Research Article

iMedPub Journals
www.imedpub.com

JOURNAL OF NURSING AND HEALTH STUDIES
ISSN 2574-2825

2018
Vol.3 No.2:4

DOI: 10.21767/2574-2825.1000033

The Impact of Neonatal Service Re-Organisation on Feeding of Preterm Infants (<34 Weeks): A Prospective Cohort Study in a Regional Neonatal Unit from 1992 to 2010

Akuma Oti Akuma[1]*, Sue Jordan[2] and Alan Watkins[3]

1 Neonatal Intensive Care Unit (NICU), Corniche Hospital, Abu Dhabi, UAE
2 College of Human and Health sciences, Swansea University, Swansea, South Wales, UK
3 College of Medicine, Swansea University, Swansea, South Wales, UK

***Corresponding author:**
Akuma Oti Akuma

akumaochibuzo@doctors.org.uk

Neonatal Intensive Care Unit (NICU), Neonatology Department, Corniche Hospital, Abu Dhabi, UAE.

Tel: +971 2 811 7777

Citation: Akuma AO, Jordan S, Watkins A (2018) The Impact of Neonatal Service Re-Organisation on Feeding of Preterm Infants (<34 Weeks): A Prospective Cohort Study in a Regional Neonatal Unit from 1992 to 2010. J Nurs Health Stud. Vol.3 No.2:4

Abstract

Objectives: To describe Neonatal Intensive Care Unit (NICU) feeding practices during the neonatal period and explore predictors of any breast milk feeding at discharge among very preterm infants admitted before and after re-organisation of neonatal services in a region of the UK.

Methods: Data on feeding of preterm infants (<34+0 weeks) at four time-points in the neonatal period and at discharge were collected prospectively on 1018 infants admitted to a regional NICU over a 19-year period. These data were subjected to unadjusted and adjusted analyses and time trends calculated before and after the transition.

Results: Initiation of breast milk feeding in preterm infants increased throughout the study. However, the proportion of infants receiving breast milk declined steadily through the neonatal period and beyond. Before re-organisation, breast milk feeding (any) at discharge increased year-by-year (slope coefficient for trend 0.127, p<0.001). After re-organisation, the trend slowed down/decelerated (slope coefficient for trend 0.071, p 0.32). Any breast milk feeding at day 7 of life, singleton pregnancy, and length of hospital stay were associated with any breast milk feeding at discharge.

Conclusions: Breast milk feeding of preterm infants increased in line with secular trends. However, this trend fell away following neonatal service reorganisation. This finding suggests that service providers and commissioners should monitor infant feeding trends in NICUs against national trends, as a benchmark of maternal and infant wellbeing and service delivery. The early predictors of any breast milk feeding at discharge found in this study need further research to validate their usefulness.

Keywords: Breastfeeding; Breast milk feeding; Preterm infants; Neonatal intensive care unit (NICU); Enteral feeding

Received: June 18, 2018; **Accepted:** July 09, 2018; **Published:** July 23, 2018

Introduction

Human breast milk is accepted as the ideal nutrition for new born infants, including those born preterm [1]. The World Health Organisation (WHO) and other authorities recommend that new born should receive exclusive breast feeding for the first six months of life [2,3]. However, despite this recommendation breast/breast milk feeding rates among new born infants in the UK is among the lowest worldwide [4]. At 34 weeks, infants are unable to suckle effectively. Therefore, we use the term breast/breast milk feeding to include both expressed milk and breastfeeding.

The last quinquennial UK infant feeding survey indicated that respondents' reported breastfeeding initiation has continued to rise since 1990, reaching 81% in 2010 [5]. However, prevalence of breastfeeding has fallen to 69% at 1 week, 55% at 6 weeks and 39% at 6 months. In this 2010 survey 3% of the infants were

born at ≤ 34 weeks gestation and 83% of those born <32 weeks gestation was reportedly admitted to the "special care" unit. It is also worth noting that the 2010 Infant survey may have suffered from a non-response bias, to the exclusion of more deprived socio-demographic groups and those who do not breastfeed. The widespread availability of breastmilk substitutes and the medicalisation of childbirth and nutrition are some of the reasons underlying the low prevalence of breast feeding [6-8]. These factors which are likely to be amplified in the highly medicalised environment of the neonatal intensive care unit (NICU) coupled with prematurity and infant-mother separation further mitigates successful breast milk feeding in this setting [9].

In 2003 the department of health (DoH) recommended the re-organisation of neonatal care in England and Wales into managed clinical networks. The main ethos of this recommendation was that highly specialised intensive care should be provided in a few centres with subsequent repatriation for convalescent care to less specialised centres, preferably closer to home [10]. The DoH report made no recommendation regarding the formal evaluation of the impact of this major service re-organisation on different aspects of neonatal care but there was recognition of the importance of collecting high quality data to explore such impact. Evidence regarding the impact of neonatal service re-organisation is now beginning to emerge from some of the databases established following its implementation [11].

Our neonatal clinical network was inaugurated following the DoH recommendations and underwent a service re-organisation in 2005. This led to cot expansion in our regional neonatal unit to accommodate the increased activity that followed the closure of a neighbouring, smaller neonatal unit. In this study we have reviewed the infant feeding data captured before and after this service re-organisation over a nineteen-year period (1992 – 2010). We aimed to determine the incidence of breast milk feeding in very preterm infants at four time points during the neonatal period and at discharge, and explore the predictors of breast milk feeding at discharge; before and after the neonatal service re-organisation. We hope our study findings will inform future research and interventions into this important aspect of neonatal care.

Materials and Methods

This study was deemed to be a service improvement review, and was approved as such by the hospital's Research and Development department.

Subjects and setting

Study data was prospectively collected and retrospectively extracted and analysed from our NICU database of clinical records. Preterm infants born <34+0 weeks gestation and admitted to the NICU between 1st January 1992 and 31st December 2010 and survived to discharge were eligible for inclusion. This study period naturally divided into two epochs: before and after 1st July 2005, when the neonatal service delivery re-configuration took place in our centre. In-born infants discharged before day 7 of life and out-born infants admitted after day 7 of life were excluded from the study.

Information on the types of milk fed on days 7, 14, 21, 28 and at discharge was extracted from the clinical database. Infant feeding at these five time-points was categorised into four groups:

1) Exclusive breast-milk, whether expressed breast milk (maternal or donor) or breastfeeding,

2) Mixed breast milk and formula feeds,

3) Exclusive formula feeds, and

4) No enteral feeds/interrupted feeds (if previously on enteral feeds). Infants in the last group were receiving parenteral nutrition at the specific time point.

Pertinent maternal and infant demographic data were extracted as in **Table 1**. The mode of delivery was grouped into three categories: unassisted vaginal delivery (breech or cephalic), caesarean section (elective and emergency), and instrumental vaginal delivery (ventouse, forceps or both). No identifiable demographic data were collected.

Statistical methods

Discharge date was used to allocate infants to study epoch. Demographic data were described using percentages for categorical variables and median and inter-quartile ranges for interval variables. Distributions of the interval data were examined, with differences between the two epochs explored using non-parametric methods (Mann-Whitney U-test).

Due to the low numbers exclusively breastfeeding, feeding groups were further conflated into two groups: breast milk or mixed feeding (any breast milk) and exclusively formula milk feeding.

Relationships between demographic variables and enteral feeding on day 7 of life (a proxy for early initiation or absence of breast milk feeding) was explored using univariate, bivariate and multivariate analyses to identify predictors of any breast milk feeding at discharge.

The prevalence of any breast-milk feeding (any) at discharge was explored in a series of binary logistic regressions model using known predictors: feeding method at 7 days (dichotomised as above), sex, singleton/multiple birth, delivery mode (dichotomised as spontaneous or other), gestational age (in weeks), birth weight (in grams), length of hospital stays (in days), and separate time trends (measured in years) covering each epoch.

The two trends were retained throughout, but other non-significant predictors were removed iteratively, starting with the least significant; the final model has all remaining predictors deemed to be statistically significant (with p-values <0.05). No missing data were imputed, so infants discharged or not enterally fed at day 7 were automatically excluded from these models.

Results

Data from 1018 infants born <34+0 weeks gestation who met the study inclusion criteria were reviewed (**Figure 1**), and analysed [using the statistical software package IBM SPSS (Version 22;

2013; IBM, Armonk, New York, USA)]. The first study epoch (1st January 1992 – 30th June 2005) included 575 infants; the second study epoch (1st July 2005 – 31st December 2010) included 443 infants. In total, 76 (42 in the first study epoch, 34 in the second) were discharged or not enterally fed at day 7.

All categorical and interval demographic variables (**Table 1**) were tested using unadjusted and bivariate statistics and no statistically significant differences were observed between study epochs. Interval demographic variables were not normally distributed, indicating the need for non-parametric methods.

Feeding during the neonatal period

Exclusive breast milk feeding in the neonatal period remained low throughout the study period; and varied from an average of 1.7% on day 7 of life to 4.2% on day 28 of life (**Table 2**).

Mixed feeding (formula+breast milk) was the most popular method at all four time-points in the neonatal period, but there was a progressive fall over time in the proportion of infants who were mixed-fed, declining from a high of 73.5% on day 7 to 56.1% on day 28 (**Table 2**).

Infants in the second study epoch were slightly more likely to be receiving any breast milk feeding (exclusive and mixed) at days 7, 14, 21 and 28 in unadjusted analyses (undertaken after excluding those already discharged and those not enterally feeding at the specific time-point in **Table 2**).

There was a significant upward trend in any breast milk feeding on day 7 of life during the first study epoch (X^2=11.05, df=1, p<0.001), but this trend disappeared during the second study epoch (X^2=1.76, df=1, p=0.19; **Table 3**).

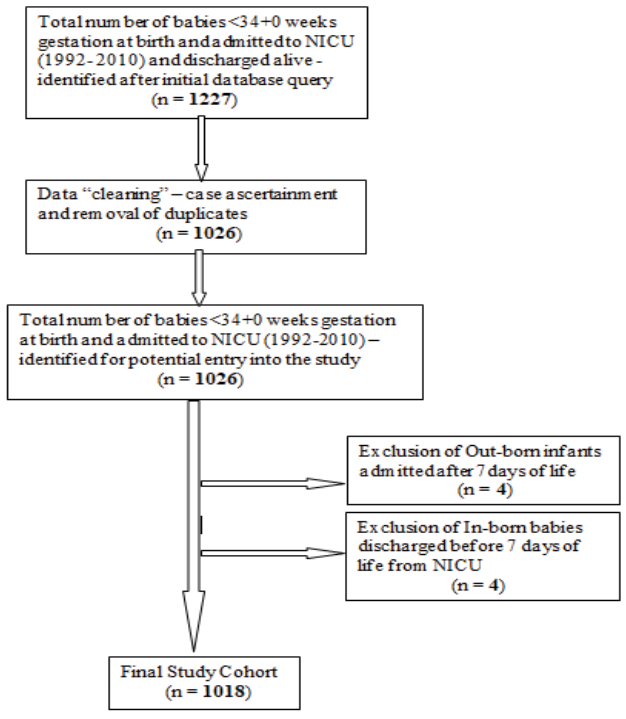

Figure 1 Subject Identification flow chart.

Table 1 Study demographics.

Categorical variables	First study epoch (n=575)		Second study epoch (n=443)	
	n (%)		n (%)	
Gender				
Male	311 (54.1%)		246 (55.5)	
Female	264 (45.9%)		197 (44.5)	
Place of birth				
Inborn	558 (97.0%)		428 (96.6)	
Out born	17 (3.0%)		15 (3.4)	
Number of foetuses in this pregnancy				
Singleton	446 (77.6%)		326 (73.6%)	
Multiple	129 (22.4%)		117 (26.4%)	
Mode of delivery				
Unassisted vaginal	202 (35.1%)		176 (39.7%)	
Caesarean section	350 (60.9%)		243 (54.9%)	
Instrumental delivery	23 (4.0%)		24 (5.4%)	
Interval Variables	**Median [IQR]**	**Full range**	**Median [IQR]**	**Full range**
Gestational age (weeks)	31 [29-33]	22-33	31 [29-33]	24-33
Birth Weight(gms)	1530 [1200-1880]	530-3150	1550 [1180-1900]	550-2828
Hospital stay(days)	30 [21-54]	7-188	32 [21-54]	7-188
Discharge gestation(weeks)	36 [35-37]	32-53	36 [36-37]	33-53
Discharge Weight(gms)	2280 [2070-2570]	1580-4980	2235 [2030-2500]	1530-5290

Note: No variables were normally distributed, indicating the need for non-parametric tests. All variable above were tested using bivariate, unadjusted statistics, and no statistically significant differences were observed.

Trend of milk feeding at discharge

All the study infants were feeding enterally at the time of discharge. The proportion of infants exclusively breast milk feeding at discharge increased slightly from 10.4% in the first study epoch to 13.8% in the second.

Exclusive formula feeding was most popular at discharge; with an average of 68% during the study. However, the proportion of infants receiving exclusive formula feeding fell from 74.8% in the first study epoch to 59.1% in the second (**Table 4**).

Infants in the second epoch were significantly more likely to be receiving any breast milk feeding (exclusive and mixed) in unadjusted analysis. The proportion of infants receiving mixed feeding at discharge increased from 14.8% in the first study epoch to 27.1% in the second study epoch (**Table 4**).

The overall upward trend in any breast milk feeding at discharge found during the study was however most marked during the first study epoch (X^2=18.41, df=1, p<0.001; **Table 5**). This finding is also demonstrated graphically by the upward linear trend during the first study epoch (**Figure 3a**).

Table 2 Patterns of feeding during the neonatal period.

Neonatal period time-point	Infants discharged or not on enteral feeds n (%)	Type of milk feeding	Epochs		
			First n (%)	Second n (%)	Both n (%)
Day 7	76 (7.5)	Breast milk	2 (0.4)	14 (3.4)	16 (1.7)
		Mixed feeding	379 (71.1)	313 (76.5)	692 (73.5)
		Formula feeding	152 (28.5)	82 (20.0)	234 (24.8)
		Total(s)*	533 (100)	409 (100)	942 (100)
Day 14	91 (8.9)	Breast milk	2 (0.4)	39 (9.7)	41 (4.4)
		Mixed feeding	331 (63.3)	279 (69.1)	610 (65.8)
		Formula feeding	190 (36.3)	86 (21.3)	276 (29.8)
		Total (s)*	523 (100)	404 (100)	927 (100)
Day 21	259 (25.4)	Breast milk	4 (0.9)	36 (11.0)	40 (5.3)
		Mixed feeding	237 (55.0)	213 (64.9)	450 (59.3)
		Formula feeding	190 (44.1)	79 (24.1)	269 (35.4)
		Total(s)*	431 (100)	328 (100)	759 (100)
Day 28	465 (45.7)	Breast milk	2 (0.6)	21 (8.7)	23 (4.2)
		Mixed feeding	158 (50.6)	152 (63.1)	310 (56.1)
		Formula feeding	152 (48.7)	68 (28.2)	220 (39.8)
		Total(s)*	312 (100)	241 (100)	553 (100)
Note: *The point total samples excludes infants that had been discharged or not enterally feeding.					

Table 3 Breastfeeding (any) trends on day 7.

Period	N (%) first year of period	N (%) last year of period	Chi sq (df 1)	P
1992-2010	12/22 (54.5)	57/73 (78.1)	19.57	<0.001
1992-2004	12/22 (54.5)	32/38 (84.2)	11.05	0.001
2006-2010	64/74(86.5)	57/73 (78.1)	1.76	0.19
Note: Non-enterally fed or discharged infants excluded.				

Table 4 Patterns of feeding at discharge.

Type of milk feeding n (%)	Epochs		
	First n=575	Second n=443	Both n=1018
Breast milk feeding	60 (10.4%)	61 (13.8%)	121 (11.9%)
Mixed feeding	85 (14.8%)	120 (27.1%)	205 (20.0%)
Formula feeding	430 (74.8%)	262 (59.1%)	692 (68.0%)

Table 5 Breastfeeding (any) trends on discharge.

Period	N (%) 1st year of period	N (%) last year of period	Chi sq (df 1)	P
1992-2010	6/25 (24.0)	37/85 (43.5)	48.0	<0.001
1992-2004	6/25 (24.0)	20/41 (48.8)	18.41	<0.001
2006-2010	32/77 (41.6)	37/85 (43.5)	0.26	0.61
Note: Non-enterally fed infants excluded.				

In contrast, the upward trends in any breast milk feeding at discharge noted during the first study epoch disappeared during the second study epoch (X^2=0.26, df=1, p=0.61; **Table 5**). This is also demonstrated graphically by the almost flat linear trend for the second study epoch (**Figure 3b**).

Predictors of "any breast-milk feeding" at discharge

The binary logistic regression model showed that any breast milk feeding at discharge was significantly and positively associated with both singleton pregnancy and any breast milk feeding on day 7 of life, but significantly and negatively associated with length of hospital stay (**Table 6**).

There was evidence of a temporal trend (that is, a sustained increase over time) in any breast milk feeding at discharge, but this was limited to those infants in the first study epoch, where a statistically significant and positive slope trend coefficient of 0.13 (p<0.001) was observed. The corresponding trend for the second study epoch was not significant, with trend coefficient 0.07 (p=0.317).

The adjusted association of singleton birth and "any breast milk feeding" at discharge was significant (adjusted OR for non-singleton births of 0.43, p<0.001) in contrast, increasing length of hospital stay was negatively associated with "any breast milk feeding" at discharge (an adjusted OR of 0.98, p<0.001).

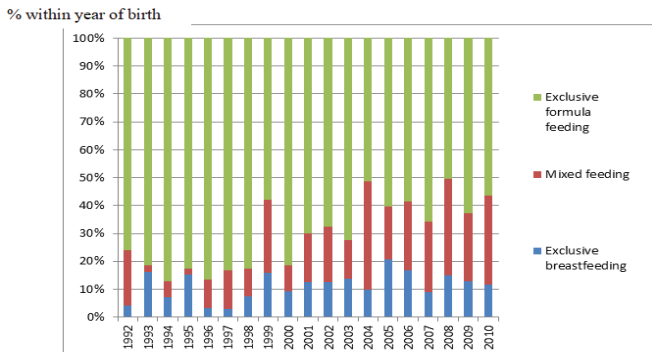

Figure 2 Feeding patterns at discharge during study period 1992-2010 (n=1018).

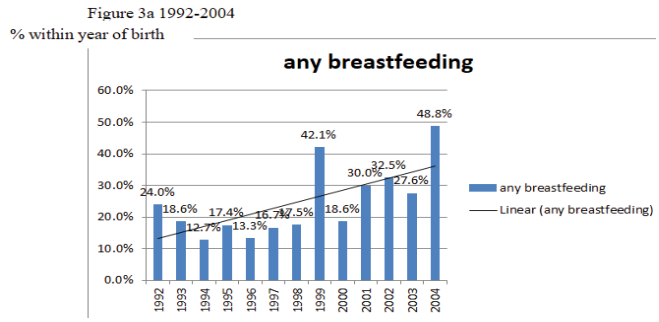

Figure 3a Trend of milk feeding at discharge.

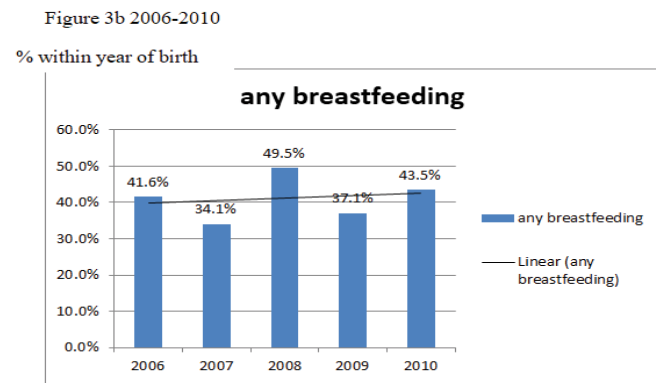

Figure 3b Trend of milk feeding at discharge.

Table 6 Predictors of any breast milk (exclusive or mixed) feeding at discharge.

Variable	Coefficient	p-value	OR (95% CI)	Model
First epoch trend (years)	0.1271	<0.001	1.135 (1.069, 1.207)	Final
Second epoch trend (years)	0.0711	0.317	1.074 (0.934, 1.234)	Final
Gender (male*, female)	-0.0830	0.604	0.920 (0.673, 1.259)	Dropped [2]
Number of foetuses (singleton*, multiple)	-0.8359	<0.001	0.433 (0.297, 0.633)	Final
Delivery mode (spontaneous*, other)	0.0913	0.583	1.096 (0.791, 1.517)	Dropped [3]
Gestational age (weeks)	-0.0018	0.980	0.998 (0.866, 1.150)	Dropped [1]
Birth weight (grammes)	0.00018	0.531	1.0002 (0.9996, 1.0007)	Dropped [4]
Hospital stay (days)	-0.0177	<0.001	0.982 (0.976, 0.989)	Final
Feeding at 7 days (exclusively formula*, any breast milk)	2.8945	<0.001	18.07 (9.52, 34.31)	Final
Note: Reference category denoted by *				

Other demographic variables including: gestational age, gender, birth weight and delivery mode were found during the modelling process to be non-significant predictors of any breast milk feeding at discharge in this study, and hence do not appear in the final model.

Discussion

Enteral feeding practices among preterm infants admitted to NICUs varies in type of milk, route of feeding, frequency of feeding and rates of advancement [12]. The process of feeding the preterm infant with breast milk is generally divided into three phases: initiation, maintenance (breast milk feeding) and transition to breast feeding at or before discharge from hospital [13]. Each of these three phases can be affected by: prematurity, separation between infant and mother, the health of the mother following childbirth, multiple pregnancies and the infant's clinical course.

Reassuringly the majority of the cohort (92.5%) received some enteral feeding on day 7 of life. This time point is important given that delivery by caesarean section was expectedly more prevalent (55% to 61%) in this cohort of preterm infants than in the wider population and these mothers, particularly those undergoing emergency sections, may be more likely to experience physiological constraints to breast feeding than those who confined naturally [14-18]. Also, 75.2% of the infants on day 7 of life received some form of breast milk (exclusive or mixed feeding) which suggests that many women who deliver preterm are initiating breast milk feeding early. This finding resonates with the UK infant feeding surveys [19,20]. However, the observed marked upward trend in initiation of breast milk feeding seen 1992 – 2004 had ceased by 2006. This reversal of secular trends following service reconfiguration is of concern and should be monitored.

Despite the evidence of increased initiation of breast milk feeding in preterm infants, this is not usually sustained during the first month of life. There was a steady decline in any breast milk feeding week by week as illustrated in **Table 2**. More infants changed from mixed feeding to exclusive formula rather than to exclusive breast milk feeding at all four time points during the first month of hospital stay. This declining trend in breast milk feeding culminated in a prevalence of 32% at discharge (range 25.2% to 40.9%) across the study period (1992-2010) in **Table 4**. Whilst we are getting better at encouraging more mothers to provide breast milk for their preterm infants in the early period

of their NICU stay, there is less success in maintaining lactation for the duration of hospital stay. This is a cause for concern, given that breast milk supply will cease if lactation is not maintained [21]. However, infants born after the service re-organisation in 2005 were more likely to receive any breast milk feeds at all four time points in the neonatal period and at discharge. Similarly, the practice of exclusive formula feeding early in life changed during the study period, with an overall trend away from exclusive formula feeding between 1992 and 2010 on a yearly basis: the rate of exclusive formula feeding at discharge fell from 75% before 2005 to 59.1% thereafter.

The average length of hospital stay in our study was one month and the longest duration of stay by any infant was six months. Both time frames fall within the current recommendations for exclusive breast feeding in newborn infants [2,3]. Our findings therefore raise pertinent question regarding whether exclusive breast milk feeding is a realistic target in very preterm infants admitted to NICUs? The barriers to successful maintenance of lactation by nursing mothers following preterm birth are well documented including: mother/baby separation, the fragility and limited neurological competence of preterm and sick infants, anxiety and stress following delivery of a high risk baby and potentially suboptimal staff attitude and lack of lactation support [9, 22]. However, there has always been the assumption that these obstacles are easily surmountable and that breast milk feeding can be successfully achieved in all infants admitted to NICUs. Clinicians should therefore bear our report of declining upward trends of breast-milk feeding in mind when planning service reconfiguration and breast-feeding support/intervention in this group of women.

The few existing studies on early predictors of breast milk feeding at discharge among the preterm population admitted to NICU have yielded conflicting findings [23-27]. We found that singleton birth, more recent year of birth (during the 1st epoch) and “any breast milk” feeding on day 7 of life are positively associated with “any breast milk feeding” at discharge. On the contrary, longer hospital stay had a negative association with “any breast milk feeding” at discharge. Birth weight, birth gestation and mode of delivery had no association with “any breast milk feeding” at discharge. These are potentially important findings which need further evaluation to ascertain their usefulness in guiding future breast milk feeding interventions in NICU.

Moreover, while some of these predictors are expected, feeding on day 7 is novel. The “non-effect” of mode of delivery on feeding on discharge means that infant feeding on day 7 is most likely relevant to both mothers who deliver surgically and naturally. It is fair to state that by day 7 after delivery most mothers, irrespective of delivery mode, will have recovered from labour and confinement sufficiently to be physically able to provide breast milk for their infant. This being the case, we opine that this period in a newly-born baby’s life provides another “window of opportunity” for targeted breast feeding support which could influence breast milk feeding outcomes at the time of discharge. The importance of such early intervention is highlighted in an economic analysis, indicating that breastfeeding support is cost-effective in neonatal units [28]. In contrast, randomised controlled trials of community breastfeeding support initiatives in the UK indicate no benefit [29- 31].

Limitations of our study

Our study period spans almost two decades and it can be argued that feeding practices in NICU have changed over this period. However, the feeding practices in our later epoch (2005-2010) are current and therefore comparable with practices in similar NICUs in the industrialised world. Moreover, the patient demographics and outcomes were largely unchanged throughout the study period which suggests that the factors affecting preterm feeding in NICU remain unchanged and hence our findings are pertinent and relevant today.

We excluded inborn infants discharged before day 7 of life and out-born infants admitted after day 7 of life in order to capture the data of interest at all four time points in the neonatal period. Likewise, infants who died before discharge from hospital was also excluded from the study in order to enable us explore feeding at discharge and its predictors. Exclusion of these infants did not affect the results because of the small numbers involved. We also acknowledge that there were far more years in the 1st study epoch than the 2nd epoch period but the number of infants in each period and the demographic variables were not significantly different. Finally, although the study data were collected from a single regional neonatal centre in the UK, the issues raised are likely to be of importance across the UK and most industrialised and developing world.

Conclusion

Our study shows that more infants now receive breast milk in the first week of life. However, the increased initiation of breast milk feeding is not usually sustained throughout the neonatal period and beyond. Moreover, the upward trend in breast milk feeding almost ceased in 2005, a development that should be monitored closely. Breast milk feeding at day 7 appears to be a novel predictor of any breast milk feeding at discharge. This finding, if confirmed, should inform breast milk feeding interventions in NICUs. Our study findings can also form the basic template for organisations and countries interested in monitoring the impact of neonatal service re-organisation on preterm feeding practises. Similarly, this dataset can also help refocus data collection on preterm infant feeding in NICUs, to capture all aspects of preterm breast milk feeding – from initiation to maintenance and ultimate transition to breast feeding at discharge.

Acknowledgment

We would like to acknowledge the following who helped us with data collection: Dr Mark Drayton, Dr Catherine Britton-Jones, Dr Jennifer Calvert and Dr Alok Sharma.

Financial Support and Sponsorship

Nil.

Conflicts of Interest

Authors declare there are no conflicts of interest.

References

1 Schanler RJ (2001) The use of human milk for premature infants. Pediatr Clin North Am 48: 207-219.

2 Kramer MS, Kakuma R (2012) Optimal duration of exclusive breastfeeding. Cochrane Database Syst Rev 8*:* 3517.

3 World Health Organization (2001) Report of the expert consultation of the optimal duration of exclusive breastfeeding. Geneva: Switzerland.

4 Dyson L, Renfrew M, Mc Fadden A, Mc Cormick F, Herbert G, et al. (2006) Promotion of breastfeeding initiation and duration. Evidence into practice briefing. London: NICE.

5 McAndrew F, Thompson J, Fellows L, Large A, Speed M, et al. (2012) Infant feeding survey 2010. Leeds: Health and Social Care Information Centre 2: 1.

6 Renfrew MJ, Dyson L, Wallace L, D'Souza L, McCormick F, et al. (2005) The effectiveness of public health interventions to promote the duration of breastfeeding. London: National Institute for Health and Clinical Excellence 9.

7 Smale M, Renfrew MJ, Marshall JL, Spiby H (2006) Turning policy into practice: More difficult than it seems. The case of breastfeeding education. Maternal & child nutrition 2: 103-113.

8 Dykes F (2006) Breastfeeding in hospital: Mothers, midwives and the production line. Routledge.

9 Davanzo R, Pastore S (2011) Promoting mother's milk use in very low birth weight infants: When nutritional hierarchy deals with the professional value system. J Hum Lact 27: 329-330.

10 Department of Health (2003) Neonatal intensive care services: Report of the department of health expert working group. Available from www.dh.gov.uk/ (centralisation).

11 Gale C, Santhakumaran S, Nagarajan S, Statnikov Y, Modi N (2012) Impact of managed clinical networks on NHS specialist neonatal services in England: Population based study. BMJ 344: e2105.

12 Klingenberg C, Embleton ND, Jacobs SE, O'connell LA, Kuschel CA (2011) Enteral feeding practices in very preterm infants: An international survey. Arch Dis Child Fetal Neonatal Ed. 97: 56-61.

13 Hurst NM (2007) The 3 M's of breast-feeding the preterm infant. J Perinat Neonatal Nurs 21: 234-239.

14 Jordan S, Emery S, Watkins A, Evans JD, Storey M, et al. (2009) Associations of drugs routinely given in labour with breastfeeding at 48 hours: Analysis of the Cardiff Births Survey. BJOG 116: 1622-1632.

15 Chien LY, Tai CJ (2007) Effect of delivery method and timing of breastfeeding initiation on breastfeeding outcomes in Taiwan. Birth 34: 123-130.

16 Rowe-Murray HJ, Fisher JR (2002) Baby friendly hospital practices: Caesarean section is a persistent barrier to early initiation of breastfeeding. Birth 29: 124-131.

17 Forster DA, McLachlan HL (2007) Breastfeeding initiation and birth setting practices: A review of the literature. J Midwifery Women's Health 52: 273-280.

18 Rajan L (1994) The impact of obstetric procedures and analgesia/ anaesthesia during labour and delivery on breast feeding. Midwifery 10: 87-103.

19 Hamlyn B, Brookes S, Oleinikova K, Wands S (2002) Infant Feeding Survey 2000. The Stationery Office (TSO), London.

20 The NHS Information Centre IFF Research (2011) Infant feeding survey: Early results. The Health and Social Care Information centre.

21 Blackburn ST (2007) Prenatal period and placental physiology. Maternal, fetal and neonatal physiology, a clinical perspective pp: 99-110.

22 Davanzo R, Monasta L, Ronfani L, Brovedani P, Demarini S, et al. (2013) Breastfeeding at NICU discharge: A multi-centre Italian study. J Hum Lact 29: 374-380.

23 Espy KA, Senn TE (2003) Incidence and correlates of breast milk feeding in hospitalized preterm infants. Soc Sci Med 57: 1421-1428.

24 Powers NG, Bloom B, Peabody J, Clark R (2003) Site of care influences breastmilk feedings at NICU discharge. J Perinatol 23: 10-13.

25 Lee HC, Gould JB (2009) Factors influencing breast milk *versus* formula feeding at discharge for very low birth weight infants in California. J Pediatr 155: 657-662.

26 Killersreiter B, Grimmer I, Bührer C, Dudenhausen JW, Obladen M (2001) Early cessation of breast milk feeding in very low birthweight infants. Early Hum Dev 60: 193-205.

27 Pineda RG (2011) Predictors of breastfeeding and breastmilk feeding among very low birth weight infants. Breastfeed Med 6: 15-19.

28 Renfrew MJ, Craig D, Dyson L, Mc Cormick F, Rice S, et al. (2009) Breastfeeding promotion for infants in neonatal units: A systematic review and economic analysis. Health Technol Assess 13: 1-146.

29 Hoddinott P, Britten J, Prescott GJ, Tappin D, Ludbrook A, et al. (2009) Effectiveness of policy to provide breastfeeding groups (BIG) for pregnant and breastfeeding mothers in primary care: Cluster randomised controlled trial. BMJ 338: a3026.

30 Mac Arthur C, Jolly K, Ingram L, Freemantle N, Dennis CL, et al. (2009) Antenatal peer support workers and initiation of breast feeding: Cluster randomised controlled trial. BMJ 338: b131.

31 Balogun OO, O'Sullivan EJ, McFadden A, Ota E, Gavine A, et al. (2016) Interventions for promoting the initiation of breastfeeding. Cochrane Database Syst Rev 11: CD001688.