

# BMJ Open Association between home birth and breast feeding outcomes: a cross-sectional study in 28 125 mother–infant pairs from Ireland and the UK

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## ABSTRACT

**Objectives:** To examine the association between breast feeding outcomes and place of birth (home vs hospital birth).

**Design:** Population-based cross-sectional study.

**Setting:** Ireland and UK.

**Participants:** 10 604 mother–infant pairs from the *Growing Up in Ireland* study (GUI, 2008–2009) and 17 521 pairs from the *UK Millennium Cohort Study* (UKMCS, 2001–2002) at low risk of delivery complications were included in the study.

**Primary and secondary outcome measures:**

Breast feeding initiation, exclusivity and duration.

**Results:** Home birth was found to be significantly associated with breast feeding at all examined time points, including at birth, 8 weeks, 6 months and breast feeding exclusively at 6 months. In GUI, adjusted OR was 1.90 (95% CI 1.19 to 3.02), 1.78 (1.18 to 2.69), 1.85 (1.23 to 2.77) and 2.77 (1.78 to 4.33), respectively, and in UKMCS it was 2.49 (1.84 to 3.44), 2.49 (1.92 to 3.26), 2.90 (2.25 to 3.73) and 2.24 (1.14 to 4.03).

**Conclusions:** Home birth was strongly associated with improved breast feeding outcomes in low-risk deliveries. While the association between home birth and breast feeding is unlikely to be directly causal, further research is needed to determine which factor(s) drive the observed differences, to facilitate development of perinatal care that supports breast feeding.

## INTRODUCTION

Breast feeding is the optimal form of infant nutrition.<sup>1 2</sup> It has been associated with short-term and long-term benefits for the infant and mother, including improved neurodevelopment, reduced incidence and severity of infections in childhood,<sup>3</sup> and a protective effect against common adult-onset metabolic diseases for the breast fed individual later in life (eg, obesity, hypertension, dyslipidaemia, type 2 diabetes),<sup>4</sup> and

## Strengths and limitations of this study

- Two large nationally representative cohorts comprising 28 125 mother–infant pairs were included in the analysis.
- These are the largest population cohorts studied until now that comprehensively examined the relationship between breast feeding and place of birth in low-risk pregnancies.
- Analysis was adjusted for multiple maternal, infant and household factors to minimise the effect of potential confounders; however, this is a cross-sectional study and the causality of the associations cannot be determined.
- Information was self-reported and eligibility for home birth was inferred from available data.

reduced incidence of gastrointestinal diseases (including inflammatory bowel disease and coeliac disease).<sup>5</sup> The benefits for the breast feeding mother include reduced rates of breast and ovarian cancers later in life.<sup>5 6</sup>

Despite the well-established benefits of breast feeding, prevalence rates remain low in many developed countries. This is particularly true for Ireland, where the breast feeding initiation rates are low, at 56% in 2008–2009,<sup>7 8</sup> compared with 81% reported in the UK in 2010.<sup>9</sup> Apart from initiation, many recent government health policies, nationally and internationally, aim to maximise the 6-month exclusive breast feeding<sup>10 11</sup> and continued breast feeding for a year or longer.<sup>3</sup> However, data from many countries suggest that very few women and infants are receiving the benefits of breast feeding for the 6 months duration that is recommended by the WHO (2001).<sup>9 12</sup>

In Ireland, the National Home Birth Service provides for planned home birth in low-risk healthy women, under the care of a self-employed midwife on behalf of the

Health Service Executive (HSE).<sup>13</sup> Similarly, in the UK, home birth is provided for women with low-risk pregnancies, and is supported by the Royal College of Midwives (RCM) and the Royal College of Obstetricians and Gynaecologists (RCOG).<sup>14</sup> Recent guidance from the National Institute for Health and Care Excellence (NICE) encourages physicians and low-risk women to consider planned home birth, as for these mothers home birth is generally as safe or safer than hospital birth, particularly in the case of multiparous women.<sup>15</sup>

Overall, home birth rates vary widely in developed countries; 2.3% of all births in England and Wales were planned home births in 2012,<sup>16</sup> whereas this was reported to be only 0.3% in Northern Ireland,<sup>17</sup> and 0.2% in the Republic of Ireland<sup>18</sup> in the same year. These rates are determined by the demand, national policies and availability of the service, as well as by the means of measuring the home birth rate.

Studies looking into the outcomes of home birth have reported high rates of breast feeding,<sup>19</sup> and it has been sporadically reported that place of birth may be associated with breast feeding outcomes;<sup>20–22</sup> however, no study until now has focused on a comprehensive examination of this association at multiple time points. Examining the relationship between place of birth and breast feeding, and understanding which aspects of care have an impact on breast feeding outcomes, are essential for informing antenatal, perinatal and postnatal policies and procedures, equally in hospital and home settings.

Here, we explore the relationship between place of birth and breast feeding outcomes in mother–infant pairs at low risk of birth complications in two large population cohorts, to deliver the largest and most comprehensive study of the relationship between home birth and breast feeding until now.

## METHODS

The Growing Up in Ireland (GUI) and UK Millennium Cohort Study (UKMCS) cohorts were included in this study. We chose to use two cohorts with complementary strengths and weaknesses to examine consistency of findings and increase statistical power.

**GUI:** All infants born between December 2007 and May 2008 in Ireland were eligible for inclusion. Families were selected randomly from the Child Benefit Register (which covers all children in Ireland) and invited to participate. Primary caregivers (typically the infant's mother) who elected to take part (N=11 134) gave written informed consent. The interviews with families took place in 2008–2009, when the infants were 9 months old, and were carried out by trained interviewers using a detailed questionnaire.<sup>23</sup> The GUI study has been described in detail elsewhere.<sup>24</sup>

**UKMCS:** Families were identified from the UK Child Benefit System, which covers all children in the UK. The UKMCS was designed to achieve an over-representation of families from areas of high poverty and ethnic diversity.

Trained interviewers carried out interviews with 18 552 families during home visits in 2001–2002 when the infants were ~9 months old (mean age 9.7 months).<sup>25</sup> The design and composition of the UKMCS and data collection have been described in detail elsewhere and the study received ethics approval from the National Health Service Ethical Authority.<sup>14 26 27</sup> The response rate was 58% in the GUI<sup>24</sup> and 72% in the UKMCS.<sup>28</sup>

## Breast feeding and home birth

Participating mothers were asked about breast feeding history, including initiation, duration and exclusivity, and about the introduction times of non-breast milk and solids (see online supplementary appendix A for detail). In GUI, mothers were specifically asked 'How old was the infant when (he or she) stopped being exclusively breast fed?' There was no such question in UKMCS; therefore, exclusivity of feeding was derived from reported time of introduction of other milk and solids to the infant's diet. Information was extracted on whether breast feeding was initiated, sustained at 8 weeks (any breast feeding), sustained at 6 months (any breast feeding) and whether the infant was exclusively breast fed at 6 months. These time points were chosen to facilitate the comparisons with previously published work.<sup>20 21 29 30</sup>

Information on place of birth was collected differently in two cohorts: in GUI, mothers were asked whether it was a 'planned home birth'; in UKMCS, mothers were asked if they gave birth at home or in the hospital (see online supplementary appendix B). We adopt the term 'home birth' for both cohorts unless otherwise stated. Further details collected about birth covered elective/planned or emergency caesarean section, vaginal breech delivery and suction (vacuum extraction) or forceps assisted delivery.

## Covariates

We adjusted our model for a range of potential confounders that are typically considered in this context,<sup>16 20–22 29–33</sup> these are listed and described below.

## Sociodemographic and lifestyle characteristics

The mother's age, partner status (alone or with a co-resident parent), socioeconomic status (derived from classification of occupation) and education were assessed. Stress, low mood and support were measured, with GUI assessing perceived support and UKMCS assessing maternal use of available supports. The body mass index (BMI) of the mother was derived from weight and height measured at time of interview in GUI. BMI was not available for all mothers in UKMCS (2316 missing) and was therefore not used in the adjusted analysis. Details of maternal alcohol consumption and smoking (smoker or non-smoker) were also recorded.

## Obstetric history, pregnancy and birth

Parity (primiparity, multiparity), gestational age (in weeks), birth mode (spontaneous vaginal, breech (GUI

only), assisted delivery or caesarean section), infant weight and gender, and maternal folic acid supplementation during pregnancy (yes/no, GUI only) were considered.

### Exclusions

In the GUI and UKMCS cohorts, exclusion criteria included place of birth other than home or hospital, or risk factors that preclude planned home birth. These risk factors were informed by HSE and NICE criteria for advocacy of birth in an obstetric unit,<sup>13 15</sup> and the final list constitutes a subset of factors that were absent in the home birth group: slow fetal growth, known fetal problems, non-singleton pregnancies, presence of maternal medical conditions and gestation under 31 weeks (for more detail, see online supplementary appendix C).

### Statistical analysis

All statistical analyses were carried out with the statistics program R, V.3.1.1 (R Version 3.1.1. Secondary R Version 3.1.1 2014. <http://www.r-project.org/>). To test the association between place of birth and breast feeding at multiple time points, we first carried out an unadjusted analysis, and then proceeded with multivariable logistic regression adjusting for selected covariates. Covariates chosen for the fully adjusted model were: infant's gender, birth weight, gestation, delivery mode, mother's age, marital status, parity, BMI (in GUI), smoking, education, socioeconomic status, income, ethnicity, alcohol, stress, depression, return to work and support. Multicollinearity of covariates was assessed using variance inflation factors (function 'vif' implemented in package 'usdm' for R); values over 4 indicate the presence of multicollinearity.

While we report results from the full model to enable comparison, we used stepwise backwards regression removing the least significant covariate at the time, and we check consistency of findings between fully adjusted and reduced models. We repeat the analysis limited to mothers who breast fed at the immediately preceding time point (eg, only mothers who breast fed at birth were analysed for association of breast feeding with home birth at 8 weeks). This was done to assess continuation of breast feeding at later time points, and to ensure that associations at later time points were not driven by strong association at earlier time points. Analysis was also conducted after exclusions of all assisted deliveries, as birth interventions are known to be strongly negatively associated with breast feeding. Findings are reported as OR (95% CI) and, where appropriate, p value is also given. Since maternal characteristics and lifestyle may be the main confounders that affect both preference for home birth and breast feeding, we also examined the differences between the two groups of mothers.

### RESULTS

In total, we analysed 10 604 mother–infant pairs from the GUI cohort and 17 521 pairs from the UKMCS

cohort. In GUI, 61% (n=6427) of mothers initiated breast feeding, 22% (n=2292) continued to breast feed for at least 6 months, and 9% (n=968) breast fed exclusively for 6 months (figure 1A). In UKMCS, 67% (n=11 774) initiated breast feeding, 22% (n=3768) continued to breast feed for at least 6 months and 1% (n=226) breast fed exclusively for 6 months (figure 1B). In GUI, there were 10 447 hospital births, and 157 planned home births, 1% of the total number of births (table 1). In UKMCS, there were 17 181 hospital births, and 340 home births, 2% of the total number of births (table 2).

### Association between home birth and breast feeding in GUI and UKMCS

Home birth was positively associated with initiation of breast feeding and with sustained breast feeding at all time points, in the unadjusted analysis and after adjustment for relevant confounders, at all time points in the GUI and UKMCS cohorts (table 3). In multivariable adjusted analysis, associations with initiation at birth, sustained breast feeding at 8 weeks and 6 months, and exclusive breast feeding at 6 months in GUI were: OR=1.90 (95% CI 1.19 to 3.02; p<0.0001), 1.78 (1.18 to 2.69; p=0.003), 1.85 (1.23 to 2.77; p=0.006) and 2.77 (1.78 to 4.33; p=0.007), respectively, and in UKMCS were: OR=2.49 (1.84 to 3.44; p=0.011), 2.49 (1.92 to 3.26; p<0.0001), 2.90 (2.25 to 3.73; p<0.0001) and 2.24 (1.14 to 4.03; p<0.0001), respectively. Only minor differences were observed between fully adjusted and reduced models. Results were largely consistent (although attenuated) when the analysis was restricted to infants who were breast fed at a previous time point only; results were consistent when births which involved interventions were excluded, or in UKMCS when restricted to a subset of participants for whom BMI was available (see online supplementary appendix D). Support in GUI was found to be inversely associated with breast feeding, and in UKMCS no association was found with uses of available supports (see online supplementary appendix E).

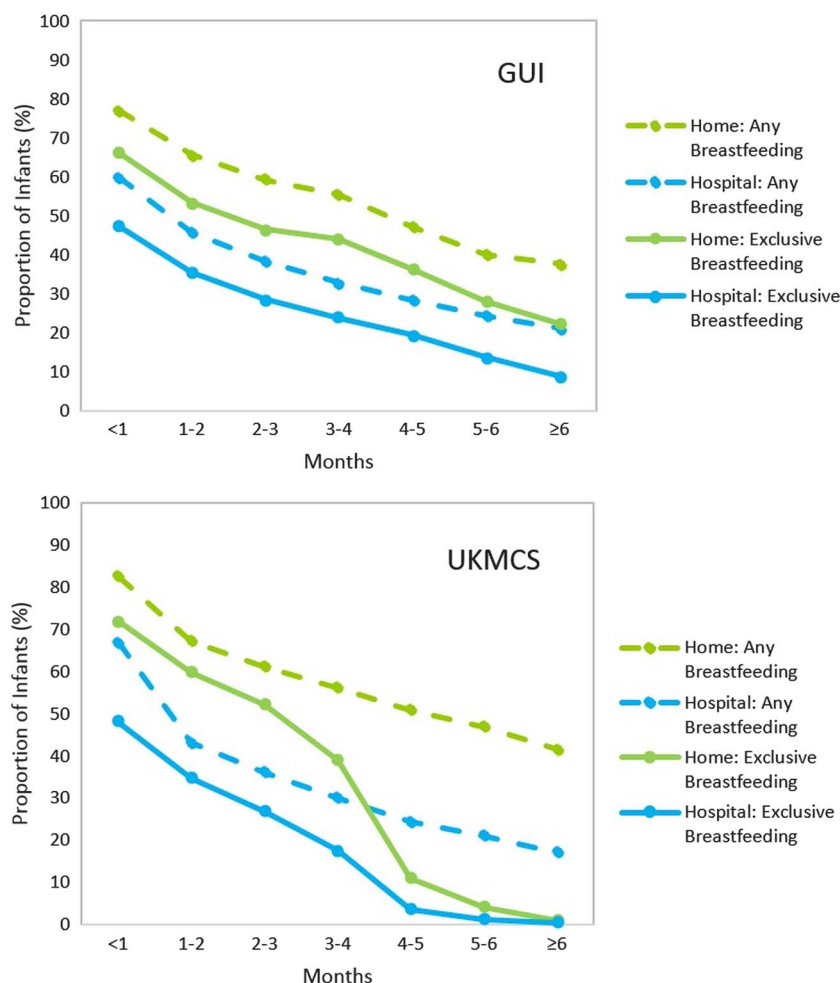
The covariates which showed a consistent association with home birth in GUI and UKMCS were higher education level or professional qualification (GUI: OR=3.62 (1.50 to 8.74); UKMCS: OR=2.26 (1.16 to 4.38)) and gestational age (per week): GUI: OR=1.15 (1.03 to 1.30); UKMCS: OR=1.13 (1.05 to 1.22; see online supplementary appendix F).

### DISCUSSION

Home birthed infants were overall twice as likely to be breast fed and sustained breast feeding was consistently associated with home birth at various time points. Our findings are consistent with previously published reports.<sup>16 20–22 29–33</sup>

The home birth rate observed in the GUI study (1.48%) was more than seven times the rate reported in

**Figure 1** Breast feeding rates in: (A) the Growing Up in Ireland (GUI) cohort (n=10 604) and (B) the UK Millennium Cohort Study (UKMCS; n=17 521). The proportion of infants who were breast fed in the first 6 months of life is shown, including the proportion (%) of any breast feeding and of exclusive breast feeding, for deliveries at home and in the hospital.



the Irish government-published data (0.2%).<sup>18</sup> The government data may report a lower rate as it includes only planned home births that were attended to by an independent midwife, and excludes home births that took place as part of hospital-administered home birth schemes.

Among developed countries, home birth rates are highest in the Netherlands (30%), where care for pregnant women is divided into primary care for low-risk women (who may choose home birth), and secondary care for women at risk of complications.<sup>35</sup> Moreover, the demand for home birth in the Netherlands is high, with 34–63% of low-risk women intending to give birth at home rather than in hospital or a birth centre.<sup>36 37</sup> In Ireland, only 9.5% reported that they would consider home birth in a subsequent pregnancy in 2000.<sup>38</sup>

Breast feeding in the UKMCS cohort was lower than previously reported UK rates, with initiation of breast feeding at 67%, compared with 81% reported in 2010.<sup>9</sup> This may be due to over-representation of deprived populations in this cohort.<sup>39</sup> There was also a sharper drop-off of exclusive breast feeding seen in UKMCS compared with GUI, with the rate in UKMCS falling sharply after 4 months. This may be related to a change in the WHO infant feeding recommendations: prior to

2001, exclusive breast feeding was recommended for 4–6 months (when the UKMCS data collection took place); however, in 2001, the WHO published new guidelines that recommend a 6-month exclusive breast feeding period (in effect when GUI was conducted).<sup>40</sup>

It is presently unclear what underlies the observed association between sustained breast feeding and home birth. Some potential factors are discussed. First, the type and level of support from health professionals that the mother receives may differ: care is typically midwife-led in the case of home birth, and physician-led in case of the hospital birth. Interestingly, a recent study among low-risk women who intended to breast feed their baby from the Netherlands did not show statistically significant differences in the breast feeding success rate between home-led and midwife-led hospital births.<sup>41</sup>

In Ireland, a self-employed community midwife is the primary carer for the mother and home birthed infant until the infant is 14 days old.<sup>13</sup> As a result, the mother receives support and consistent advice from a single midwife. In contrast, multiple health professionals are involved in care following hospital birth, potentially providing unpredictable and inconsistent input. There is also a difference in the level of training related to

**Table 1** Pregnancy, maternal and household characteristics for the GUI cohort (n=10 604)

Variables	GUI: total		BF initiated		BF≥8 weeks		BF at 6 months		EBF at 6 months	
	n	Per cent	n	Per cent	n	Per cent	n	Per cent	n	Per cent
Total	10 604	100	6402	60	4896	46	2282	22	963	9
Place of birth										
Planned home birth	157	1	121	2 (77*)	103	2 (66*)	59	3 (38*)	35	4 (22*)
Hospital birth	10 447	99	6281	98 (60†)	4793	98 (46†)	2223	97 (21†)	928	96 (9†)
Maternal age										
<30	3453	33	1827	29	1288	26	531	23	215	22
30–35	3662	35	2334	36	1807	37	854	37	341	35
≥35	3489	33	2241	35	1801	37	897	39	407	42
Marital status										
Single parent	1272	12	520	8	340	7	133	6	44	5
Parity										
Primiparous	4312	41	2911	45	2158	44	954	42	375	39
Multiparous	6292	59	3491	55	2739	56	1328	58	588	61
Education										
≤Lower second.	1236	12	362	6	241	5	92	4	31	3
Upper second.	3467	33	1736	27	1220	25	493	22	205	21
No degree	2038	19	1269	20	896	18	386	17	154	16
Degree	3854	36	3054	48	2534	52	1307	57	569	59
Socioeconomic status										
Never worked	1193	11	472	7	343	7	170	7	58	6
Unskilled	971	9	557	9	423	9	198	9	78	8
Semiskilled	3213	30	1700	27	1224	25	540	24	230	24
Manager/Prof.	5172	49	3635	57	2875	59	1360	60	593	62
Otherwise emp.	55	1	38	1	31	1	14	1	4	0.4
Ethnicity										
Irish	8736	78	4422	69	3158	65	1279	56	558	58
Other white	1471	13	1309	20	1104	23	586	26	275	29
Black	361	3	339	5	317	6	209	9	47	5
Asian	301	3	274	4	245	5	164	7	62	6
Other	52	0	47	1	44	1	25	1	11	1
Smoking										
Current smoker	2559	24	1127	18	772	16	219	10	80	8
Alcohol use										
Rare/never	1893	18	1274	20	1052	21	663	29	282	29
Alcohol consumption										
<7 U/week	8109	76	4949	77	3829	78	1889	83	818	85
7–14 U/week	1760	17	1055	16	785	16	301	13	112	12
≥14 U/week	727	7	390	6	274	6	88	4	32	3
BMI										
<25	5496	52	3485	54	2720	56	1319	58	570	59
25–30	2967	28	1759	27	1318	27	579	25	242	25
≥30	1634	15	855	13	621	13	269	12	100	10
Missing	534	5	303	5	237	5	115	5	51	5
Infant gender										
Female	5180	49	3210	50	2468	50	1170	51	522	54
Gestational age (weeks)										
<37	627	6	341	5	270	6	86	4	36	4
≥37	9940	94	6055	95	4600	94	2186	96	924	96
Mode of delivery										
SVD	6350	60	3913	61	3038	62	1519	67	652	68
Breech	38	0.4	24	0	20	0.4	5	0.2	1	0
Assisted	1527	14	971	15	698	14	306	13	129	13
Caesarean	2687	25	1517	24	1138	23	452	20	181	19

Continued

Table 1 Continued

Variables	GUI: total		BF initiated		BF ≥ 8 weeks		BF at 6 months		EBF at 6 months	
	n	Per cent	n	Per cent	n	Per cent	n	Per cent	n	Per cent
Folate										
Folate usage	6511	61	4109	64	3192	65	1468	64	666	69
Birth weight										
<2.5 kg	494	5	275	4	219	3	70	3	29	3

\*The proportion of mothers (%) who had planned home birth and were still BF at the specified BF time point, of the total number of mothers who had planned home birth.

†The proportion of mothers (%) who had planned hospital birth and were still BF at the specified BF time point, of the total number of mothers who had planned hospital birth.

BF, breast feeding; BMI, body mass index (maternal, postdelivery, kg/m<sup>2</sup>); EBF, exclusive breast feeding; GUI, Growing Up in Ireland; n, number of participants; otherwise emp., otherwise gainfully employed; Prof., professional; SVD, spontaneous vaginal delivery; U, units of alcohol, where 1 unit is 10 mL of pure alcohol; within education: second., secondary school (school from age ~12 to 18); within socioeconomic status.

lactation among carers, with midwives typically receiving more education in this area. The default national hospital birth model of care involves shared care between the obstetrician and general practitioner,<sup>42</sup> followed by a statutory universal visit from a public health nurse (PHN). This is important because intervention in the early postpartum period has been shown to improve maternal and infant outcomes. PHNs in Ireland are population-based generalist nurses, whose postnatal visit should take place within 48 hours of discharge;<sup>43</sup> however, the percentage of first visits actually achieved during this period varies significantly (57–85%),<sup>44</sup> and the service has been found to fall short of meeting postnatal breast feeding support needs.<sup>45</sup>

Second, psychological factors are likely to have an important role in the success of breast feeding. The physiological experience of giving birth at home in a familiar environment may lead to reduced stress, and a reduction in stress could contribute to an intervention-free birth, and may consequentially influence breast feeding outcomes. Moreover, postpartum circumstances of home birth that enable immediate and prolonged skin-to-skin contact can facilitate homeostasis of the infant, mother–infant bonding and play a role in the cascade of events that promote lactogenesis.<sup>46</sup>

Stress in the perinatal period has been linked to delayed breast feeding.<sup>47–49</sup> Intrapartum interventions are stress-provoking and they have been negatively associated with breast feeding.<sup>50</sup> However, it is difficult to isolate birth circumstances, at home or in hospital, as directly causative of increased stress: women who report psychosocial stress during pregnancy are more likely to experience birth complications themselves,<sup>51</sup> and may also be less likely to breast feed as a result of background levels of stress, thereby confounding a direct relationship between birth circumstances-related hypothalamic-pituitary-adrenal axis activation and subsequent breast feeding. Apart from interventions, analgesia during labour is also common in hospital birth but rare in home birth. This is relevant because analgesia has been shown to cause lethargy in the infant and to delay milk production, thereby interfering with breast feeding initiation.<sup>52</sup>

With regard to partner support, in GUI we found no association between breast feeding and a living-in partner, while in UKMCS an association was found, but was not consistent across the time points. In other measures of support, in the UKMCS the presence of a partner, or usage of supports was not found to be associated with breast feeding at all assessed time points; however, surprisingly, a consistent inverse association was observed in GUI of perception of support with breast feeding and home birth. Some responses, on questioning on levels of support perceived, may have been an indirect measurement of maternal sociodemographic or personality traits, such as resilience and self-reliance. Further studies aimed at addressing all elements of professional and partner/community support, including non-perceived support, are needed.

Additional psychological factors that have been known to affect breast feeding include anxiety, adaptability, mother's priorities and mothering self-efficacy, breast feeding self-efficacy, dispositional optimism, faith in breast milk, breast feeding expectations, planned duration of breast feeding and the time of the infant feeding decision and other;<sup>53 54</sup> unfortunately, we were unable to study these.

Third, we hypothesise that the mothers who deliver at home may differ in unmeasured and/or unmeasurable characteristics, such as in personality, beliefs, lifestyle choices or in their attitudes towards birth and infant feeding. Many of these potential factors are difficult to capture or even define clearly. In our analysis of home versus hospital birth, we found sustained differences between the home and hospital birth mothers: the former were more educated, the infant's gestational age was greater and they reported low levels of support. There are other differences which are unmeasured in study cohorts, including factors which may preclude birth at home, such as distance to the hospital and the facilities available in the home. However, we consistently observe the association between home birth and improved breast feeding outcomes, even after adjustment for multiple maternal sociodemographic,

**Table 2** Pregnancy, maternal and household characteristics for the UKMCS cohort (n=17 521)

Variables	UKMCS: total		BF initiated		BF $\geq$ 8 weeks		BF at 6 months		EBF at 6 months	
	n	Per cent	n	Per cent	n	Per cent	n	Per cent	n	Per cent
Total	17 521	100	11 774	67	7630	44	3768	22	226	1
Place of birth										
Home birth	340	2	280	2 (82*)	228	3 (67*)	159	4 (47*)	13	6 (4*)
Hospital birth	17 181	98	11 494	98 (67†)	7402	97 (43†)	3609	96 (21†)	213	94 (1†)
Maternal age										
<30	9762	56	5915	50	3307	43	1425	38	88	39
30–35	5042	27	3733	32	2684	35	1387	37	77	34
$\geq$ 35	2764	16	2124	18	1638	22	956	25	61	27
Marital status										
Single parent	7121	41	3904	33	2185	29	907	24	52	23
Parity										
Multiparous	8596	49	5573	47	3876	51	2077	76	141	62
Primiparous	8975	51	6201	53	3754	49	1691	24	85	38
Maternal education										
NVQ 1–3	9039	52	5537	47	3196	42	1329	35	75	33
NVQ 4–5	5093	29	4408	38	3377	44	1904	51	97	43
Foreign Qual.	542	3	404	3	299	4	173	5	14	6
No Qual.	2846	17	1405	12	743	10	354	9	39	17
SES										
Never worked	2114	12	1308	11	817	11	1904	11	39	17
Lower	948	5	587	5	353	5	127	3	6	3
Intermediate	2929	17	2084	18	1299	17	629	17	36	16
Routine	6400	36	3461	29	1886	25	815	22	52	23
Employer	624	4	482	4	360	5	193	5	18	8
Manag./Prof.	4556	26	3852	33	2915	38	1575	42	75	33
Ethnicity										
White	14 677	84	9317	79	5884	77	2838	75	141	63
Black	644	4	600	5	482	6	269	7	19	8
Asian‡	1691	9	1379	12	894	12	440	12	46	21
Other	511	3	457	4	355	5	213	6	18	8
Smoking status										
Smoker	5274	30	2659	23	1320	17	454	12	26	12
Maternal alcohol consumption§										
Every day	372	2	293	2	210	3	112	3	5	2
5–6x/week	353	2	304	3	224	3	124	3	2	1
<2x/week	5597	32	3910	33	2690	35	1345	36	77	34
$\leq$ 2x/month	6945	40	4290	37	2575	34	1140	30	57	25
Never	4281	24	2975	25	1931	25	1047	28	85	38
Maternal BMI										
<18	612	3	386	3	236	3	125	3	5	2
18–25	8691	50	5898	50	4043	53	2094	56	115	51
25–30	3920	22	2625	22	1645	22	777	21	59	26
$\geq$ 30	1982	11	1316	11	753	10	355	9	22	10
Missing	2316	13	1549	13	953	12	417	11	25	11
Infant gender										
Female	8523	49	5704	48	3749	49	1894	50	129	57
Gestational age (weeks)										
<37	1055	6	703	6	395	5	169	5	9	4
$\geq$ 37	16 274	94	10 954	94	7158	95	2859	95	211	96
Mode of delivery										
SVD	12 168	69	8044	68	5311	70	2663	71	173	76
Assisted	1685	10	1196	10	751	10	340	9	11	5
Caesarean	3665	21	2533	22	1568	20	765	20	42	19

\*The proportion of mothers (%) who had home birth and were still BF at the specified BF time point, of the total number of mothers who had home birth.

†The proportion of mothers (%) who had hospital birth and were still BF at the specified BF time point, of the total number of mothers who had hospital birth.

‡Indian, Bangladeshi or Pakistani nationality.

§Alcohol consumption: the reported figures are frequency of alcohol consumption (not units of alcohol consumption).

BF, breast feeding; BMI, body mass index (maternal, measured postdelivery, available for n=15 205, 87%); EBF, exclusive breast feeding; Manag., managerial; n, number of participants; Prof., professional; education level is classified according to National Vocation Qualification (NVQ) level, NVQ level 3 corresponds to a qualification of A-levels standard (school leaving examinations at 18 years of age) and level 4 is at certificate level, a qualification immediately above leaving-school level; SES; socioeconomic status: maternal employment is classified according to the National Statistics, Socio-Economic Classification,<sup>34</sup> a five-part classification system; SVD, spontaneous vaginal delivery; UKMCS, UK Millennium Cohort Study; Qual., qualification.

**Table 3** The association between place of birth (home birth vs hospital birth) and breast feeding in GUI (n=10 604) and UKMCS (n=17 521) cohorts

Breast feeding time point	Study population	Unadjusted analysis			Adjusted analysis		
		OR	95% CI	p Value	OR	95% CI	p Value
Initiation	GUI	2.23	1.53 to 3.24	<0.0001	1.9	1.19 to 3.02	<0.0001
Initiation	UKMCS	2.31	1.74 to 3.05	<0.0001	2.49	1.84 to 3.44	0.011
8 weeks	GUI	2.25	1.61 to 3.13	<0.0001	1.78	1.18 to 2.69	0.0029
8 weeks	UKMCS	2.69	2.14 to 3.38	<0.0001	2.49	1.92 to 3.26	<0.0001
6 months	GUI	2.23	1.61 to 3.09	<0.0001	1.85	1.23 to 2.77	0.0058
6 months	UKMCS	3.3	2.66 to 4.10	<0.0001	2.9	2.25 to 3.73	<0.0001
6 months: exclusive	GUI	2.94	2.01 to 4.31	<0.0001	2.77	1.78 to 4.33	0.0073
6 months: exclusive	UKMCS	3.17	1.79 to 5.60	<0.0001	2.24	1.14 to 4.03	<0.0001

The ORs and corresponding 95% CIs are shown for any breast feeding at birth, 8 weeks and 6 months, and exclusive breast feeding for 6 months, according to place of birth (home vs hospital birth).

The strongest association in GUI is with exclusive breast feeding for 6 months, adjusted OR=2.77 (1.78 to 4.33), and in UKMCS it is with breast feeding for 6 months, 2.90 (2.25 to 3.73); the weakest association in GUI is with breast feeding for 8 weeks, 1.78 (1.18 to 2.69), and in UKMCS it is with breast feeding exclusively for 6 months, 2.24 (1.14 to 4.03).

Other covariates which were associated with breast feeding initiation and at all assessed time points included maternal factors; older maternal age and perception of low support (GUI); birth factors; later gestational age and heavier birth weight; and socioeconomic factors; higher education level, higher household income and later timing of return to work. Negatively associated covariates included maternal factors; Irish or British ethnicity, higher parity, smoking status: smoker, higher alcohol consumption and higher BMI; socioeconomic factors; long-term unemployment; birth characteristics: caesarean mode of delivery and infant characteristics: male infant.

BMI, body mass index; GUI, Growing Up in Ireland; UKMCS, UK Millennium Cohort Study.

psychosocial, lifestyle and obstetric factors, including education and gestational age; some of these covariates are likely to in part capture unmeasured confounders.

A retrospective cohort study (n=225) conducted in a small ethnoreligious community in rural Canada, the Old Order Mennonites, also reported a significant association between home birth and breast feeding outcomes. The unique traditional lifestyle setting of the Mennonites, a homogeneous community which generally eschews the use of technological advances and modern conveniences, maintains an agricultural way of life and for whom community traditions are of great importance, presents a setting in which mothers may be of similar beliefs and disposition, including a tendency towards breast feeding over other 'less natural' means of infant nutrition.<sup>55</sup> Despite this unique setting, home birth in this community continued to independently predict exclusive breast feeding for 6 months, OR=2.83 (1.14 to 7.06). This further suggests that the association observed may not be wholly due to pre-existing differences in world view in those mothers who choose home birth. Unfortunately, no information on treatment of high-risk births was given in the paper, so it cannot be excluded that the association is partially driven by higher risk deliveries taking place in a hospital.

A woman's decision to give birth at home is often embedded in a refutation of a public narrative (the medical model of childbirth) and a challenge to obstetric models of care; hence, they implicitly challenge the reliance on technology and more medicalised approaches to childbirth.<sup>56</sup> It could be suggested that this perspective on birth is more likely to lead women towards the adoption of natural methods of infant feeding and hence favour breast feeding. These mothers

are more likely to reject the notion of breast feeding as a challenging skill,<sup>57</sup> and anticipate a positive breast feeding experience. Midwives providing home birth services have also suggested that the sense of empowerment and satisfaction that many women express after a home birth forms the foundation of empowered parenting and successful breast feeding.<sup>56</sup>

Finally, it has been shown that formula supplementation in the early postnatal period reduces the likelihood of subsequent exclusive breast feeding, and also reduces the overall duration of breast feeding.<sup>58 59</sup> All 19 maternity units in Ireland participate in the Baby Friendly Health Initiative, step 6 of which states that newborn infants should receive no food or drink other than breast milk, unless medically indicated. However, hospital births have been associated with formula supplementation<sup>60</sup> which may be based on clinical findings, or may be encouraged due to the busy clinical routine or inadequate staffing, where formula feeding is a more convenient solution to feeding problems than diagnosis and treatment of breast feeding issues.<sup>61</sup> A further barrier to supporting breast feeding may be the lack of a lactation consultant and/or staff training in breast feeding needs.<sup>62</sup> Economically, both breast feeding and the ability to give birth at home have a potential to significantly lower the cost of care.<sup>63 64</sup>

### Strengths and limitations

Research question was addressed in two very large cohort studies that together comprised 28 125 mother–infant pairs. Detailed information was collected in both cohorts, and enabled us to adjust the analysis for a range of factors. One limitation of the study is the inconsistent response option with respect to place of birth in study

questionnaires: GUI focused on *planned* home birth (unplanned home births were coded as 'other' and excluded from the analysis) and UKMCS on *any* home birth (both planned and unplanned home births). However, the consistency of results in the two cohorts and with previously published findings<sup>16 20–22 29–33</sup> suggests that the difference in measurement (home birth vs planned home birth) may not be all that important or that misclassification is low, maybe because most home births are planned in the developed world. Together, this supports the association between home birth and breast feeding outcomes. Limitations also include maternal reporting of the information and consequential risk of recall bias as a longer breast feeding duration may have been reported due to social desirability; however, there is no reason to expect differential reporting according to place of birth. Similarly, participants could self-select through opting out from the study, and therefore under-representation of lower socioeconomic groups may have occurred. Questionnaires had limited ability to capture support for the mother; we used the presence of a live-in partner in the analysis, which does not necessarily correspond to getting support. Only a small proportion of home births occurred in our study cohorts, and we did not have information on breast feeding intent or previous success. Apart from increased risk of complications, some other factors may have necessitated opting for hospital birth (such as having inadequate facilities at home, or the home being too far from the midwife or maternity hospital<sup>13 15</sup>), but these were not assessed in GUI and UKMCS, as these were population-based studies. The findings should be interpreted with caution in regions with a substantially different provision of maternity health service.

Policy changes to increase breast feeding could include altering current models of perinatal care for mothers, and addressing a possible diminished sense of self-reliance in mothers who choose hospital birth, relative to those who undergo home birth. Standards of perinatal care may be altered by increasing the availability and accessibility of home birth for low-risk mothers, and midwife-led care could also be increased as it is economical in low-risk mothers,<sup>65</sup> but underused in Ireland,<sup>66 67</sup> compared with other countries, for example, the Netherlands where midwife-led care is the default model for low-risk women.<sup>68</sup> Upscaling midwifery services has been predicted to reduce maternal and infant mortality,<sup>69</sup> and the need for such upscaling has been highlighted recently in Ireland.<sup>70</sup> The question of differential maternal confidence in breast feeding ability between home and hospital birth mothers requires further investigation, as this may also be a target for improvement. The association of improved breast feeding and home birth is most likely due to a range of factors, but aspects of home versus hospital birth care, including maternal autonomy, and the environment of the birth place, and midwife delivered perinatal care, could inform further efforts to improve breast feeding rates.

## CONCLUSIONS

Currently breast feeding rates fall short of the WHO recommendations in Ireland and the UK. This is particularly true for the rate of breast feeding exclusively for 6 months, which occurred in <10% of infants in this study. Results presented in this study showed that improved breast feeding is twice as likely in home versus hospital birth. Further studies are needed to determine which elements of perinatal care could be altered to improve breast feeding outcomes.

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**Data sharing statement** The anonymised Growing Up in Ireland data are available on request for bona fide research purposes only, <http://www.ucd.ie/issda/data/growingupinirelandgui>. Similarly, data access for the UK Millennium Cohort Study is available from <https://discover.ukdataservice.ac.uk>.

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## REFERENCES

1. WHO, UNICEF. Global strategy on Infant and young child feeding. Geneva: WHO, 2003.
2. Wu TC, Chen PH. Health consequences of nutrition in childhood and early infancy. *Pediatr Neonatol* 2009;50:135–42.
3. Section on Breastfeeding. Breastfeeding and the use of human milk. *Pediatrics* 2012;129:e827–41.
4. Kelishadi R, Farajian S. The protective effects of breastfeeding on chronic non-communicable diseases in adulthood: a review of evidence. *Adv Biomed Res* 2014;3:3.
5. Fund WHOUNCs. Innocenti Declaration on the Protection, Promotion and Support of Breastfeeding. Secondary Innocenti Declaration on the Protection, Promotion and Support of Breastfeeding. 1990. <http://www.unicef.org/programme/breastfeeding/innocenti.htm>
6. Hanson LA, Korotkova M, Håversen L, *et al*. Breast-feeding, a complex support system for the offspring. *Pediatr Int* 2002;44:347–52.

7. Ladewig EL, Hayes C, Browne J, *et al*. The influence of ethnicity on breastfeeding rates in Ireland: a cross-sectional study. *J Epidemiol Community Health* 2014;68:356–62.
8. Brick A, Nolan A. Explaining the increase in breastfeeding at hospital discharge in Ireland, 2004–2010. *Ir J Med Sci* 2014;183:333–9.
9. McAndrew F, Thompson J, Fellows L, *et al*. Infant feeding survey 2010. Leeds: Health and Social Care Information Centre, 2012.
10. Breastfeeding NCo. *Breastfeeding in Ireland: a five-year strategic action plan*. Dublin: The Department of Health and Children, 2005.
11. Prevention CfDca. US breastfeeding rates fall short of National Goals. *JAMA* 2014;312:1090.
12. Begley CB, Gallagher LG, Clarke M, *et al*. *The National Infant Feeding Survey*. Dublin: Trinity College Dublin, 2008.
13. HSE. National Home Birth Services. Secondary National Home Birth Services. 2014. <http://www.hse.ie/eng/services/list/3/maternity/homebirth.html>
14. Royal College of Midwives (RCM) and the Royal College of Obstetricians and Gynaecologists (RCOG). Joint statement No.2. Secondary Royal College of Midwives (RCM) and the Royal College of Obstetricians and Gynaecologists (RCOG). Joint statement No.2 2007. <http://www.rcog.org.uk/files/rcog-corp/uploaded-files/JointStatementHomeBirths2007.pdf>
15. NICE. Intrapartum care: care of healthy women and their babies during childbirth. Secondary intrapartum care: care of healthy women and their babies during childbirth. 2014. <http://www.nice.org.uk/guidance/cg190/resources/guidance-intrapartum-care-care-of-healthy-women-and-their-babies-during-childbirth-pdf>
16. Catling-Paull C, Coddington RL, Foureur MJ, *et al*. Publicly funded homebirth in Australia: a review of maternal and neonatal outcomes over 6 years. *Med J Aust* 2013;198:616–20.
17. Northern Ireland Statistics and Research Agency. Births in Northern Ireland 2012. Secondary Northern Ireland Statistics and Research Agency. Births in Northern Ireland 2012. 2013. [http://www.nisra.gov.uk/archive/demography/publications/births\\_deaths/births\\_2012.pdf](http://www.nisra.gov.uk/archive/demography/publications/births_deaths/births_2012.pdf)
18. The Economics and Social Research Institution. *Perinatal Statistics Report 2012*. 2013.
19. Cheyney M, Bovbjerg M, Everson C, *et al*. Outcomes of care for 16,924 planned home births in the United States: the midwives alliance of North America statistics project, 2004 to 2009. *J Midwifery Womens Health* 2014;59:17–27.
20. Norris S, Collin SM, Ingram J. Breastfeeding practices among the Old Order Mennonites in Ontario, Canada: a multiple methods study. *J Hum Lact* 2013;29:605–10.
21. Brocklehurst P, Hardy P, Hollowell J, *et al*. Perinatal and maternal outcomes by planned place of birth for healthy women with low risk pregnancies: the Birthplace in England national prospective cohort study. *BMJ* 2011;343:d7400.
22. Al-Sahab B, Lanes A, Feldman M, *et al*. Prevalence and predictors of 6-month exclusive breastfeeding among Canadian women: a national survey. *BMC Pediatr* 2010;10:20.
23. Ireland NLSoci. Primary Caregiver Questionnaire. Secondary Primary Caregiver Questionnaire. 2008. [http://www.growingup.ie/fileadmin/user\\_upload/documents/Infant\\_Qs/Infant\\_Primary\\_Caregiver\\_Questionnaire.pdf](http://www.growingup.ie/fileadmin/user_upload/documents/Infant_Qs/Infant_Primary_Caregiver_Questionnaire.pdf)
24. Quail A, Williams J, McRory C, *et al*. Summary guide to wave 1 of the infant cohort (at 9 months) of Growing Up in Ireland. Secondary summary guide to wave 1 of the infant cohort (at 9 months) of Growing Up in Ireland. 2011. <http://www.ucd.ie/issda/static/documentation/esri/GUI-SummaryGuideInfants.pdf>
25. Hawkins SS, Cole TJ, Law C. Maternal employment and early childhood overweight: findings from the UK Millennium Cohort Study. *Int J Obes (Lond)* 2008;32:30–8.
26. Hansen K. *Millennium Cohort Study first, second, third and fourth surveys: a guide to the datasets*. 4th edn. London: Centre for Longitudinal Studies. Institute of Education, University of London, 2010.
27. Dex S Joshi H. *Children of the 21st century: from birth to nine months*. Bristol: The Policy Press, 2005.
28. Griffiths LJ, Tate AR, Dezateux C. The contribution of parental and community ethnicity to breastfeeding practices: evidence from the Millennium Cohort Study. *Int J Epidemiol* 2005;34:1378–86.
29. van Rossem L, Oenema A, Steegers EA, *et al*. Are starting and continuing breastfeeding related to educational background? The generation R study. *Pediatrics* 2009;123:e1017–27.
30. Shearer JM. Five year prospective survey of risk of booking for a home birth in Essex. *BMJ* 1985;291:1478–80.
31. Lanting CI, Van Wouwe JP, Reijneveld SA. Infant milk feeding practices in the Netherlands and associated factors. *Acta Paediatr* 2005;94:935–42.
32. Johnson KC, Daviss BA. Outcomes of planned home births with certified professional midwives: large prospective study in North America. *BMJ* 2005;330:1416.
33. Dowswell T, Thornton JG, Hewison J, *et al*. Should there be a trial of home versus hospital delivery in the United Kingdom? *BMJ* 1996;312:753–7.
34. Office NS. SOC2010 VOLUME 3 NS-SEC (Rebased On SOC2010) User Manual. Secondary SOC2010 VOLUME 3 NS-SEC (Rebased On SOC2010) User Manual. 2010. <http://www.ons.gov.uk/ons/guide-method/classifications/current-standard-classifications/soc2010/soc2010-volume-3-ns-sec-rebased-on-soc2010-user-manual/index.html>
35. de Jonge A, van der Goes BY, Ravelli AC, *et al*. Perinatal mortality and morbidity in a nationwide cohort of 529,688 low-risk planned home and hospital births. *BJOG* 2009;116:1177–84.
36. van Haaren-ten Haken T, Pavlova M, Hendrix M, *et al*. Eliciting preferences for key attributes of intrapartum care in the Netherlands. *Birth* 2014;41:185–94.
37. de Jonge A, Geerts CC, van der Goes BY, *et al*. Perinatal mortality and morbidity up to 28 days after birth among 743 070 low-risk planned home and hospital births: a cohort study based on three merged national perinatal databases. *BJOG* 2015;122:720–8.
38. O'Donovan M, Connolly G, Zainal S, *et al*. Attitude to home birth in an antenatal population at the Rotunda Hospital. *Ir Med J* 2000;93:207–8.
39. Thulier D, Mercer J. Variables associated with breastfeeding duration. *J Obstet Gynecol Neonatal Nurs* 2009;38:259–68.
40. Fewtrell M, Wilson DC, Booth I, *et al*. Six months of exclusive breast feeding: how good is the evidence? *BMJ* 2011;342:c5955.
41. de Cock TP, Manniën J, Geerts C, *et al*. Exclusive breastfeeding after home versus hospital birth in primary midwifery care in the Netherlands. *BMC Pregnancy Childbirth* 2015;15:262.
42. HSE. Maternity and Infant Care Scheme. Secondary Maternity and Infant Care Scheme. 2014. <http://www.hse.ie/eng/services/list/3/maternity/combinedcare.html>
43. Deyner S. *Best health for children revisited: report from the National Core Child Health Programme to Review Group to the Health Service Executive*. Programme of Action for Children, Dublin. Dublin, 2005.
44. DoHC. *State of the Nations Children: Ireland 2008*. Dublin: The Stationery Office, 2008.
45. Leahy-Warren P, MHAIPA. *A review of the breastfeeding support services provided by public health nurses in Ireland: a report prepared for the HSE*. Cork: University College Cork, 2009.
46. Robiquet P, Zamiara PE, Rakza T, *et al*. Observation of skin-to-skin contact and analysis of factors linked to failure to breastfeed within 2 hours after birth. *Breastfeed Med* 2016;11:126–32.
47. de Jager E, Broadbent J, Fuller-Tyszkiewicz M, *et al*. The role of psychosocial factors in exclusive breastfeeding to six months postpartum. *Midwifery* 2014;30:657–66.
48. Chen DC, Nommsen-Rivers L, Dewey KG, *et al*. Stress during labor and delivery and early lactation performance. *Am J Clin Nutr* 1998;68:335–44.
49. Dewey KG. Maternal and fetal stress are associated with impaired lactogenesis in humans. *J Nutr* 2001;131:3012S–5S.
50. Bai DL, Wu KM, Tarrant M. Association between intrapartum interventions and breastfeeding duration. *J Midwifery Womens Health* 2013;58:25–32.
51. Paarlberg KM, Vingerhoets AJ, Passchier J, *et al*. Psychosocial factors and pregnancy outcome: a review with emphasis on methodological issues. *J Psychosom Res* 1995;39:563–95.
52. Ransjö-Arvidson AB, Matthiesen AS, Lilja G, *et al*. Maternal analgesia during labor disturbs newborn behavior: effects on breastfeeding, temperature, and crying. *Birth* 2001;28:5–12.
53. O'Brien M, Buikstra E, Fallon T, *et al*. Exploring the influence of psychological factors on breastfeeding duration, phase 1: perceptions of mothers and clinicians. *J Hum Lact* 2009;25:55–63.
54. O'Brien M, Buikstra E, Hegney D. The influence of psychological factors on breastfeeding duration. *J Adv Nurs* 2008;63:397–408.
55. Horst I. *A separate people: an insider's view of Old Order Mennonite customs and traditions*. Waterloo, ON: Herald Press, 2000.
56. Cheyney MJ. Homebirth as systems-challenging praxis: knowledge, power, and intimacy in the birthplace. *Qual Health Res* 2008;18:254–67.
57. Bailey C, Pain RH, Aarvold JE. A 'give it a go' breast-feeding culture and early cessation among low-income mothers. *Midwifery* 2004;20:240–50.
58. Chantray CJ, Dewey KG, Pearson JM, *et al*. In-hospital formula use increases early breastfeeding cessation among first-time

- mothers intending to exclusively breastfeed. *J Pediatr* 2014;164:1339–45.e5.
59. Parry JE, Ip DK, Chau PY, *et al.* Predictors and consequences of in-hospital formula supplementation for healthy breastfeeding newborns. *J Hum Lact* 2013;29:527–36.
  60. Sheehan D, Krueger P, Watt S, *et al.* The Ontario Mother and Infant Survey: breastfeeding outcomes. *J Hum Lact* 2001;17:211–19.
  61. Bartick M, Stuebe A, Shealy KR, *et al.* Closing the quality gap: promoting evidence-based breastfeeding care in the hospital. *Pediatrics* 2009;124:e793–802.
  62. Taveras EM, Li R, Grummer-Strawn L, *et al.* Opinions and practices of clinicians associated with continuation of exclusive breastfeeding. *Pediatrics* 2004;113:e283–90.
  63. Bartick M, Reinhold A. The burden of suboptimal breastfeeding in the United States: a pediatric cost analysis. *Pediatrics* 2010;125:e1048–56.
  64. Anderson RE, Anderson DA. The cost-effectiveness of home birth. *J Nurse Midwifery* 1999;44:30–5.
  65. Bernitz S, Aas E, Oian P. Economic evaluation of birth care in low-risk women. A comparison between a midwife-led birth unit and a standard obstetric unit within the same hospital in Norway. A randomised controlled trial. *Midwifery* 2012;28:591–9.
  66. Information C. Flexible Maternity Services. Secondary Flexible Maternity Services. 2010. [http://www.citizensinformation.ie/en/birth\\_family\\_relationships/before\\_your\\_baby\\_is\\_born/flexible\\_maternity\\_services.html](http://www.citizensinformation.ie/en/birth_family_relationships/before_your_baby_is_born/flexible_maternity_services.html)
  67. Kennedy P. *Maternity in Ireland: a woman-centred perspective*. Dublin: The Liffey Press, 2002.
  68. Amelink-Verburg MP, Verloove-Vanhorick SP, Hakkenberg RM, *et al.* Evaluation of 280,000 cases in Dutch midwifery practices: a descriptive study. *BJOG* 2008;115:570–8.
  69. Homer CS, Friberg IK, Dias MA, *et al.* The projected effect of scaling up midwifery. *Lancet* 2014;384:1146–57.
  70. Devane D, Murphy-Lawless J, Begley CM. Childbirth policies and practices in Ireland and the journey towards midwifery-led care. *Midwifery* 2007;23:92–101.