



ELSEVIER

Contents lists available at ScienceDirect

Midwifery

journal homepage: www.elsevier.com/midw

Early life factors associated with the exclusivity and duration of breast feeding in an Irish birth cohort study

Hazel Ann Smith, RM, MSc (PhD candidate)^{a,*}, Jonathan O'B Hourihane, MB, DM, FRCPI (Professor of Paediatrics & Child Health)^a, Louise C. Kenny, MB, ChB(hons), PhD, MRCOG (Professor of Obstetrics/Director of INFANT)^{b,c}, Mairead Kiely, BSc, PhD, DISDip, PG Dip T&L in Higher Education (Senior Lecturer in Human Nutrition)^{b,d}, Deirdre M. Murray, MB, MRCPI, PhD (Consultant Paediatrician and Senior Lecturer in the Department of Paediatrics and Child Health)^{a,b}, Patricia Leahy-Warren, PhD, MSc (research), Hdip PHN, BSc, RPHN, RM, RGN (Senior Lecturer with the School of Nursing & Midwifery)^e

^a Paediatrics & Child Health, Clinical Investigations Unit, Cork University Hospital, Wilton, Cork, Ireland

^b Irish Centre for Fetal and Neonatal Translational Research (INFANT), Cork University, Maternity Hospital, 5th Floor, Wilton, Cork, Ireland

^c Department of Obstetrics and Gynaecology, Cork University Maternity Hospital, 5th Floor, Wilton, Cork, Ireland

^d School of Food and Nutritional Sciences, Food Science Building, University College, Cork, Ireland

^e School of Nursing & Midwifery, Brookfield Health Sciences Complex, University College Cork, Ireland

ARTICLE INFO

Article history:

Received 12 January 2015

Received in revised form

22 April 2015

Accepted 26 April 2015

Keywords:

Breast feeding

Parental leave

Intensive care units

Newborn: birth-1 month

Infant: 1-23 month

ABSTRACT

Objective: to investigate the influence of parental and infant characteristics on exclusive breast feeding from birth to six months of age and breast feeding rates at two, six and 12 months of age in Ireland.

Methodology: secondary data analysis from the Cork BASELINE Birth Cohort Study (<http://www.baselinestudy.net/>). Infants were seen at birth and two, six, and 12 months of age. Maternal and paternal history, neonatal course and feeding data were collected at birth and using parental questionnaires at each time point.

Participants: 1094 singleton infants of primiparous women recruited at 20 weeks' gestation who were breastfeeding on discharge from the maternity hospital.

Findings: at discharge from the maternity hospital and at two months, neonatal intensive-care unit admission had the strongest influence on exclusive breast feeding status (adjusted OR 0.17, 95% CI 0.07–0.41 at discharge) and at two months (adjusted OR=0.20, 95% CI 0.05–0.83). A shorter duration of breast feeding was significantly associated with younger maternal age, non-tertiary education, Irish nationality and neonatal intensive-care unit admission. There was a significant difference in the duration of any breast feeding between infants who were and were not admitted to the neonatal intensive-care unit, 28(10.50, 32) weeks versus 32(27, 40) weeks. Mothers whose maternity leave was between seven and 12 months (adjusted OR=2.76, 95% CI 1.51–5.05) breast fed for a longer duration compared to mothers who had less than six months of maternity leave.

Key conclusions: admission to the neonatal intensive care unit negatively influenced both exclusivity and duration of breast feeding. Length of maternity leave, and not employment status, was significantly associated with duration of breast feeding.

Implications for practice: additional support may be required to ensure continued breast feeding in infants admitted to the neonatal intensive-care unit. Length of maternity leave is a modifiable influence on breast feeding and offers the opportunity for intervention to improve our rates of breast feeding.

© 2015 Elsevier Ltd. All rights reserved.

Introduction

In 2003 Ireland adopted the World Health Organization (WHO) recommendations for exclusive breast feeding in the first six

months of life (Department of Health & Children, 2003). Recently there has been an increase in breast feeding initiation rates in Irish maternity hospitals (Health Research and Information Division, 2013) but this has not translated into increased duration of breast

* Corresponding author.

E-mail address: smith.hazelann@gmail.com (H.A. Smith).

feeding for either “exclusive” or “any” breast feeding. Ireland continues to have one of the lowest breast feeding rates internationally (The Economic and Social Research Institute, 2012).

Breast feeding is an intricate health behaviour and studies have shown that the reasons and influences for mothers to breast feed are multifactorial and complex. Empirical research has found postnatal depression, anxiety, social/paternal support to be among factors influencing the duration of exclusive breast feeding. Overall, maternal self-efficacy was the most reported psychosocial factor and it was found to be the most effective in influencing exclusive breast feeding duration (De Jager et al., 2013).

Internationally, demographic factors, such as maternal age, smoking, employment and education level, marital status and household income have all been found to significantly influence breast feeding duration (Dennis et al., 2013). There is limited research focusing on the predictors of exclusive breast feeding and studies that have examined exclusive breast feeding have found conflicting results (Dubois and Girard, 2003; Scott et al., 2006; Chudasama et al., 2008; Kristiansen et al., 2010; Jones et al., 2011; Tan, 2011; De Jager et al., 2013; Dennis et al., 2013; Vieira et al., 2014).

Hospital practices have also been shown to influence breast feeding rates (Giovannini et al., 2005; Merten et al., 2005). The critical role that maternity services provide in promoting and supporting breast feeding has been recognised internationally (World Health Organization and UNICEF, 1989). In 1991 the WHO and UNICEF developed the Baby Friendly Hospital Initiative (BFHI) in an effort to promote best breast feeding practices in hospitals to protect and strengthen breast feeding rates (World Health Organization, 1998).

Studies specific to the Irish breast feeding population have examined which factors are associated with any breast feeding (Tarrant et al., 2011b; Leahy-Warren et al., 2014) but not exclusive and few have descriptively described which mothers were exclusively breast feeding (Belgley et al., 2008; Williams et al., 2010).

We wished to examine the early life factors which affected duration of breast feeding and exclusivity of breast feeding in a prospective maternal-infant cohort.

Methods

Design and setting

The Cork BASELINE Birth Cohort Study (www.baselinestudy.net) is a longitudinal birth cohort study following singleton infants of low-risk primigravida mothers who participated in the SCOPE Ireland Study (www.scopestudy.net). Participants were recruited, between 2008 and 2011, at 20 weeks' gestation from the SCOPE Ireland Study. Details of the Cork BASELINE Birth Cohort Study have been previously reported (O'Donovan et al., 2014).

All infants were born in a single large maternity hospital, which has a BFHI certificate of membership. A certificate of membership is awarded to hospitals that are participating in the initiative but do not yet meet the criteria for BFHI accreditation. Infants were returned to a separate research suite for study visits at two, six, and 12 months of age. Infants who were born preterm ($\leq 36^{+6}$ gestational weeks) were seen at their corrected age for each of the appointments. Each assessment involved face-to-face questionnaires and growth measurements. If mothers were unable to attend a study visit they were offered a telephone interview.

Data collection

The clinical research ethics committee of the Cork Teaching Hospitals provided ethical approval for both the SCOPE Ireland

Study (ref ECM5(10) 05/02/08) and the Cork BASELINE Birth Cohort Study (ref ECM5(9) 01/07/2008).

Maternal and paternal body mass index (BMI) was measured at 15 ± 1 weeks' gestation. Maternal and paternal BMI groups were classified as per WHO guidelines (World Health Organization, 2006). Mothers were screened for gestational diabetes as per the local maternity unit guidelines. Pre-existing diabetes was an exclusion criterion for the SCOPE Ireland Study.

Information on intrapartum (mode of childbirth, infant sex, birth weight & gestational age at childbirth) and neonatal (method of feeding, length of stay in the maternity hospital and if applicable: admission to neonatal intensive-care unit (NICU), reason for admission to NICU and length of stay in the NICU) events were collected from the maternity records, prospectively, by a single research midwife. Gestational age at childbirth was classified as preterm ($\leq 36^{+6}$ gestational weeks) or term ($\geq 37^{+0}$ gestational weeks).

Demographic details (marital status, tertiary education, employment status and job title, household income, maternal and paternal nationality, maternal date of birth and type of maternity care) and smoking status during pregnancy were collected at two months. Socio-economic status (SES) was determined using the Irish Central Statistical Office (CSO) guidelines (Central Statistics Office, 2006). The age (months) of infant when the mother returned to work was collected at both the six and 12 months of age appointments.

Infants were categorised as exclusively breast fed per WHO definitions if they received breast-milk only (with the exception of medicines, vitamins, minerals and oral rehydration solution). Partial breast feeding included infants who had received any artificial feeds and/or solid food (World Health Organization, 2001).

Statistical analyses

Anonymised data were entered prospectively into a password protected internet database. For analysis, data were transferred to IBM SPSS Statistics 20 (IBM Corp., Armonk, NY). Continuous variables are shown as mean (SD), unless otherwise stated, and categorical variables are presented as numbers and percentages. Statistical significance was achieved for p values ≤ 0.05 .

Descriptive analysis was undertaken to determine the prevalence of exclusive breast feeding and rates of breast feeding at each time point. χ^2 test examined for associations between maternal, paternal and infant characteristics with exclusive breast feeding at discharge from the maternity hospital and at two and six months of age and breast feeding rates at each of the study visits in the first year of life (two, six and 12 months of age). Breast feeding duration was tested using Mann-Whitney test when examining between two categories and Kruskal-Wallis test was employed when investigating across three or more categories. Breast feeding duration is presented as median (25th and 75th percentile).

Significant factors, identified through univariate analysis, were entered into logistic regression models to assess for the adjusted odds ratio (adjusted OR) for exclusive breast feeding at discharge from the maternity hospital and at two and six months and on breast feeding rates at two, six and 12 months of age.

Findings

At 20 weeks' gestation 1537 mothers consented for their child to participate in the Cork BASELINE Birth Cohort Study and 1094 (71.18%) were exclusively or partially breast feeding their infant on discharge from the maternity hospital. The response rate of breast-feeding mothers at two, six and 12 months was 999 (91.3%), 966 (88.3%) and 909 (83.1%), respectively. In total, 874 (79.9%) of

breast-feeding mothers attended all three appointments with their infants. There was no evidence that mothers who did not respond at follow-ups differed from those who did in any important respects.

The majority of mothers were married (70.9%) or co-habiting with their partner (20.6%) and 58.0% had a university (degree or higher) qualification. A minority (5.7%) of mothers reported smoking during their pregnancy. Over half of the infants were delivered vaginally (unassisted 37.4% and instrumental 37.1%). Mean (SD) gestational age was 39.94 (1.66) weeks and average birth weight was 3.47 (0.53) kg. In total 12.7% of the cohort were admitted to the NICU, see Table 1. Respiratory distress (32.4%), requiring phototherapy (28.1%) and other (25.2%) were the three most common reasons reported for admission to the NICU. Other reasons listed included, in order of frequency: infection, preterm childbirth, feeding problems, hypoglycaemia, cyanosis, birth asphyxia, small-for-gestational age and congenital abnormality.

Hospital records showed that at discharge 469 (42.9%) of infants left the maternity hospital exclusively breast feeding and the remaining 625 (57.1%) breast-fed infants had received artificial milk supplementation at least once prior to discharge.

Exclusive breast feeding at discharge

In univariate analysis factors associated with exclusive breast feeding at discharge included: normal maternal and paternal BMI status, unassisted vaginal childbirth of a term infant who was not

admitted to the NICU, infant birth weight between 2.51 and 3.99 kg and staying four days or less in the maternity hospital following childbirth.

Once all significant factors were entered into logistic regression, paternal BMI, preterm childbirth and birth weight groups no longer significantly influenced exclusive breast feeding. Admission to the NICU had the strongest influence on a mother not exclusively breast feeding her infant at discharge from the maternity hospital. The odds of an infant, who was admitted to the NICU, being exclusively breast fed on discharge from the maternity hospital were over five times lower (adjusted OR=0.17, 95% 0.07–0.41) compared to infants who were not admitted to the NICU (Table 2). In total 92.1% of breast-feeding infants admitted to the neonatal unit had been given artificial milk supplementation prior to discharge.

Admission to the NICU was examined further to see if the reason for admission or the length of stay affected the rate of exclusive breast feeding. None of the listed reasons for admission to the NICU or length (days) of stay in the NICU was not associated with exclusive breast feeding at discharge.

Exclusive breast feeding at two months

At two months of age maternity care practices (mode of childbirth, length of stay in the maternity hospital following childbirth and admission to the NICU) continued to be the most commonly associated factors with exclusive breast feeding.

Table 1
Baseline characteristics of study participants.

	N	%
Infant sex		
Male	546	49.9
Female	548	50.1
Admission to neonatal unit		
No	955	87.3
Yes	139	12.7
Maternal age		
19–23 years	49	4.5
24–28 years	191	17.5
29–33 years	586	53.6
34–38 years	225	20.6
39–43 years	42	3.8
44–48 years	1	0.09
Maternal BMI		
Normal (18.5–24.99)	671	61.3
Underweight (< 18.5)	12	1.1
Overweight (25–29.99)	298	27.2
Obese (30–40.50)	110	10.1
Maternal tertiary education		
No	399	36.5
Yes	634	58.0
Maternal employment*		
Unemployed	96	8.8
Employed	937	85.6
Maternity leave*		
< 6 months	95	8.7
6 months	123	11.2
7–12 months	535	48.9
> 12 months	1	0.1
Maternal Nationality		
Born in Ireland	809	73.9
Born outside of Ireland	224	20.5
Paternal BMI		
Normal (18.5–24.99)	267	24.4
Underweight (< 18.5)	1	0.1
Overweight (25–29.99)	455	41.6
Obese (30–60.0)	115	10.5

* % does not equal 100 as some data are missing as not all mothers completed questions based on their employment.

Table 2
Adjusted odds ratios for exclusive breast feeding at birth ($n=834$) and two months ($n=601$).

	Birth Adjusted OR (95% CI)	2 months Adjusted OR (95% CI)
Gestational age at childbirth		
Preterm (≤ 36 w 6d)	0.26 (0.06–1.12)	
Term (≥ 37 w 0d)	1	
Mode of childbirth		
Unassisted vaginal childbirth	1	1
Assisted vaginal childbirth	0.70* (0.49–0.98)	0.66 (0.42–1.02)
Elective caesarean section	1.40 (0.69–2.87)	2.56 (1.00–6.56)
Emergency caesarean section	0.80 (0.41–1.57)	1.08 (0.41–2.83)
Birth weight groups		
≤ 2.50 kg	1.90 (0.35–10.29)	
2.51–3.99 kg	1	
≥ 4 .kg	0.98 (0.62–1.53)	
Admission to neonatal unit		
No	1	1
Yes	0.17 (0.07–0.41)***	0.20 (0.05–0.83)**
Duration of stay in the maternity hospital		
1 day	1	1
2 days	0.44 (0.18–1.04)	1.82 (0.66–5.00)
3 days	0.42 (0.18–1.01)	1.09 (0.39–2.98)
4 days	0.17 (0.06–0.47)**	0.49 (0.14–1.71)
5 days	0.09 (0.03–0.30)***	0.17 (0.31–0.92)*
6 days	0.52 (0.01–0.51)*	0.00 (0.00)
≥ 1 week	0.27 (0.40–1.80)	1.07 (0.12–9.41)
Maternal BMI		
Underweight (< 18.5)	3.11 (0.73–13.24)	0.42 (0.90–19.27)
Normal (18.5–24.99)	1	1
Overweight (25–29.99)	0.86 (0.61–1.21)	0.74 (0.47–1.17)
Obese (30–40.50)	0.40 (0.23–0.69)**	0.34 (0.13–0.85)**
Paternal BMI		
Normal (18.5–24.99)	1	
Overweight (25–29.99)	0.75 (0.56–1.09)	
Obese (30–40.50)	0.65 (0.39–1.07)	

* $p \leq 0.005$.

** $p \leq 0.01$.

*** $p \leq 0.001$.

In adjusting for all identified significant factors, admission to the NICU remained the strongest predictor of exclusive breast feeding at two months of age. The odds of an infant, who was admitted to the NICU, being exclusive breast fed at two months were five times lower (adjusted OR=0.20, 95% 0.05–0.83) compared to infants who were not admitted to the NICU (Table 2). Maternal obesity and prolonged length of stay in the maternity hospital (more than five days) were also associated with a reduction in exclusive breast feeding at two months (Table 2).

Admission to the NICU was again investigated further to see if the reason for NICU admission or if the NICU length of stay also increased the odds for a mother to have stopped exclusive breast feeding before two months. The reasons for admission which were negatively associated with rates of exclusive breast feeding at two months were birth asphyxia ($p=0.020$) and infection ($p=0.049$). Length of stay in the NICU was negatively associated with exclusive breast feeding at two months, ($p=0.001$).

Exclusive breast feeding at six months

Our cohort had extremely low rates of exclusive breast feeding at six months 7/909 (0.7%). Older maternal age was the only variable found to be significantly associated with exclusive breast feeding as per WHO recommendations of six months ($p \leq 0.001$). This may be due to the small sample size of seven mothers that did exclusively breast fed for six months, which limited our ability to investigate for any predictive factors.

Breast feeding duration

Rates of exclusive breast feeding dropped by 39.6% in the first eight weeks of life and only seven mothers reported exclusive breast feeding for the first six months of life. By 12 months of age 8.0% ($n=87$) of infants were receiving any breast-milk, no infant was exclusively breast fed at 12 months of age, see Fig. 1. Duration of breast feeding significantly differed between infants who were exclusively breast fed on discharge from the maternity hospital and those that had been supplemented with artificial milk in the postnatal period. Infants that were not exclusively breast fed on discharge were breast fed for a shorter period of time: 30 (25.50, 37) weeks versus 32 (28, 42) weeks, $p < 0.001$.

Overall, infants who left the maternity hospital exclusive breast fed had significantly greater odds of being breast feeding at two months (adjusted OR=3.02, 95% CI 2.22–4.10), six months (adjusted OR=2.04, 95% CI 1.40–2.98) and 12 months (adjusted OR=2.03, 95% CI 1.12–3.67) compared to infants that left the maternity hospital partially breast fed, see Tables 3–5.

Maternal and paternal nationality, maternal tertiary education, preterm childbirth and admission to the NICU were all significantly associated with breast feeding status at each time point.

There was a significant difference in the duration of any breast feeding between infants who were and were not admitted to the NICU; 28 (10.50, 32) weeks versus 32 (27, 40) weeks, $p=0.019$. No significant difference was found between duration of breast feeding and any of the listed reasons for admission ($p=0.250$).

The odds of a mother, born outside of Ireland, to be breast feeding at two months (adjusted OR=2.43, 95% CI 1.59–3.73) were twice that of a mother born in Ireland and this trend continued at

six months (adjusted OR=2.39, 95% CI 1.46–3.91). In maternal age groups, the odds of a mother, aged 19–23 years, to be breast feeding at two months (adjusted OR=0.38, 95% CI 0.17–0.86) were lower compared to mothers aged 30–34 years-old, no other age group significantly influenced breast feeding at two months. Mothers with a tertiary education had nearly twice the odds to be breast feeding at two months compared to mothers with no tertiary education (adjusted OR=1.88, 95% CI 1.38–2.57), see Table 3.

At six months maternal tertiary education continued to positively influence breast feeding rates. Mothers with a tertiary education had greater odds to be breast feeding compared to mothers with no tertiary education (adjusted OR=1.63, 95% CI 1.08–2.46). Almost 86% of the mothers in our cohort were in employment during their pregnancy. Within this working group of mothers we found that maternity leave of 7–12 months (adjusted OR=2.76, 95% CI 1.51–5.05) was associated with a longer breast feeding duration compared to maternity leave that was less than six months, see Table 4. We investigated the reasons given by 688 (91.01%) out of the 756 mothers, who were in employment and had stopped breast feeding by the 12 month appointment, for why they had ceased breast feeding. Returning to work was the most common ($n=135$, 19.62%) reason for mothers to stop breast feeding their child.

At 12 months infants born to a mother with a tertiary education (adjusted OR=2.35, 95% CI 1.20–4.62) and infants who had left the maternity hospital exclusively breast feeding (adjusted OR=2.03, 95% CI 1.12–3.67) had twice the odds of being breast fed compared to infants born to mothers with no tertiary education and those that had received infant artificial milk supplementation in the maternity hospital, respectively (Table 5).

Discussion

We have established which early life factors influenced both exclusive breast feeding in the first six months and non-exclusive breast feeding rates at two, six and 12 months of age in a cohort of primiparous mothers who initiated breast feeding. We have identified the key areas surrounding exclusive breast feeding in the first six months of life and breast feeding duration in the first year of life. Our results are important to both the Irish setting and for other countries experiencing an increase in breast feeding initiation but have not seen an increase in their exclusive breast feeding rates or the duration of time mothers report breast feeding their infants (Hamade et al., 2013).

Maternity care practices (mode of childbirth, admission to the NICU and duration of stay in the maternity hospital following childbirth) were all significantly associated with exclusive breast feeding at discharge from the maternity hospital and at two months of age. Admission to the NICU, and not the reason for admission or length of stay in the NICU, was associated with both decreased rates of exclusive breast feeding and the duration of any breast feeding. Lower breast feeding rates in the NICU compared to the postnatal wards in maternity hospitals has been previously reported (Wallace et al., 2013). Previous studies investigating breast feeding rates in NICU have primary focused on a specific neonatal population (Bonet et al., 2010; Maia et al., 2011; Lee et al., 2012) and not on a population-based cohort. We have found that admission to the NICU, independent of the reason, including preterm childbirth and low birth weight, negatively impact on breast feeding. This is a critical finding for maternity services as our results suggest admission to the NICU requires attention to ensure that all mothers receive the necessary and appropriate support to maintain breast feeding.

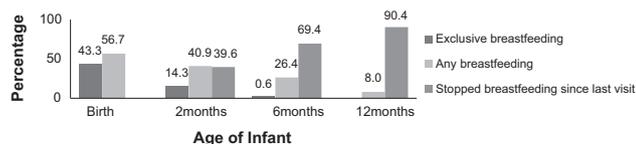


Fig. 1. Breast feeding rates at birth and two, six and 12 months.

Table 3
Adjusted odds ratios for any breast feeding at two months ($n=992$).

	2 months Adjusted OR (95% CI)
Gestational age at childbirth: Term (≥ 37 w 0d)	1
Preterm (≤ 36 w 6d)	0.48 (0.20–1.12)
Birth weight groups: 2.51–3.99 kg	1
≤ 2.50 kg	0.7 (0.27–1.86)
≥ 4 .kg	1.2 (0.79–1.81)
Admission to neonatal intensive care unit: No	1
Yes	1.1 (0.69–1.77)
Exclusive breast feeding on discharge from hospital: No	1
Yes	3.01 (2.22–4.10)***
Smoked during pregnancy: No	1
Yes	0.40 (0.20–0.71)**
Maternal age (years): 29–33	1
19–23	0.38 (0.17–0.86)*
24–28	0.66 (0.44–1.00)
34–38	0.8 (0.56–1.14)
39–43	1.00 (0.47–2.12)
Marital status: Married	1
Single or separated	0.98 (0.67–1.44)
Defacto (in a stable relationship but not married)	0.91 (0.37–2.27)
Maternal tertiary education: No	1
Yes	1.88 (1.38–2.57)***
Socio-economic status: professional	1
Managerial and technical	0.94 (0.65–1.36)
Non-manual	0.73 (0.45–1.17)
Skilled	1.17 (0.54–2.57)
Un-skilled	0.87 (0.38–2.03)
Ungainful and unknown	0.87 (0.42–1.81)
Maternal nationality: Born in Ireland	1
Born outside of Ireland	2.43 (1.59–3.73)***
Maternal BMI: Normal (18.5–24.99)	1
Underweight (< 18.5)	0.98 (0.23–4.19)
Overweight (25–29.99)	0.77 (0.56–1.06)
Obese (30–40.50)	0.68 (0.42–1.11)
Paternal nationality: Born in Ireland	1
Born outside of Ireland	1.46 (0.95–2.23)

* $p \leq 0.005$.

** $p \leq 0.01$.

*** $p \leq 0.001$.

Previous studies (Giovannini et al., 2005; Merten et al., 2005; Declercq et al., 2009; Tarrant et al., 2011a; Nickel et al., 2013) examining exclusive breast feeding with maternity care practices have only explored associations between the exposure and outcome but have not investigated the relationship between covariates. Obviously, mode of childbirth, admission to NICU and length of hospital stay are all strongly interrelated and were significantly associated with each other in our cohort ($p < 0.001$). Of these we found that NICU admission had the strongest association, further supporting that management of feeding in NICU should be an area of focus for maternity services to protect and promote breast feeding.

Tertiary maternal education and exclusive breast feeding at discharge from the maternity hospital were the only two characteristics that positively influenced breast feeding rates consistently at two, six and 12 months. Household income and maternal employment status did not influence breast feeding duration but for mothers who were employed the length of their maternity leave significantly influenced whether they continued to provide any breast-milk to their infant. Data from the national cohort Growing Up in Scotland survey has also demonstrated that it is the length of maternity leave that influences breast feeding duration and not the employment status of the mother (Skafida, 2012). We found that mothers who were breast feeding at two, six and 12 months reported longer maternity leave than mothers who stated that they were no longer breast feeding at two, six and 12 months. Returning to work was the most common reason mothers gave for stopping to breast feed, although most stated that they breast fed as long as they

had planned. This suggests that mothers determine how long they would like to breast fed based on their planned duration of maternity leave. This is supported by results from the United States' Infant Feeding Practices Study II (2005–2007) which found that mothers decided how long they wished to breast fed for based on their duration of maternity leave (Mirkovic et al., 2014).

Maternal non-Irish nationality increased rates of breast feeding at two and six months of age and this has been reported in previous Irish studies (Belgley et al., 2008; Tarrant et al., 2011b). As the rate of mothers born outside Ireland increases, so too has the rate of breast feeding initiation increased (Health Research and Information Division, 2013). This is in line with other studies in England and America (Brick and Nolan, 2013). These results suggest that it may be the change in maternal characteristics rather than breast feeding promotion that is increasing breast feeding rates (Ladewig et al., 2014).

Our study population are predominantly low-risk healthy professional mothers with a tertiary education, in current employment and non-smokers. All infants are singleton and most were born at term without medical complications. Previous research would indicate that this population would be the most highly motivated to continue breast feeding their infant after hospital discharge (Ekström et al., 2003). In examining this population of breast-feeding mothers we have found that the characteristics involved in exclusive breastfeeding differed to what influenced breast feeding duration and the effect of various characteristics on breast feeding duration changed over time. These are important findings

Table 4
Adjusted odds ratios for any breast feeding at six months ($n=722$).

	6 months Adjusted OR (95% CI)
Gestational age at childbirth: Term ($\geq 37w 0d$)	1
Preterm ($\leq 36w 6d$)	0.19 (0.34–1.10)
Birth weight groups: 2.51–3.99 kg	1
≤ 2.50 kg	0.51 (0.04–6.62)
≥ 4 kg	0.82 (0.49–1.38)
Admission to neonatal intensive care unit: No	1
Yes	0.47 (0.22–0.98)*
Exclusive breast feeding on discharge from hospital: No	1
Yes	2.04 (1.40–2.98)***
Duration of stay in the maternity hospital: 1 day	1
2 days	1.24 (0.45–3.42)
3 days	1.48 (0.54–4.02)
4 days	1.30 (0.46–3.66)
5 days	1.77 (0.53–5.89)
6 days	5.61 (1.08–29.02)*
≥ 1 week	1.46 (0.24–8.97)
Smoked during pregnancy: No	1
Yes	0.35 (0.11–1.12)
Maternal tertiary education: No	1
Yes	1.63 (1.08–2.46)*
Duration of maternity leave: < 6 months	1
6 months	0.93 (0.44–1.97)
7–12 months	2.76 (1.51–5.05)**
Socio-economic status: Professional	1
Managerial and Technical	0.58 (0.38–0.89)*
Non-manual	0.47 (0.25–0.87)*
Skilled	1.06 (0.40–2.83)
Un-skilled	0.30 (0.85–1.03)
Ungainful and unknown	0.75 (0.23–2.51)
Maternal nationality: Born in Ireland	1
Born outside of Ireland	2.39 (1.46–3.91)**
Maternal BMI: Normal (18.5–24.99)	1
Underweight (< 18.5)	1.71 (0.31–9.43)
Overweight (25–29.99)	0.67 (0.44–1.02)
Obese (30–40.50)	0.26 (0.11–0.61)*
Paternal nationality: Born in Ireland	1
Born outside of Ireland	2.52 (1.51–4.20)***

* $p \leq 0.005$.

** $p \leq 0.01$.

*** $p \leq 0.001$.

which we hope will inform effective breast feeding promotion and support (Simard et al., 2005; Thulier and Mercer, 2009).

The terms ‘fully’ and ‘exclusive’ are often used interchangeable (Scott et al., 2006; Chudasama et al., 2008; De Jager et al., 2013) making it difficult to determine if the study population are actually being exclusively breast fed. Few studies have accurate prospective data available on the immediate maternity and neonatal care provided to the infant and their mother (Giovannini et al., 2005; Jones et al., 2011; Tan, 2011). There are limitations to our study. This is a secondary data analysis; investigating breast feeding practice was not a primary objective of the Cork BASELINE Birth Cohort Study. Breast feeding is a complex health behaviour, driven by many connecting factors (Scott et al., 2006; Semenic et al., 2008). Our study did not collect data on other hospital practices (such as rooming-in, skin-to-skin contact) or contact with other health care professionals, psychological or social factors. Hospital practices, interactions with other health care professionals outside of the maternity setting, feeding intentions, societal and family support for breast feeding are influential in how a mother feeds her child (Difrisco et al., 2011; Whelan et al., 2011; Shortt et al., 2013; Odum et al., 2014). Strengths of this paper include the consistent use of WHO definitions to describe breast feeding patterns (Fewtrell, 2011) and, in comparison to others studies (Giovannini et al., 2005; Jones et al., 2011; Tan, 2011), we also prospective collected information on maternity care practices. Our study has identified two key areas in

both maternity care practices and national policy on maternity leave that have potential to convert breast feeding initiation into increased duration of breast feeding.

Key conclusion

This study sought to examine what parental and infant characteristics influenced exclusive and any breast feeding in a country with increasing breast feeding initiation rates but not an overall increase in breast feeding rates. We have found that admission to the NICU significantly reduced the odds of an infant being exclusively breast fed on discharge from the maternity hospital and at two months and that admission to the NICU also significantly reduced the duration of any breast feeding. Admission to the NICU is potentially a time of focussed intervention and maternity services need to ensure that they are effectively supporting breast-feeding mothers whose infants have been admitted to the NICU.

We also found that maternity leave, independent of SES, has a significant effect on breast feeding duration. Countries that provide mothers with paid maternity leave greater than six months also report some of the world’s highest breast feeding (exclusive and duration) rates (Save The Children, 2012). Countries with low breast feeding rates should re-evaluate their current maternity

Table 5Adjusted odds ratios for any breast feeding at 12 months ($n=704$).

	12 months Adjusted OR (95% CI)
Gestational age at childbirth: Term (≥ 37 w 0d)	1
Preterm (≤ 36 w 6d)	0 (0.00-0.00)
Infant sex: Male	1
Female	1.54 (0.87-2.72)
Admission to neonatal intensive care unit: No	1
Yes	0.14 (0.02-1.10)
Exclusive breast feeding on discharge from hospital: No	1
Yes	2.03 (1.12-3.67)*
Maternity care: Public	1
Private	0.48 (0.23-0.99)*
Marital status: Married	1
Single or separated	0.30 (0.12-0.76)*
Defacto (in a stable relationship but not married)	4.40 (0.66-29.41)
Maternal tertiary education: No	1
Yes	2.35 (1.20-4.62)*
Maternal employment: Unemployed	1
Employed	0.46 (0.20-1.07)
Maternal Nationality: Born in Ireland	1
Born outside of Ireland	1.61 (0.83-3.12)
Paternal nationality: Born in Ireland	1
Born outside of Ireland	2.27 (1.17-4.41)**
Paternal BMI: Normal (18.5-24.99)	1
Overweight (25-29.99)	0.70 (0.37-1.31)
Obese (30-40.50)	1.82 (0.85-3.89)

* $p \leq 0.005$.** $p \leq 0.01$.

leave provision, and in work facilities for breast-feeding mothers which may help to improve their current breast feeding rates.

Funding

The Cork BASELINE Birth Cohort Study and Hazel A Smith's Ph.D. is funded by the National Children's Research Centre (NCRC), Ireland. L.C.K, D.M and M.K are supported by a Science Foundation Ireland Program Grant for INFANT (12/RC/2272).

Conflict of Interest

None of the authors had any conflicts of interest.

Acknowledgements

To all the children and their families who give their time and attention to the Cork Baseline Birth Cohort Study. Many thanks for your continued support. We would also like thank all the staff involved with the Cork BASELINE Birth Cohort.

References

- Belgley, C., Gallagher, L., Clarke, M., Carroll, M., Millar, S., 2008. The National Infant Feeding Survey. Trinity College, Dublin.
- Bonet, M., Blondel, B., Agostino, R., et al., 2010. Variations in breastfeeding rates for very preterm infants between regions and neonatal units in Europe: results from the MOSAIC cohort. *Arch. Dis. Child. - Fetal Neonatal Ed.* 96, F450-F452.
- Brick, A., Nolan, A., 2013. Explaining the increase in breastfeeding at hospital discharge in Ireland, 2004-2010. *Ir. J. Med. Sci.* 3, 1-7.
- Central Statistics Office, 2006. Appendix 7, Broad level of occupational groups in Census 2006 classification (http://www.cso.ie/en/media/csoie/surveysandmethodologies/surveys/populations/documents/pdfdocs/COP_quality_report_appendix7_8.pdf) (accessed 18.11.13).
- Chudasama, R., Patel, P., Kavishwar, A., 2008. Factors associated with duration of exclusive breastfeeding. *Internet J. Pediatr. Neonatol.* 3 (accessed 22.11.13) (<http://ispub.com/IJPN/9/1/4871>).
- De Jager, E., Skouteris, H., Broadbent, J., Amir, L., Mellor, K., 2013. Psychology correlates of exclusive breastfeeding: a systematic review. *Midwifery* 29, 506-518.
- Declercq, E., Lobbok, M.H., Sakala, C., O'Hara, M., 2009. Hospital practices and women's likelihood of fulfilling their intention to exclusively breastfeed. *Am. J. Public Health* 99, 929-935.
- Dennis, C.L., Gagnon, A., Van Hulst, A., Dougherty, G., 2013. Prediction of duration of breastfeeding among migrant and Canadian-born women: results from a multi-centre study. *J. Pediatr.* 162, 72-79.
- Department of Health & Children, 2003. Department of Health and Children Announces Policy Change in Breastfeeding Guidelines (<http://www.dohc.ie/press/releases/2003/20030805.html>) (accessed 09.10.13).
- Difrisco, E., Goodman, K., Budin, W., Lilienthal, M., Kleinman, A., Holmes, B., 2011. Factors associated with exclusive breastfeeding 2 to 4 weeks following discharge from a large, urban, academic medical center striving for baby-friendly designation. *J. Perinat. Educ.* 20, 28-35.
- Dubois, L., Girard, M., 2003. Social determinants of initiation, duration and exclusivity of breastfeeding at the population level: the results of the Longitudinal Study of Child Development in Quebec (ELDEQ 1998-2002). *Can. J. Public Health* 94, 300-305.
- Ekström, A., Widström, A., Nissen, E., 2003. Duration of breastfeeding in Swedish primiparous and multiparous women. *J. Hum. Lact.* 19, 172-178.
- Fewtrell, M.S., 2011. The evidence for public health recommendations in infant feeding. *Early Hum. Dev.* 87, 715-721.
- Giovannini, M., Riva, E., Banderali, G., Salvioni, M., Radaelli, G., Agostoni, C., 2005. Exclusive versus predominant breastfeeding in Italian maternity wards and feeding practices through the first year of life. *J. Hum. Lact.* 21, 259-265.
- Hamade, H., Chaaya, M., Saliba, M., Chaaban, R., Osman, H., 2013. Determinants of exclusive breastfeeding in an urban population of primiparas in Lebanon: a cross-sectional study. *BMC Public Health* 13, 702-711.
- Health Research and Information Division, 2013. Perinatal Statistics Report. The Economic and Social Research Institute, Dublin.
- Jones, J.R., Kogan, M.D., Singh, G.K., Dee, D.L., Grummer-Strawn, L.M., 2011. Factors associated with exclusive breastfeeding in the United States. *Pediatrics* 128, 1117-1125.
- Kristiansen, A., Lande, B., Øverby, N.C., Andersen, L.F., 2010. Factors associated with exclusive breast-feeding and breast-feeding in Norway. *Public Health Nutr.* 13, 2087-2096.
- Ladewig, E.L., Hayes, C., Browne, J., Layte, R., Reulbach, U., 2014. The influence of ethnicity on breastfeeding rates in Ireland: a cross-sectional study. *J. Epidemiol. Community Health* 68, 356-362.
- Leahy-Warren, P., Mulcahy, H., Phelan, A., Corcoran, P., 2014. Factors influencing initiation and duration of breastfeeding in Ireland. *Midwifery* 30, 345-352.
- Lee, H.C., Kurtin, P.S., Wight, N.E., et al., 2012. A quality improvement project to increase breast milk use in very low birth weight infants. *Pediatrics* 130, e1679-1687.
- Maia, C., Brandão, R., Roncalli, Â., Maranhão, H., 2011. Length of stay in a neonatal intensive care unit and its association with low rates of exclusive breastfeeding in very low birth weight infants. *J. Matern. Neonatal Med.* 24, 774-777.
- Merten, S., Dratva, J., Ackermann-Liebrich, U., 2005. Do baby-friendly hospitals influence breastfeeding duration on a national level? *Pediatrics* 116, e702-e708.
- Mirkovic, K.R., Perrine, C.G., Scanlon, K.S., Grummer-Strawn, L.M., 2014. In the United States, a mother's plans for infant feeding are associated with her plans for employment. *J. Hum. Lact.* 30, 292-297.
- Nickel, N.C., Lobbok, M.H., Hudgens, M.G., Daniels, J.L., 2013. The extent that noncompliance with the ten steps to successful breastfeeding influences breastfeeding duration. *J. Hum. Lact.* 29, 59-70.
- O'Donovan, S.M., Murray, D.M., Hourihane, J.O.B., Kenny, L.C., Irvine, A.D., Kiely, M., 2014. Cohort Profile: the Cork BASELINE Birth Cohort study: babies after SCOPE: evaluating the longitudinal impact on neurological and nutritional endpoints. *Int. J. Epidemiol.* <http://dx.doi.org/10.1093/ije/dyu157>. (accessed 10.06.15) (<http://ije.oxfordjournals.org/content/early/2014/08/07/ije.dyu157.full.pdf+html?sid=286497f9-7f30-4d2c-843a-ef1ebc775008>).
- Odom, E.C., Li, R., Scanlon, K.S., Perrine, C.G., Grummer-Strawn, L., 2014. Association of family and health care provider opinion on infant feeding with mother's breastfeeding decision. *J. Acad. Nutr. Diet.* 114, 1203-1207.
- Save The Children, 2012. Nutrition in the First 1000 Days. Save The Children, London.
- Scott, J.A., Binns, C.W., Oddy, W.H., Graham, K.I., 2006. Predictors breastfeeding duration: evidence from a cohort study. *Pediatrics* 117, e646-e655.
- Semenic, S., Loiselle, C., Gottlieb, L., 2008. Predictors of the duration of exclusive breastfeeding among first-time mothers. *Res. Nurs. Health* 31, 428-441.
- Shortt, E., McGroorrian, C., Kelleher, C., 2013. A qualitative study of infant feeding decisions among low-income women in the Republic of Ireland. *Midwifery* 29, 453-460.
- Simard, I., O'Brien, H.T., Beaudoin, A., et al., 2005. Factors influencing the initiation and duration of breastfeeding among low-income women followed by the Canada prenatal nutrition program in 4 regions of Quebec. *J. Hum. Lact.* 21, 327-337.
- Skafida, V., 2012. Juggling work and motherhood: the impact of employment and maternity leave in breastfeeding duration: a survival analysis on growing up in Scotland data. *Matern. Child Health J.* 16, 519-527.

- Tan, K., 2011. Factors associated with exclusive breastfeeding among infants under six months of age in Peninsular Malaysia. *Int. Breastfeed. J.* 6, 2–8.
- Tarrant, M., Wu, K.M., Fong, D.Y., et al., 2011a. Impact of baby-friendly hospital practices on breastfeeding in Hong Kong. *Birth: Issues Perinat. Care* 38, 238–245.
- Tarrant, R.C., Younger, K.M., Sheridan-Pereira, M., Kearney, J.M., 2011b. Factors associated with duration of breastfeeding in Ireland: potential areas for improvement. *J. Hum. Lact.* 27, 262–271.
- The Economic and Social Research Institute, 2012. *Breastfeeding in Ireland 2012: Consequences and Policy Responses*. ESRI, Dublin.
- Thulier, D., Mercer, J., 2009. Variables associated with breastfeeding duration. *J. Obstet., Gynecol., Neonatal Nurs.* 38, 259–268.
- Vieira, T., Vieira, G., De Oliveira, N., Mendes, C.M., Giugliani, E.R., Silva, L., 2014. Duration of exclusive breastfeeding in a Brazilian population: new determinants in a cohort study. *BMC Pregnancy Childbirth* 14, 175–183.
- Wallace, L.M., Higman, W., Blake, K., Law, S., Anwar, K., 2013. Assessing the knowledge and confidence to perform breastfeeding practices in the neonatal unit – a case study of the use of the Neonatal Unit Clinical Assessment Tool (NUCAT) in Coventry, England. *J. Neonatal Nurs.* 19, 154–161.
- Whelan, B., McEvoy, S., Eldin, N., Kearney, J., 2011. What primary health professionals need to promote breastfeeding. *Pract. Nurs.* 22, 35–39.
- Williams, J., Greene, S., McNally, S., Murray, A., Quail, A., 2010. *The Infants and Their Families. Infant Cohort. Growing up in Ireland. National Longitudinal Study of Children*. Department of Health & Children, Dublin.
- World Health Organization, 1998. *Evidence for the Ten Steps to Successful Breastfeeding*. WHO, Geneva.
- World Health Organization, 2001. *Breastfeeding and Replacement Feeding Practices in the Context of Mother-to-child Transmissions of HIV*. WHO, Geneva.
- World Health Organization, 2006. *BMI Classification*. (http://apps.who.int/bmi/index.jsp?introPage=intro_3.html) (accessed 10.09.13).
- World Health Organization, UNICEF, 1989. *Protecting, Promoting and Supporting Breast-feeding: The Special Role of Maternity Services*. WHO, Geneva.