM, public health midwife; CI, confidence interval. * $P < 0.05$; ** $P < 0.01$; *** $P < 0.001$. P -values and CIs have been adjusted to take into account the sampling methods.

government institutions such as maternity homes, peripheral units and rural and district hospitals.

The rate of EBF in infants under 6 months of age was significantly lower in mothers who were not visited by a PHM at home during pregnancy than those who were visited (68.3% vs. 77.7%, respectively, $P = 0.021$) (Table 3). Those who lived in the tea estate sector or urban areas had significantly lower rates compared with those living in rural areas ($P = 0.0001$). Mothers who were involved in household decisions had a higher EBF rate than those who were not, indicating the importance of the woman's autonomy in making decisions as a predictor of EBF.

Current breastfeeding was significantly lower among mothers from the urban areas and the tea estate sector than among mothers from rural areas (Table 3). Lower rates were also observed among mothers who delivered in private hospitals, underwent caesarean delivery, were from the richest wealth quintile, or received no antenatal or postnatal home visits by the PHM. Continuation of breastfeeding by the end of the first year was significantly lower in similar categories to those for current breastfeeding.

Four suboptimal practices (delayed initiation, non-EBF, current non-breastfeeding and discontinuation of breastfeeding at 1 year of age) were examined in the multivariate analysis. The adjusted OR for the factors associated with these feeding patterns are shown in Tables 4 and 5.

Delayed initiation of breastfeeding was strongly associated with low birthweight (adjusted OR = 2.24) and caesarean delivery (adjusted OR = 3.30) (Table 4). The number of home deliveries in the sample was low; however, it was a factor associated with delay in initiation compared with non-specialist hospitals (adjusted OR = 5.29). The delay was less likely if the child was a female (adjusted OR = 0.75), and mothers were from the 'richer' households compared with those from the 'poorest' households (adjusted OR = 0.60). Compared with rural areas, mothers from the tea estate sector had a lower risk for delay in initiation (adjusted OR = 0.61).

Infant's age was a strong predictor for non-EBF, indicating that EBF rates rapidly drops with the age especially after 3 months (Table 5). Compared with

the rural areas, both the urban areas (adjusted OR = 1.72) and the tea estate sector (adjusted OR = 4.48) had an increased odds for non-EBF. Those who were not visited by a PHM during the 10 days after birth reported a higher risk of non-EBF (adjusted OR = 1.89).

A child was more likely to be currently non-breastfed if he or she was born in a private hospital (adjusted OR = 3.73), born by caesarean delivery (adjusted OR = 1.46) or lived in an urban area (adjusted OR = 2.80) or the estate sector (adjusted OR = 3.23) (Table 5). Absence of antenatal home visits by PHM during pregnancy was a predictor of currently non-breastfed status (adjusted OR = 1.46). Those with secondary education had lower risk for having their children non-breastfed compared with mothers who had higher education (adjusted OR = 0.63).

Discontinuation of breastfeeding by 1 year was more likely when the child was born by caesarean delivery (adjusted OR = 2.97), or lived in the tea estate sector (adjusted OR = 11.41) (Table 5). Those who were not visited by a PHM during the 10 days after birth had a higher risk of discontinuation by 1 year (adjusted OR = 2.62).

For all these outcomes, there were significant provincial differences indicating the province has either a risk or protective effect for suboptimal breastfeeding practices. For example, compared with the Western Province, Eastern Province has a lesser risk (adjusted OR = 0.61), and the North Central Province has a greater risk (adjusted OR = 1.96) of delaying in initiation of breastfeeding.

Discussion

The present study revealed that in Sri Lanka the vast majority of mothers initiated breastfeeding within the first hour after birth, and most of the children were currently being breastfed. The EBF rate under 6 months of age was almost 76%. The rate of continued breastfeeding remained high in the first and second years. When compared with 46 countries in the world as compiled in the WHO report on IYCF indicators Part III country profiles, the rate of early initiation of

Table 4. Multivariate analysis for factors associated with delayed initiation and non-exclusive breastfeeding

Outcome	Independent variable	Adjusted odds ratio	95% CI		P-value
Delayed initiation	Sex of child				
	Male	1.00			
	Female	0.75	0.59	0.94	0.01
	Age of child (months)				
	0–5	1.00			
	6–11	1.22	0.89	1.69	0.22
	12–17	1.48	1.09	2.02	0.01
	18–23	1.65	1.21	2.26	<0.01
	Birthweight (g)				
	Normal (≥ 2500)	1.00			
	Low (< 2500)	2.24	1.66	3.03	<0.01
	Place of delivery				
	District/rural hospital/peripheral unit/maternity home	1.00			
	Home	5.29	1.66	16.88	0.01
	Teaching/general/base hospital	1.17	0.82	1.67	0.40
	Private hospital/other	1.37	0.70	2.69	0.35
	Mode of delivery				
	Non-caesarean	1.00			
	Caesarean section	3.30	2.54	4.28	<0.01
	Household wealth index				
	Poorest	1.00			
	Poorer	0.96	0.67	1.36	0.81
	Middle	1.00	0.69	1.46	0.98
	Richer	0.60	0.39	0.90	0.02
	Richest	0.91	0.63	1.32	0.63
	Residence				
	Rural	1.00			
	Urban	1.23	0.93	1.63	0.15
	Estate	0.61	0.39	0.95	0.03
	Province				
	Western	1.00			
	Central	1.07	0.78	1.48	0.67
	Southern	1.11	0.80	1.55	0.52
	Eastern	0.61	0.39	0.95	0.03
	North Western	0.83	0.50	1.39	0.48
	North Central	1.96	1.25	3.07	<0.01
	Uva	1.19	0.71	2.02	0.51
	Sabaragamuwa	0.98	0.63	1.53	0.93
Non-exclusive breastfeeding	Age of infant (months)				
	0 to less than 1	1.00			
	1 to less than 2	0.80	0.27	2.39	0.69
	2 to less than 3	1.95	0.65	5.82	0.23
	3 to less than 4	3.74	1.33	9.55	0.01
	4 to less than 5	6.98	2.50	19.52	<0.01
	5 to less than 6	24.61	8.84	68.46	<0.01
	Number of post-natal home visits by PHM				
	At least one visit	1.00			
	None	1.89	1.17	3.05	0.01
	Household wealth index				
	Poorest	1.00			
	Poorer	0.44	0.22	0.86	0.02
	Middle	0.58	0.30	1.10	0.09
	Richer	0.75	0.38	1.10	0.40
	Richest	0.87	0.42	1.47	0.70
	Decisions making				
	Mother involved	1.00			
	Mother not involved	1.58	0.96	2.59	0.07
	Residence				
	Rural	1.00			
	Urban	1.72	1.02	2.89	0.04
	Estate	4.48	2.24	8.99	<0.01
	Province				
	Western	1.00			
	Central	0.50	0.26	0.97	0.04
	Southern	1.41	0.65	3.05	0.38
	Eastern	2.74	1.45	5.19	<0.01
	North Western	0.62	0.27	1.44	0.27
	North Central	0.50	0.18	1.42	0.20
	Uva	0.76	0.38	1.55	0.46
	Sabaragamuwa	0.69	0.32	1.48	0.34

P-values and confidence intervals (CIs) have been adjusted to take into account the sampling methods.

Table 5. Multivariate analysis for factors associated with currently non-breastfeeding and discontinuation of breastfeeding at 1 year

Outcome	Independent variable	Adjusted odds ratio	95% confidence interval (CI)		P-value
Currently non-breastfed	Maternal education				
	Higher	1.00			
	Secondary	0.63	0.46	0.87	0.01
	Primary or no education	1.15	0.67	1.95	0.61
	Age of child (months)				
	0–5	1.00			
	6–11	11.83	2.78	50.36	<0.01
	12–17	42.41	9.32	193.07	<0.01
	18–23	94.91	21.40	420.97	<0.01
	Place of delivery				
	District/rural hospital/peripheral unit/maternity home	1.00			
	Teaching/general/base hospital	0.94	0.56	1.57	0.81
	Private hospital/other	3.73	1.95	7.13	<0.01
	Mode of delivery				
	Non-caesarean	1.00			
	Caesarean section	1.46	1.03	2.08	0.03
	Antenatal home visits by PHM				
	Yes	1.00			
	No	1.46	1.05	2.03	0.02
	Residence				
	Rural	1.00			
	Urban	2.80	1.90	4.12	<0.01
	Estate	3.23	1.93	5.40	<0.01
Discontinued at 1 year	Mode of delivery				
	Non-caesarean	1.00			
	Caesarean section	2.97	1.38	6.40	<0.01
	Number of post-natal home visits by PHM				
	At least one	1.00			
	None	2.62	1.21	5.65	0.01
	Residence				
	Rural	1.00			
	Urban	1.96	0.86	4.47	0.11
	Estate	11.41	3.51	37.12	<0.01
	Province				
	Western	1.00			
	Central	0.14	0.04	0.56	0.01
	Southern	0.30	0.07	1.31	0.11
	Eastern	0.62	0.18	2.13	0.45
	North Western	0.53	0.09	3.01	0.47
	North Central				
	Uva	0.33	0.09	1.13	0.08
	Sabaragamuwa	0.86	0.20	3.86	0.87

PHM, public health midwife. *P*-values and CIs have been adjusted to take into account the sampling methods.

breastfeeding in Sri Lanka was the highest and the EBF was the second (WHO *et al.* 2010).

Even though Sri Lanka has relatively good breastfeeding indicators, continued promotion of breastfeeding is still necessary. There are many reasons that breastfeeding should be further promoted through

health system. The first reason is the strong evidence that 10–15% of under-five deaths in resource-poor countries could be prevented through achievement of 90% coverage with EBF and 19% reduction of neonatal deaths with universal initiation of breastfeeding within the first hour of life (Jones *et al.* 2003; Mullany

et al. 2008). The second reason is the challenge the country still faces in tackling child undernutrition, where substantial reductions are needed in the prevalence of stunting, wasting, underweight and anaemia in children under 5 years of age. There has been hardly any improvement in stunting, wasting and underweight according to DHS in 1993, 2000 and 2006–2007 (DCS 1995, 2002; DCS & MOH 2009). Improvement in breastfeeding practices would contribute to a reduction in child undernutrition. The evidence from Cambodia can be cited as an example where compliance with breastfeeding indicators was associated with reduced risk of underweight in 0–5 months infants (Marriott *et al.* 2010). The third reason is a concern among breastfeeding promotion groups about the continuing marketing strategies of commercial infant milk producers and the poor implementation of the code for marketing breast milk substitutes in the country may lead to early discontinuation of breastfeeding.

It is also important to interpret the indicators correctly, and due caution is needed when interpreting EBF rates as highlighted by a recent assessment (Agampodi *et al.* 2009). EBF is based on a cross-section of children from birth to just under 6 months of age using a 24-h recall. It therefore does not represent the proportion of infants who are exclusively breastfed until just under 6 months of age and should not be interpreted as such (Daelmans *et al.* 2009). The present analysis has revealed that only 50% of infants were exclusively breastfed by the age of 4–5 months, with a rapid decline thereafter. Because of the same reason, investigating the association between stunting and EBF rate using cross-sectional data may not be appropriate as stunting is an outcome of long-term nutritional insufficiency.

Early initiation rate has increased from 56.3% in 2000 to 83.3% in 2006–2007 possibly because of the emphasis given in the health messages to promote early initiation during the period after year 2000 (DCS & MOH 2009; Senarath *et al.* 2010b). Younger children, especially those born within 12 months before the survey, showed better early initiation compared with older children, indicating a temporal association of better rates with time. Caesarean delivery was an important determinant of delayed

initiation of breastfeeding. This effect was consistently present in studies from different settings (Dewey *et al.* 2003; Antoniou *et al.* 2005) as well as in the analysis of Sri Lanka DHS 2000 (Senarath *et al.* 2010b). The delay could be attributed to the very nature of caesarean delivery, or conditions that led to caesarean delivery or its complications. However, lack of knowledge and skills of operating theatre nursing staff on breastfeeding support and poor commitment by medical staff are the likely reasons for delay in initiation of breastfeeding. Because there is a rapid rise in the rate of caesarean sections in the country, the most effective strategy would be to reduce unnecessary caesarean sections. With the increasing rate of caesarean deliveries in Sri Lanka, a strong commitment and close supervision are needed by the consultant obstetricians, paediatricians and nurses in health institutions to prevent delay in initiation of breastfeeding. Another strong predictor of delayed initiation was the low-birthweight infant, and it is advisable for care providers to look into possibilities of early initiation of breast milk in these clinical situations. Newborn care and lactation management training programmes should address these issues and involve staff of operating theatres and special care baby units.

Compared with the rate of EBF in 2000 (DCS 2002), the present level indicates a remarkable improvement, and this could be due to the change in recommended duration of EBF from 4 months to 6 months during 2007. EBF rate has declined significantly with age, especially after 3–4 months. Therefore, it is important to reinforce the need to continue EBF preferably through PHMs home visits around the infant's third month of life and follow-up at subsequent clinic and home visits.

The results showed that lack of initial post-natal home visits by PHM was associated with non-EBF and discontinuation of breastfeeding at the end of 1 year. There is evidence that frequent contacts with PHM have improved breastfeeding practices in Sri Lanka (Senarath *et al.* 2010b), and retraining PHMs on breastfeeding counselling, together with supportive supervision have sustained high EBF rates until 6 months (Agampodi & Agampodi 2008). Therefore, we recommend strengthening of the home visits of

PHMs using effective training strategies and supportive supervision. The policy makers and supervising officers should rearrange the present workload of PHMs to allow them to make more home visits.

Although caesarean delivery and low birthweight delayed timely initiation of breastfeeding, there was no difference in the EBF rates between children born by caesarean or non-caesarean delivery or with low and normal birthweight. Similar results have been found in other settings (Chye *et al.* 1997). This indicates that, with a plan to breastfeed and appropriate support, women who have low-birthweight infants or undergone caesarean section can establish breastfeeding and achieve EBF even if they are not able to achieve early initiation. However, some studies have shown that caesarean delivery as a significant predictor for failure in EBF (Butler *et al.* 2004; Pechlivani *et al.* 2005).

The results revealed that there are subpopulations with poor breastfeeding practices in Sri Lanka despite higher rates at the national level. Compared with rural, the urban and tea estate sectors had higher risk for non-EBF, non-current breastfeeding and discontinuation at 1 year. In contrast to this, early initiation was better in the tea estate sector, probably because of the majority of births taking place in lower level hospitals. The urban sector in this study was a socio-economically diverse and densely populated region, with a considerable number of families belonging to both the highest and the lowest socio-economic groups and a high proportion of working mothers. The tea estate sector is a relatively homogeneous community with a socio-economically poor, less educated tea estate worker population and children are kept in child-care centres when their mothers are at work in the tea estates. Comparatively low breastfeeding practices in the tea estate sector had been reported in a previous study of plantation sector and in the analysis of Sri Lanka DHS in 2000 (Sorensen *et al.* 1998; Senarath *et al.* 2010b). Also, many differences were seen across provinces indicating the inequalities across different regions. Therefore, it is important to find out whether the breastfeeding and infant feeding promotion strategies have reached these communities and find better means of delivering effective interventions to these communities.

These subpopulations are geographically and administratively distinct, and various social, cultural, political, workplace and health care determinants could have contributed to the poor practices. We recommend that specific interventions to promote breastfeeding considering the reasons for sub-standard practices be implemented in such populations. However, our study could not recognize many socio-cultural and work-related factors because DHS did not explore these dimensions. More qualitative research would be required to identify the beliefs, attitudes and cultural practices regarding breastfeeding, workplace arrangements, competency of health care providers and volunteers in these subpopulations.

In conclusion, breastfeeding practices were satisfactory and strongly influenced by social/economic factors, such as type of residence and delivery places, and by factors concerning health care system. This study identified specific factors that are associated with suboptimal breastfeeding practices. This approach may be useful to countries with DHS or similar national surveys to identify target groups for breastfeeding promotion.

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Conflicts of interest

The authors declare that they have no conflicts of interest.

Contributions

US designed the study, obtained data sets, guided analysis and wrote the manuscript and revised it. IS converted data and conducted analysis. SG interpreted the results, revised the manuscript and assisted in writing the discussion. HJ conducted literature survey, compiled tables, wrote the results section. DF interpreted the results, reviewed the paper and made revisions. MD advised on study design, guided statistical modelling and provided assistance to interpret results and reviewed and revised the paper.

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