

BMJ Open Changes in the prevalence of breast feeding in preterm infants discharged from neonatal units: a register study over 10 years

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ABSTRACT

Objective: There are indications that the prevalence of exclusively breastfed preterm infants is decreasing in Sweden. The objective was to investigate trends in exclusive breast feeding at discharge from Swedish neonatal units and associated factors in preterm infants.

Design, setting and participants: This is a register study with data from the Swedish Neonatal Quality Register. Data from 29 445 preterm infants (gestational age (GA) <37 weeks) who were born during the period 2004–2013 were retrieved. Data included maternal, perinatal and neonatal characteristics. Data were analysed for the whole population as well as for 3 GA groups.

Results: From 2004 to 2013, the prevalence of exclusive breast feeding decreased, in extremely preterm (GA 22–27 weeks) from 55% to 16%, in very preterm (GA 28–31 weeks) from 41% to 34% and in moderately preterm infants (GA 32–36 weeks) from 64% to 49%. The decline was statistically significant ($p < 0.001$) in all 3 GA groups. This decline remained significant when adjustments were made for factors negatively associated with exclusive breast feeding and which became more prevalent during the study period, that is, small for GA (all groups) and maternal mental illness (very preterm and moderately preterm infants).

Conclusions: In the past 10 years, Sweden has experienced a lower rate of exclusive breast feeding in preterm infants, especially in extremely preterm infants. The factors analysed in this study explain only a small proportion of this decline. The decline in exclusive breast feeding at discharge from neonatal units raises concern and present challenges to the units to support and promote breast feeding.

INTRODUCTION

Breast feeding provides many benefits for the infant. The nutritional, immunological and neurological advantages are even more pronounced in preterm infants (born before <37 gestational weeks) and infants with low birth weight.^{1–4} It has been suggested that even small changes in the prevalence of

Strengths and limitations of this study

- This study, which covers the majority of preterm births in Sweden, gives a unique picture of changes in breastfeeding prevalence in preterm infants discharged from Swedish neonatal units over a 10-year period, together with associated factors.
- The large number of included infants enables a good estimation of the association between changes in maternal and infant factors, and the studied outcome; breast feeding in a vulnerable population.
- The study is limited by the fact that the Swedish Neonatal Quality (SNQ) register was not comprehensive from start and that it does not include data on socioeconomic status, mothers' body mass index or smoking habits, all of which are factors known to affect breast feeding.

breast feeding may result in significant societal health disparities for infants and mothers through changes in health, healthcare costs and economic productivity.⁵

Sweden, in comparison with other European/high-income countries, has traditionally been acknowledged as having a pro-breastfeeding culture, with higher rates of breast feeding during infancy.^{6–7} However, between 2004 and 2012, the overall prevalence of exclusive breast feeding in Sweden decreased from 89% to 81% at 1 week, 77% to 66% at 2 months and 19% to 15% at 6 months.⁸ In contrast, the UK and the USA reported increasing rates of exclusive breast feeding up to four respectively 6 months.^{6–7} However, no recent data are available, nationally or internationally, on national trends in breast feeding in the preterm infant population. Findings from Swedish studies show that more than 90% of mothers of preterm or low birthweight infants were breast feeding at discharge in the late 1990s and early 2000s.^{9–10} Compared with term infants, the preterm



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infants had a significantly shorter duration of breast feeding.^{9–11} Several factors can affect the prevalence and duration of breast feeding, in term infants as well as in preterm infants, including maternal factors (eg, physiological and sociodemographic factors, previous breastfeeding experiences, and support from partner and family),^{11–13} infant factors (eg, gestational age (GA) and neonatal morbidity),¹⁰ sociocultural factors (eg, societal attitudes and culture, and possibilities for work leave)^{14–16} and healthcare factors, (eg, hospital staffing rates, staff attitudes and support, guidelines, and design of neonatal units).^{15–17–18} Further, preterm infants are, depending on GA, immature in their sucking behaviour; they have a weak suck and difficulties to coordinate breathing and swallowing, which delays the attainment of exclusive breast feeding.¹⁹ The mother who wants to breast feed needs to express breast milk through pumping several times per day and the infants are initially fed through a tube. During the transition period from tube feeding to breast feeding, the mothers cannot take full responsibility for their infants' nutrition in the same way as parents of healthy infants born at term can and are often dependent on infant maturity and neonatal staff advices and support.^{20–21}

While conducting an ongoing intervention study of breastfeeding support after discharge from neonatal units in Sweden,²² we received indications that fewer mothers of preterm infants breast fed than expected from previous data. Thus, the primary aim of this study was to investigate breastfeeding prevalence in preterm infants discharged from Swedish neonatal units during a 10-year period (2004–2013) and to examine the potential role of maternal, perinatal and neonatal characteristics on the breastfeeding trend.

METHODS

Design, population and data collection

The Swedish Neonatal Quality (SNQ) register was started in 2003, and is gradually expanding since then and now includes individual data from all infants cared for in all Swedish neonatal units. Data for this study were collected for each year, starting 2004 until 2013. The number of neonatal units that reported data to SNQ during the study period was 30 in 2004 and 37 in 2013. The data are recorded on standardised forms prospectively filled out on admission to the neonatal unit and completed at discharge. For the purpose of this study, we retrieved data on preterm infants with a GA of <37 weeks who were discharged from Swedish neonatal units and where data on feeding at discharge were available in the SNQ register (figure 1). Data obtained from the SNQ register included the following maternal variables: maternal illness, gestational diabetes, pre-eclampsia, which were pre-stated items in the register with a yes/no alternative. In addition, there was a space for free text where a range of diseases such as diabetes, hypertension and thyroid disorders were specified. From that text, all text related to mental illness (eg, anxiety, depression, bipolar disorder)

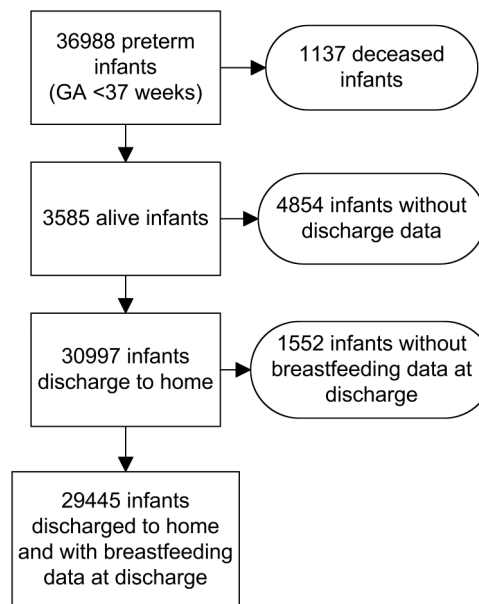


Figure 1 Flow chart over included and excluded infants. Data from the Swedish Neonatal Quality register (2004–2013). GA, gestational age.

was retrieved. Infant data included: birth year, multiple birth, mode of delivery (caesarean section/vaginal), GA, birth weight, small for GA (SGA, defined as a birth weight <−2 SDs from the mean according to the Swedish standard) and sex. The following neonatal morbidities and treatments were included: bronchopulmonary dysplasia (BPD, defined as the need for additional oxygen at 36 gestational weeks), retinopathy of prematurity (ROP, any degree) and necrotising enterocolitis (NEC). The length of stay (days) was also obtained. Breast feeding at discharge was categorised as: exclusive (ie, only breast milk, medication, fortification and vitamins), partial (ie, breast milk in combination with formula) and no breast feeding (ie, no breast milk). The term breast feeding was used both for breast feeding at the breast and for breast milk feeding by bottle, tube or cup.²³

Setting

From 2004 to 2013, the Swedish population increased to 9.6 million and the number of births per year increased from 99 571 to 111 364, with about 5% of the infants born preterm, that is, with a GA<37 weeks.²⁴ Preterm infants with a GA<35 weeks are most often cared for in neonatal units. Neonatal care is offered at 29 local and county hospitals (levels 1–3 care) and 8 university hospitals (levels 1–4 care).²⁵ Infants with a GA of 35–36 weeks are usually cared for at maternity units, unless they have medical problems, in which case they are admitted to neonatal units.

In Swedish neonatal units, parents are allowed to stay with their preterm infants at all hours.²⁶ Some units have family rooms where the family can stay with their infants for the entire hospital stay. Almost all units provide various degrees of kangaroo mother care and

developmental care.²⁷ The neonatal units have either their own milk bank or have access to a central breast milk bank for mother's own or donor breast milk. Almost all preterm infants in neonatal units receive the mother or donor's milk during the first weeks of life.²⁸ Some infants receive their mother milk or donor's milk throughout the stay in the neonatal unit and others for just a few weeks. Both the mother and father are eligible to receive paid sick leave when the infant is cared for in the neonatal unit.

Statistical analysis

All statistical analyses were performed for each of the three GA groups: extremely preterm (22+0–27+6 weeks), very preterm (28+0–31+6 weeks) and moderately preterm (32+0–36+6 weeks). Binominal data (maternal mental illness, gestational diabetes, pre-eclampsia, multiple birth, caesarean section, SGA, male sex, BPD, ROP and NEC) are presented with number and percentage, normally distributed data (birth weight) with mean and SD, and data with a skewed distribution (GA and length of stay) with median and IQR. Exclusive breast feeding was compared with partial and no breast feeding in all analysis. First, to assess the trend in breast feeding during the investigated time (2004–2013), unadjusted logistic regression analyses were conducted, in which the OR represents the average difference over time for not breast feeding exclusively. Second, unadjusted logistic regression analyses were conducted to assess whether there was a statistically significant increase or decrease in the prevalence of the *independent variables* during the investigated time. Third, unadjusted logistic regression analyses were performed to investigate the effect of each independent variable on exclusive versus no/partial breast feeding at discharge. Finally, factors that were significantly negatively associated with exclusive breast feeding *and* showed a significant increased trend over time were included in the adjusted logistic regression models. To describe the proportion of explained variation in the dependent variable, Nagelkerke R^2 tests were used. Owing to few cases, the factors BPD $n=23$ (0.1%) and NEC $n=26$ (0.1%) in the moderately preterm group and gestational diabetes $n=13$ (0.7%) in the extremely preterm group were excluded in the regression analyses. Data from the logistic regression models are presented with ORs and 95% CIs. Statistical significance level was set at $p<0.05$ in all analyses, and calculations were performed with SPSS (IBM Corp, Released 2012, IBM SPSS Statistics for Windows, V.21.0, Armonk, New York, USA: IBM Corp).

Ethics

The SNQ register has an ongoing data collection at all Swedish neonatal units and parents are informed during the hospital stay that perinatal data are collected in the register, and that they can decline or withdraw the collected data during the hospital stay or at any time after discharge.

RESULTS

Characteristics of mothers and infants

The study included data from 29 445 preterm infants who were discharged from neonatal units and had breastfeeding data at discharge, of which 1936 (6.6%) were extremely preterm, 4595 (16%) very preterm and 22 914 (78%) moderately preterm. Characteristics of mothers and infants are presented in [table 1](#).

Breastfeeding rates at discharge in the three gestational groups

For all preterm infants, a decrease in exclusive breast feeding was observed from 59% in 2004 to 45% in 2013. During the same period, partial breast feeding increased from 29% to 40% while the proportion of infants that were not breast fed increased from 12% to 15% ([figure 2](#)). The decrease in exclusive breast feeding was most pronounced in extremely preterm infants (from 55% to 16%). In very preterm infants, there was a decrease from 41% to 34% and in moderately preterm infants from 64% to 49% ([figure 3](#)). The decrease in exclusive breast feeding and the increases in partial and no breast feeding were statistically significant ($p<0.001$), both for the total population and for all three GA groups separately.

Changes in treatment, care and diagnoses in 2004–2013

During the study period, the proportion of mothers with mental illness increased from 1.7% to 5.7% ($p<0.001$). The proportion of infants born SGA increased from 4.2% to 9.1% ($p<0.001$).

The prevalence of ROP decreased in extremely preterm infants (from 57% to 38%, $p=0.001$). In the moderately preterm infants, there was a small decrease in the proportion of multiple births (from 25% to 23%, $p<0.05$). The overall prevalence prevalence of gestational diabetes, pre-eclampsia, caesarean section, multiple birth, BPD and NEC did not change significantly over the study period.

Risk factors for not being exclusively breast fed in extremely preterm infants

In extremely preterm infants, the OR (95% CI) for not being exclusively breast fed increased during the investigated period OR 1.28 (1.23 to 1.32). These infants had an OR of 6.5 (4.13 to 10.2) of not being exclusively breast fed at discharge in 2013 as compared with 2004. Infant birth year explained 13% of the decrease in exclusive breast feeding in this group. In the unadjusted logistic regression analyses multiple birth, SGA and NEC were additional factors significantly associated with not being exclusively breast fed. Factors independently associated with the decrease in exclusive breast feeding were: infant birth year (OR 1.27, 1.23 to 1.32) and SGA (OR 1.95, 1.26 to 3.03; [table 2](#)).

Table 1 Characteristics of 29 445 preterm infants discharged from Swedish neonatal units in 2004–2013

	Extremely preterm n=1936		Very preterm n=4595		Moderately preterm n=22 914		Total N=29 445	
	No	Per cent	No	Per cent	No	Per cent	No	Per cent
<i>Demographic variables</i>								
Maternal mental illness	59	3.0	153	3.3	828	3.6	1040	3.5
Gestational diabetes	13	0.7	65	1.4	483	2.1	561	1.9
Pre-eclampsia	240	12	895	20	3040	13	4175	14
Multiple birth	499	26	1310	29	5361	23	7170	24
Caesarean section	1186	61	3143	68	10 079	44	14 408	49
GA at birth weeks; median (IQR)	26 (25–27)		30 (29–31)		34 (33–35)		34 (32–35)	
Birth weight, gm; mean (SD)	850 (214)		1460 (338)		2416 (533)		2164 (694)	
Small for GA	162	8.4	502	11	1621	7.1	2285	7.8
Male sex	1017	53	2490	54	13 463	54	15 970	54
Bronchopulmonary dysplasia	1056	55	319	6.7	23	0.1	1386	4.7
Retinopathy of prematurity (any)	917	47	219	4.8	0	0	1136	3.9
Necrotising enterocolitis	132	6.8	60	1.3	26	0.1	218	0.7
Length of stay, days; median (IQR)	90 (73–112)		44 (33–57)		13 (9–20)		17 (10–31)	

Data from the SNQ register. The three GA groups were defined as follows: extremely preterm (GA 22–27 weeks), very preterm (GA 28–31 weeks) and moderately preterm (GA 32–36 weeks). GA, gestational age; SNQ, Swedish Neonatal Quality.

Risk factors for not being exclusively breast fed in very preterm infants

In the unadjusted logistic regression analyses very preterm infants, birth year, mental illness, caesarean section, multiple births, SGA, BPD and NEC were all significantly associated with not being breast fed exclusively. Infant birth year explained 0.5% of the decrease in exclusive breast feeding in this group. Factors independently associated with the decrease in exclusive breast feeding were: birth year (OR 1.04, 1.02 to 1.06), mental illness (OR 2.00, 1.38 to 2.91) and SGA (OR 1.57, 1.29 to 1.92; [table 3](#)).

Risk factors for not being exclusively breast fed in moderately preterm infant

In the unadjusted logistic regression analyses, multiple factors significantly associated with not being exclusively breast fed included infant birth year, mental illness,

gestational diabetes, pre-eclampsia, caesarean section, multiple births and SGA. Infant birth year explained 1.9% of the decrease in exclusive breast feeding in this group. Factors independently associated with the decrease in exclusive breast feeding were: birth year (OR 1.09, 1.08 to 1.10), mental illness (OR 1.59, 1.38 to 1.83) and SGA (OR 1.51, 1.36 to 1.67; [table 4](#)).

When the analyses were repeated for the three GA groups but only included comparisons between no breast feeding and exclusive breast feeding (ie, partial breast feeding was excluded), the findings were very similar to those obtained when partial breast feeding was included.

DISCUSSION

The present study demonstrates that a substantial decline in the prevalence of exclusive breast feeding at

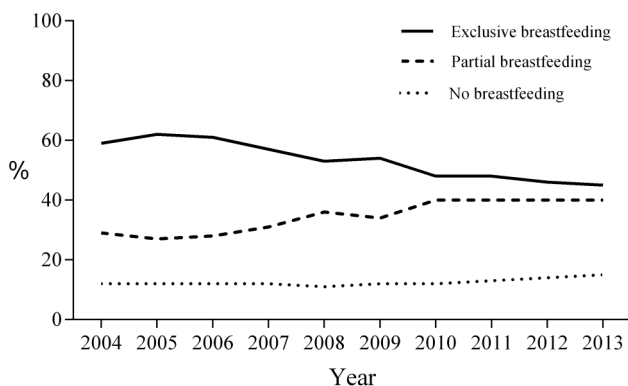


Figure 2 Breastfeeding prevalence in 29 445 preterm infants discharged from Swedish neonatal units: exclusive (n=15 356), partial (n=10 403) and no (n=3686) breast feeding. Data from the Swedish Neonatal Quality register (2004–2013).

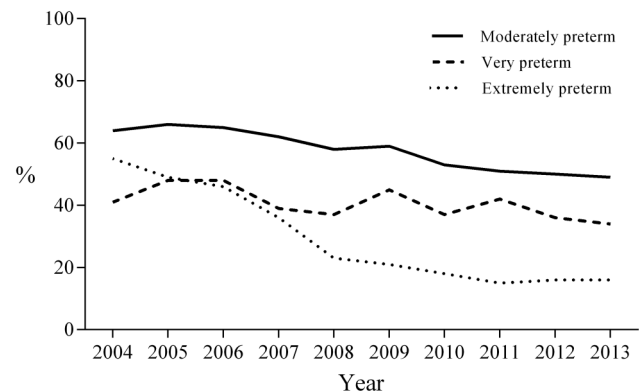


Figure 3 Exclusive breast feeding at discharge from neonatal units, in three gestational age groups: extremely n=550, very n=1848 and moderately n=12 958 preterm infants. Data from the Swedish Neonatal Quality register (2004–2013).

Table 2 ORs and 95% CIs for not breast feeding exclusively in unadjusted and adjusted logistic regression analyses at discharge from neonatal units in extremely preterm infants (GA 22–27 weeks, n=1936)

	n (%)	Percentage of infants exclusively breast fed	Unadjusted OR (95% CI)	Adjusted† OR (95% CI)
Infant birth year			1.28 (1.23 to 1.32) **	1.27 (1.23 to 1.32)**
Maternal factors				
Maternal mental illness				
Yes	59 (3.0)	18%	1.98 (1.0 to 3.94)	
No	1877 (97)	29%	ref	
Pre-eclampsia				
Yes	240 (12)	33%	0.78 (0.59 to 1.05)	
No	1696 (88)	28%	ref	
Caesarean section‡				
Yes	1186 (61)	28%	1.11 (0.90 to 1.35)	
No	749 (39)	30%	ref	
Infant factors				
Multiple birth				
Multiple	499 (26)	19%	2.04 (1.58 to 2.62)**	
Singleton	1437 (74)	32%	ref	
Small for GA				
Yes	162 (8.4)	17%	2.09 (1.37 to 3.20)**	1.95 (1.26 to 3.03)**
No	1774 (91.6)	29%	ref	
Bronchopulmonary dysplasia				
Yes	1056 (55)	27%	1.21 (1.0 to 1.48)	
No	880 (45)	31%	ref	
Retinopathy of prematurity				
Yes	917 (47)	28%	1.01 (0.83 to 1.23)	
No	1019 (53)	28%	ref	
Necrotising enterocolitis				
Yes	132 (6.8)	12%	3.05 (1.79 to 5.19)**	
No	1804 (93.2)	30%	ref	

Data from the Swedish Neonatal Quality register from 2004 to 2013.

*p<0.05.

**p<0.001.

†Adjusted for factors that negatively affected breast feeding *and* which became more prevalent from 2004 to 2013. These factors include small for GA and infant birth year.

‡Data were missing for one infant.

GA, gestational age.

discharge from Swedish neonatal units occurred in preterm infants between 2004 and 2013. The decline in exclusive breast feeding was present in all three GA groups but largest in the extremely preterm infants, with a decrease from 55% to 16%. The decline in exclusive breast feeding in all three GA groups remained statistically significant even after adjusting for factors that were negatively associated with exclusive breast feeding *and* which increased during the study period. Our conclusion is that the investigated maternal, perinatal and neonatal risk factors influence the breastfeeding trend to a limited extent and that other factors are more influential. We can only speculate about potential factors that may have influenced the observed decline in breast feeding.

During the study period, increased attention to the risks of postnatal weight loss and the need for securing postnatal infant weight gain and optimal growth occurred.²⁹ Fortification of breast milk has been increasingly practised in Swedish neonatal units, as a general routine for preterm infants or after individual analysis of

the nutritional content of the breast milk. During 2004–2013, postdischarge formulas were introduced to promote optimal growth. Although these interventions are probably associated with improved short-term outcomes, such as better weight gain, there is no information on long-term outcomes.³⁰ Furthermore, and hypothetically, these strategies may contribute to undermining the mother's aspirations and expectations, triggering a feeling of insecurity about the quality of her breast milk. In a study by Sweet,³¹ parents of very preterm infants reported that the neonatal staff assumed that the breast milk intake was insufficient when their infants had a less than optimal growth. This attitude made parents lose confidence in their ability to breast feed, believing that they 'failed' in breast feeding.

The staffing situation in Swedish neonatal units has changed during the study period,³² with reports of nursing staff shortages from units throughout Sweden. Though we do not have the absolute staffing numbers, with a high workload in the neonatal unit as well and many new staff members, it is likely that lack of time and

Table 3 ORs and 95% CIs for not breast feeding exclusively in unadjusted and adjusted logistic regression analyses at discharge from neonatal units in very preterm infants (GA 28–31 weeks, n=4595)

	n (%)	Percentage of infants exclusively breast fed	Unadjusted OR (95% CI)	Adjusted† OR (95% CI)
Infant birth year			1.04 (1.02 to 1.07)**	1.04 (1.02 to 1.06)**
Maternal factors				
Maternal mental illness				
Yes	153 (3.3)	25%	2.08 (1.44 to 3.02)**	2.00 (1.38 to 2.91)**
No	4442 (96.7)	41%	ref	
Gestational diabetes				
Yes	65 (1.4)	34%	1.32 (0.79 to 2.21)	
No	4530 (98.6)	40%	ref	
Pre-eclampsia				
Yes	895 (20)	39%	1.08 (0.93 to 1.26)	
No	3700 (80)	41%	ref	
Caesarean section‡				
Yes	3143 (68)	37%	1.61 (1.42 to 1.82)**	
No	1449 (32)	48%	ref	
Infant factors				
Multiple birth				
Multiple	1310 (29)	29%	1.97 (1.72 to 2.26)**	
Singleton	3285 (71)	45%	ref	
Small for GA				
Yes	502 (11)	31%	1.58 (1.29 to 1.93)**	1.57 (1.29 to 1.92)**
No	4093 (89)	41%	ref	
Bronchopulmonary dysplasia				
Yes	307 (6.7)	31%	1.52 (1.18 to 1.95)**	
No	4288 (93.3)	41%	ref	
Retinopathy of prematurity				
Yes	219 (4.8)	35%	1.25 (0.94 to 1.67)	
No	4376 (95.2)	40%	ref	
Necrotising enterocolitis				
Yes	60 (1.3)	25%	2.04 (1.13 to 3.66)*	
No	4535 (98.7)	40%	ref	

Data from the Swedish Neonatal Quality register from 2004 to 2013.

*p<0.05.

**p<0.001.

†Adjusted for factors that negatively affected breast feeding and which became more prevalent from 2004 to 2013. These factors include maternal mental illness, small for GA and infant birth year.

‡Data were missing for three infants.

GA, gestational age.

knowledge about breast feeding can affect the support system given to mothers. Much research shows that professional support is important for successful breast feeding.^{12 33}

To promote infants and families' health and well-being,³⁴ many neonatal units in Sweden have been redesigned for single family rooms and parents are encouraged to practise skin-to-skin with their infants for longer periods. Although this physical environment is important for family-centred care,¹⁵ it could be argued that the parents will be left to themselves in single-patient rooms, and that it will be more difficult for the staff to be present, support and promote breast feeding than it is in the open-bay room design.

There are also indications that parents' attitudes towards breast feeding have changed during the past two decades in Sweden. Holmberg *et al*,³⁵ investigating mothers' experiences and feelings related to

breastfeeding initiation, found that mothers experienced breast feeding as more difficult in 2011 than in 1992–1993. Furthermore, in 2011, the mothers perceived higher levels of tension, insecurity and anxiety. Mothers of preterm infants may be even more vulnerable in that obstacles and breastfeeding problems are usually more prominent in this group.³⁶

What is particularly alarming is the significant decline in exclusive breast feeding in the extremely preterm group. It seems unlikely that mothers of extremely preterm infants do not want to breast feed to the same extent as other mothers. Therefore, further research is needed to understand what factors have the greatest impact on breastfeeding rates and how these rates can be improved. Support services and strategies to facilitate breastfeeding rates and exclusivity are important and could enhance health and quality of life in infants and mothers. The support services and strategies should

Table 4 ORs and 95% CIs for not breast feeding exclusively in unadjusted and adjusted logistic regression analyses at discharge from neonatal units in moderately preterm infants (GA 32–36 weeks, n=22 914)

	n (%)	Percentage of infants exclusively breast fed	Unadjusted OR (95% CI)	Adjusted† OR (95% CI)
Infant birth year			1.09 (1.08 to 1.10)**	1.09 (1.08 to 1.10)**
Maternal factors				
Maternal mental illness				
Yes	828 (3.6)	25%	1.74 (1.51 to 2.00)**	1.59 (1.38 to 1.83)**
No	22 086 (96.4)	41%	ref	
Gestational diabetes				
Yes	483 (2.1)	34%	1.42 (1.18 to 1.70)**	
No	22 431 (97.9)	40%	ref	
Pre-eclampsia				
Yes	3040 (13)	39%	1.32 (1.22 to 1.42)**	
No	19 874 (87)	41%	ref	
Caesarean section‡				
Yes	10 079 (44)	37%	1.71 (1.62 to 1.80)**	
No	12 802 (56)	48%	ref	
Infant factors				
Multiple birth				
Multiple	5361 (23)	29%	2.88 (2.70 to 3.07)**	
Singleton	17 553 (77)	45%	ref	
Small for GA				
Yes	1621 (7.1)	31%	1.56 (1.41 to 1.73)**	1.51 (1.36 to 1.67)**
No	21 293 (92.9)	41%	ref	

Data from the Swedish Neonatal Quality register from 2004 to 2013.

*p<0.05.

**p<0.001.

†Adjusted for factors that negatively affected breast feeding and which became more prevalent from 2004 to 2013. These factors include maternal mental illness, small for GA and infant birth year.

‡Data were missing for 33 infants.

GA, gestational age.

focus on both the nutrition and protection components in breast feeding and on promoting breast feeding as a relationship between the mother and infant. This approach will hopefully change society's attitudes, reduce pressure on parents, and benefit both parents and the infant.³⁷ The implementation of the Baby Friendly Hospital Initiative (BFHI) for neonatal units³⁸ is one example of an intervention that could improve breast-feeding prevalence for preterm infants. The neo-BFHI consists of 10 revised steps from the original 10 BFHI³⁹ and 3 guiding principles: the staff attitude towards the mother must focus on the individual mother and her situation, the facility must provide family-centred care, supported by the environment, and the healthcare system must ensure continuity of care. Such an intervention, with a holistic approach and in which relational aspects of care are acknowledged and integrated, should be beneficial for parents and their infants.

Important secondary findings in this study are the increase of factors that negatively affect breast feeding: in the SNQ register mothers of preterm infants in Sweden are reported to have more physical and mental illnesses in 2013 than in 2004, of which many (eg, mental illness,^{40 41} obesity,⁴² gestational diabetes)⁴³ affect breast feeding negatively. The proportion of infants born SGA has increased from 2004 to 2013 and

this increase was associated with a negative effect on exclusive breast feeding. Infants born SGA and who have a rapid weight gain may have an increased risk to develop adiposity, insulin resistance and cardiovascular diseases later in life.⁴⁴ Breast feeding has been shown to reduce the risk of developing some of those conditions, which makes a decline in breast feeding especially troublesome in this group.^{3 44} To the best of our knowledge, this link between SGA and the increased risk for not breast feeding has not been described previously and needs further investigation because of its important implications for children's health.

Although participation in the SNQ register was not mandatory for all neonatal units from the beginning of the study period, the register covers the majority of preterm births in Sweden and therefore the data can be considered representative for the country. The external validity of this study is quite strong because of three factors: the data were collected in a setting of standard clinical practice; the study has a large sample size that enables a better estimation of event rates; and by the 'hard' end points and outcomes. On the other hand, it is difficult to estimate the study's validity when the data quality in the SNQ registry has not been validated. Other limitations are that the SNQ register was not comprehensive from start and that it does not include data

on socioeconomic status (SES), mothers' body mass index or smoking habits, all of which are factors known to affect breast feeding. Maternal SES has shown to be associated with breastfeeding prevalence; mothers with higher SES breast feed to a higher extent and have a longer breastfeeding duration.^{45–47} It is less likely that mothers' SES would affect the result in this study, that is, the decline in breast feeding, since the proportion of mothers with low SES has not changed during this time period (2004–2013) in Sweden.⁴⁸ In the past decade, maternal smoking has decreased in Sweden, which is beneficial for breast feeding. However, maternal overweight/obesity has increased,²⁴ and could potentially be one explanatory factor to the decline in breast feeding. Mother's mental health status was retrieved from free text in the SNQ form, which could have been under-reported. In Sweden, there is an increase from 2007 to 2013 in young women who report mental illness,⁴⁹ which is consistent with the results in our study. The increase in mothers with mental illness and SGA infants raise concern and these groups of mothers and infants need special attention and support in breast feeding.

CONCLUSIONS

Over the course of 10 years (2004–2013), the prevalence of exclusive breast feeding at discharge from the neonatal unit decreased significantly in Swedish preterm infants. The dramatic decrease, especially in the extremely preterm infants, raises concern as this group of infants are the most vulnerable in terms of short-term and long-term health and development. "The findings on the decline in breastfeeding are not only of interest for Sweden." Sweden is known to be a probreastfeeding country with high breastfeeding rates and a beneficial parental financial support during infants' hospitalisation that enables parents' presence. Hence, more research is needed in order to understand the underlying reasons for the decline in breast feeding where almost the opposite could have been expected as more neonatal units in Sweden have single family rooms now compared with a decade ago. Research is needed in different contexts to evaluate the phenomena of breast feeding and how to improve exclusive breast feeding, particularly in mothers of the smallest and most vulnerable infants.

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