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Breastfeeding practices in the United Kingdom: Is the neighbourhood context important?

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Abstract

Breastfeeding is an important public health issue worldwide. Breastfeeding rates in the United Kingdom, particularly for exclusive breastfeeding, are low compared with other OECD countries, despite its wide-ranging health benefits for both mother and child. There is evidence that deprivation in the structural and social organisation of neighbourhoods is associated with adverse child outcomes. This study aimed to explore whether breastfeeding initiation, exclusive breastfeeding for at least 3 months, and any type of breastfeeding for at least 6 months were associated with neighbourhood context measured by neighbourhood deprivation and maternal neighbourhood perceptions in a nationally representative U.K. sample. A cross-sectional analysis was conducted using data from the Millennium Cohort Study. Logistic regression was carried out on a sample of 17,308 respondents, adjusting for individual- and familial-level socio-demographic characteristics. Neighbourhood deprivation was independently and inversely associated with breastfeeding initiation. Compared with the least deprived areas, the likelihood of initiating breastfeeding was 40% lower in the most deprived neighbourhoods (OR: 0.60, 95% CI [0.50, 0.72]). The relationship between both exclusive and any type of breastfeeding at 3 and 6 months respectively with neighbourhood deprivation after adjustment for potential confounders was not entirely linear. Breastfeeding initiation (OR: 0.78, 95% CI [0.71, 0.85]), exclusivity for 3 months (OR: 0.84, 95% CI [0.75, 0.95]), and any breastfeeding for 6 months (OR: 0.82, 95% CI [0.73, 0.93]) were each reduced by about 20% among mothers who perceived their neighbourhoods lacking safe play areas for children. Policies to improve breastfeeding rates should consider area-based approaches and the broader determinants of social inequalities.

KEYWORDS

breastfeeding, deprivation, maternal perception, neighbourhood, social environment, social inequalities

1 | INTRODUCTION

The promotion of breastfeeding is a fundamentally important public health issue globally. Mothers are advised to breastfeed infants exclusively for the first 6 months of life; thereafter, it should be prolonged up to 24 months of age or beyond with complementary nutrition (WHO, 2018). Benefits for the infants encompass protection against sepsis, diarrhoea, respiratory infections (Khan, Vesel, Bahl, & Martines, 2015), and gastrointestinal infections (Kramer & Kakuma, 2012). Breastfeeding is also important for the development of nervous and endocrine systems (Ballard & Morrow, 2013). Long-term protection against Type 2 diabetes, obesity (Horta, Loret de Mola, & Victora, 2015), and malocclusions (Peres, Cascaes, Nascimento, & Victora, 2015) has also been reported. Benefits are also extended to the

mother protecting against Type 2 diabetes, breast and ovarian cancers (Victora et al., 2016).

Societal gains have also been evaluated. If every infant was breastfed until 6 months of age, cognitive deficits could be avoided with consequential global savings of US$ 300 billion yearly (Rollins et al., 2016). Assuming a moderate increase in breastfeeding rates, Renfrew et al. (2012) estimated annual NHS savings of about £48 million through a reduction in breast cancer cases and acute infant diseases.

Exclusive breastfeeding for the first 6 months of life varies worldwide; however, the global mean remained at around 36% over the period of 2007–2014 (WHO, 2009; WHO, 2015).

In the United Kingdom in 2010, the prevalence of breastfeeding fell from 81% at birth to 69% at week one and declined further to 55% at 6 weeks. At 6 months, 34% of mothers were still breastfeeding; however, only 1% were breastfeeding exclusively (McAndrew et al., 2012). Additionally, the World Health Statistics 2015 shows that exclusive breastfeeding rates for the first 6 months of life remained unchanged at around 1% and were among the lowest worldwide in the 2007–2014 year period (WHO, 2015).

Breastfeeding is a complex behaviour influenced by an array of individual, social, and societal factors. One of these is the social environment where the mother resides. The socio-economic and political context stratifies individuals socially, shaping intermediary determinants (e.g., living conditions) that may lead to social inequalities in child health (WHO, 2010). Although structural determinants of health remain paramount, understanding the mechanisms through which intermediary determinants such as neighbourhoods affect child health could contribute to effective public health interventions aiming to increase breastfeeding rates in the United Kingdom.

Neighbourhood effects on child outcomes can be direct or more likely indirect (Leventhal & Brooks-Gunn, 2000). Resources such as access to professional support (e.g., access to a Baby-Friendly Initiative facility) and social relationships including social capital may facilitate positive health-related behaviours (Leventhal & Brooks-Gunn, 2000), which include breastfeeding. For instance, Tofani, Lamarca, Sheiham, and Vettore (2015) found that low individual- and neighbourhood-level social capital were associated with less healthy diets throughout pregnancy. Additionally, collective efficacy referring to formal and informal control monitoring the behaviour of residents (Leventhal & Brooks-Gunn, 2000) can improve neighbours' perceptions of safety within their neighbourhoods (Uchida, Swatt, Solomon, & Varano, 2014), which in turn could contribute to the willingness of mothers to breastfeed in public spaces.

Spatial mobility and virtual networking may have widened their influence on people's everyday lives. However, contemporary neighbourhood's redefinition by Sampson, Morenoff, and Gannon-Rowley (2002) considers spatial dynamics wherein neighbourhoods are influenced by their surrounding areas, thereby revealing that through the lens of social processes, neighbourhood boundaries extend further than mere census geography. Furthermore, there is considerable evidence that the neighbourhood remains important across a range of health-related behaviours.

Research examining neighbourhood effects on breastfeeding is limited and has produced some conflicting findings. Cubbin et al. (2008) using data collected via mailed questionnaire and telephone (follow-up) from Florida and Washington found no association between neighbourhood-level deprivation and breastfeeding initiation. Similarly, Lagerberg, Magnusson, and Sundelin (2011) studied a convenience sample of Swedish mother–child dyads. They revealed no association between any breastfeeding at 4 months and neighbourhood socio-economic status. Conversely, a Swedish study (Almquist-Tangen et al., 2013) and a Canadian study (Brown et al., 2013) found variations in breastfeeding duration and exclusivity respectively by neighbourhood income deprivation. Burdette (2013) using a large sample of American low-income, unmarried, urban mothers revealed that living in a highly educated neighbourhood increased the likelihood of initiating and sustaining breastfeeding, whereas the percentage of immigrants, ethnic diversity, and economic deprivation at neighbourhood level did not play a significant role. The use of selective study samples, as well as cultural and economic differences between countries, may explain why there are such contrasts in research findings.

Considering the wide-ranging benefits of breastfeeding along with low rates of exclusive breastfeeding in the United Kingdom, this study aims to explore whether breastfeeding initiation, exclusivity, and duration were associated with neighbourhood context conceptualised by deprivation and maternal neighbourhood perceptions in a nationally representative sample of U.K. children.

Key messages

- In the United Kingdom, as neighbourhood deprivation increased, odds for breastfeeding initiation decreased: odds lowered by 40% among mothers living in the most deprived areas compared with those living in the least deprived neighbourhoods.
- The likelihood of breastfeeding initiation, exclusivity at 3 months or more, and any breastfeeding for at least 6 months each reduced by about 20% with the maternal perception of neighbourhoods lacking safe play environments for children compared with neighbourhoods perceived as safe to play.
- Addressing social inequalities can be paramount in increasing the effectiveness of multifaceted and context-led interventions aiming at improving breastfeeding rates in the United Kingdom.

2 | METHODOLOGY

2.1 | Sample

This study was based on the cross-sectional analysis of data from the first wave of the U.K. Millennium Cohort Study (MCS). The MCS is a multidisciplinary project following the lives of approximately 19,000 children born in the United Kingdom during the period of 2000–2002. The MCS explores the social ecology in which the family

is nested, approaching topics such as parenting, demography, and social capital, and includes linked-in data on the neighbourhoods where the families lived when the cohort baby was born. Therefore, the MCS is well placed to investigate neighbourhood effects on children's health. The sampling frame for the MCS was the electoral ward. A cluster random sample was drawn that was stratified to over-represent economically disadvantaged areas, areas with high proportions of people from ethnic minority backgrounds, and the three smaller countries of the United Kingdom. A detailed description of the MCS sampling methodology can be found elsewhere (Hansen, 2012).

At wave one, the children were 9 months old and biological mothers constituted 99.7% of main respondents. Among the 28 fathers who were main respondents, only six provided answers to the breastfeeding questions. Therefore, in our analyses, cohort babies for whom the main respondent was not the biological mother were excluded. Also excluded were families whose cohort members were twins and triplets.

The MCS wave one gained ethical approval (MREC/01/6/19) from the South West Multi-Centre Research Ethics Committee in 2001 (Hansen, 2012).

2.2 | Measures

2.2.1 | Neighbourhood factors

"Neighbourhood-level deprivation" was measured via the indices of multiple deprivation (IMD) for England (ODPM, 2004), Scotland (Scottish Executive, 2004), Wales (National Assembly for Wales, 2005), and Northern Ireland (NISRA, 2005). For each U.K. country, the IMD is constructed in a very similar way, including the following domains: (a) barriers to housing and services, (b) crime, (c) income, (d) employment, (e) health and disability, (f) living environment deprivation, and (g) education, skills, and training (ODPM, 2004). Linked into the MCS data are IMD rank deciles for each U.K. country, based on a weighted cumulative model of these domains (Noble et al., 2008). For the purposes of this study, the rank deciles for each U.K. country were combined into a single variable and categorised into quintiles.

Maternal neighbourhood perceptions were operationalised at the individual level. "Neighbourhood satisfaction" was assessed by asking the mother, "How satisfied or dissatisfied are you with the area you live in? By your area, I mean within about a mile or 20 minutes' walk from here." The response categories were "very satisfied," "fairly satisfied," "neither satisfied nor dissatisfied," "fairly dissatisfied," and "very dissatisfied." "Neighbourhood friendliness" measured maternal perceptions about neighbours by asking mothers, "Please choose the phrase that you feel applies to most of your neighbours." Response categories were "friendly," "neither friendly nor unfriendly," "unfriendly," and "cannot say." "Neighbourhood safety for the child" was a dichotomous variable ("yes"/"no") obtained by asking the mother, "Are there any places in your area where children can play safely?"

2.2.2 | Breastfeeding outcomes

Thresholds for the breastfeeding outcomes were chosen based on the literature and relevant recommendations by the U.K. Department of Health and WHO (2018). Breastfeeding initiation: Breastfeeding initiation has been defined as the mother putting the baby to the breast or giving her breast milk to the baby within a period of 48 hr after birth (Dyson et al., 2006). In the MCS, breastfeeding initiation was measured by asking the mother, "Did you ever try to breastfeed [baby]?" The variable was dichotomised into "no" and "yes." Exclusive breastfeeding for at least 3 months: WHO defines exclusive breastfeeding as the infant receiving only breast milk, including milk expressed or from a wet nurse, and no other liquids or solids with the exception of oral rehydration solutions, drops or syrups consisting of vitamins, mineral supplements, or medicines (WHO, 2017). We derived this variable using information about the age of the child when breastfeeding stopped ("How old was [baby] when he/she last had breast milk?") and the age any other type of milk was introduced ("How old was [baby] when he/she first had formula milk, such as Cow & Gate or SMA?"). Exclusive breastfeeding was dichotomised into "none to less than 3 months" and "3 months or more." It should be noted that at the time of the first wave of the MCS (2000–2002), the U.K. Department of Health advised mothers to breastfeed exclusively for at least 4 months with the introduction of solid foods thereafter (Department of Health, 1994). The 3-month cut-off was chosen because at 4 months, only 613 (3.4%) women in the sample were exclusively breastfeeding. Any breastfeeding for at least 6 months encompassed babies exclusively, predominantly, or partially breastfed (WHO, 2008). Any breastfeeding was dichotomised into "none to less than 6 months" and "6 months or more."

2.2.3 | Covariates

As we wanted to know whether neighbourhood factors contributed to breastfeeding rates over and above individual- and familial-level socio-demographic characteristics, it was necessary to control for individual-level socio-demographic background that may confound this relationship. These variables were specified a priori, informed by a review of the literature. Confounding factors comprised household and maternal characteristics. "Household structure" summarised the number of parents within the household dichotomised into "two parents" and "single parent." "Household income" was measured using OECD equivalised weekly family income divided into weighted quintiles. "Household social class" was measured by the National Statistics Socio-economic Classification (Rose, Pevalin, & O'Reilly, 2005). We combined maternal and paternal social class into a single variable wherein the highest social class of either partner was considered and categorised into "managerial and professional," "intermediate," "small employers and self-employed," "low supervisory and technical," "semiroutine and routine," "never worked," and "not classifiable." "Residential mobility" measured the total time the family had been living at the current address as follows: "more than 5 years," "more than 1 up to 5 years," and "up to 1 year." "Maternal age" was used as a continuous variable (unit = years) and also as a categorical variable (four age groups). The former was used in the regression analysis and the latter in the descriptive analysis of the sample. "Maternal general health" was derived from the question, "How would you describe your health generally?" The response categories comprised "excellent," "good," "fair," and "poor." "Maternal longstanding illness" was a dichotomous variable

derived by probing the mother, "Do you have a longstanding illness, disability or infirmity?" "Maternal education" was measured using the National Vocational Qualification (NVQ) classification. The derived NVQ variable considers both vocational and academic qualifications. It was recategorised as follows: "NVQ levels 4 and 5" (e.g., degree or higher degree), "NVQ level 3" (e.g., 2+ A levels), "NVQ level 2" (e.g., 5 General Certificate of Secondary Education A–C or 1 A level), "NVQ level 1" (e.g., <5 General Certificate of Secondary Education D–E), "none," and "overseas qualification only." "Maternal ethnicity" was measured using six categories: "White," "Mixed," "Indian," "Pakistani and Bangladeshi," "Black or Black British," and "Other ethnic groups."

2.3 | Statistical analysis

The data were analysed using STATA version 14. The complex survey design of the MCS was accounted for by using the STATA "svy" command followed by variables for the stratification design, clustering effect, and finite population correction, in addition to the MCS overall weights, which are the inverse of the predicted probability of participation in a wave combined with the sampling weights.

For descriptive statistics, an initial assessment of neighbourhood exposures and covariates with each breastfeeding outcome was carried out using chi-squared tests accounting for the survey design. The initial assessment of neighbourhood exposures and covariates with each breastfeeding outcome revealed that all differences in the proportions were statistically significant except for breastfeeding initiation and longstanding illness. However, *p* values are not included in Tables 1 and 2 as they were deemed redundant given that trends are clear from the presented data. We conducted a complete case analysis as the rate of missingness for any variable did not exceed 5%, which is considered an appropriate threshold (Schafer, 1999). Characteristics of participants with missing data on exposures and covariates were explored using chi-squared tests accounting for the survey design. For the neighbourhood factors, multicollinearity was tested and ruled out, and further investigation of possible interactions between maternal neighbourhood satisfaction and IMD revealed no clear associations.

For each of the three breastfeeding outcomes, a series of four multivariable logistic regression models was estimated. We applied a theoretical approach to our model construction using control variables that explain breastfeeding initiation and duration, and no variable was removed based on *p* values. The following modelling strategy was developed: (a) Model 1 included the IMD quintiles; (b) Model 2 additionally adjusted for maternal neighbourhood

TABLE 1 Descriptive statistics: Breastfeeding outcomes by neighbourhood characteristics

Neighbourhood factors	18,234 (N)[a]	Breastfeeding initiation	Exclusive breastfeeding	Any breastfeeding[b]
	n	Yes (%)	≥3 months (%)	≥6 months (%)
Neighbourhood-level deprivation				
IMD				
Highest quintile	2,687	82.8	25.8	26.6
2nd highest	2,444	77.9	23.9	24.3
Middle quintile	3,030	71.7	19.1	18.7
2nd lowest	4,165	62.8	14.3	15.4
Lowest quintile	5,908	56.0	11.2	12.7
Maternal neighbourhood perceptions				
Neighbourhood satisfaction				
Very satisfied	7,375	74.2	22.2	22.5
Fairly satisfied	7,332	67.1	16.8	17.5
Neither	1,344	65.6	14.1	15.1
Fairly dissatisfied	1,305	65.6	13.4	16.6
Very dissatisfied	837	57.7	9.8	11.2
Missing	41	58.9	24.2	21.1
Neighbourhood friendliness				
Friendly	14,345	70.0	19.1	19.5
Neither	2,336	70.4	16.9	18.3
Unfriendly	504	61.6	15.5	15.7
Cannot say	441	59.9	13.5	13.9
Missing	608	72.1	16.7	23.9
Neighbourhood safety (child)				
Yes	10,939	74.6	21.3	21.9
No	7,027	60.3	13.5	14.2
Missing	268	71.3	16.0	20.4

Note. Data from the Millennium Cohort Study wave 1: Proportions accounted for the survey design.

[a]Sample size after exclusion criteria and deletion of missing values on breastfeeding outcomes. [b]Included babies exclusively, predominantly, or partially breastfed.

TABLE 2 Descriptive statistics: Breastfeeding outcomes by household and maternal characteristics

Familial and individual factors	18,234 (N)[a]	Breastfeeding initiation	Exclusive breastfeeding	Any breastfeeding[b]
	n	Yes (%)	≥3 months (%)	≥6 months (%)
Household characteristics				
Household structure				
Two parents	15,092	73.1	20.3	20.9
Single parent	3,142	49.0	8.1	9.3
Household income				
Highest quintile	2,907	87.0	29.9	27.3
2nd highest	3,168	79.2	22.7	23.3
Middle quintile	3,444	71.3	17.0	20.0
2nd lowest	4,089	59.8	13.4	14.4
Lowest quintile	4,565	50.6	9.3	10.8
Missing	61	66.2	28.4	28.1
Household social class				
Managerial and professional	6,878	83.4	27.4	27.6
Intermediate	2,370	68.8	15.3	16.7
Small and self-employed	1,071	69.4	16.7	20.5
Low sup. and technical	1,547	62.4	11.0	10.8
Semiroutine and Routine	4,887	50.6	8.7	8.9
Never worked	1,287	50.1	9.4	11.8
Not classifiable	194	66.8	14.7	21.6
Residential mobility				
>5 years and over	4,927	69.6	19.2	21.0
>1 up to 5 years	9,709	71.6	19.7	19.9
Up to 1 year	3,558	64.0	14.2	14.8
Missing	40	56.5	17.8	23.0
Maternal characteristics				
Age group				
12 to 19	1,581	45.3	4.9	4.8
20 to 29	8,557	65.1	13.3	14.0
30 to 39	7,710	77.5	25.3	25.9
40 plus	383	82.9	31.2	36.9
Missing	3	43.6	0.0	0.0
General health				
Excellent	5,474	74.3	24.3	22.8
Good	9,563	68.4	17.4	18.9
Fair	2,669	65.0	11.4	13.5
Poor	522	62.4	8.1	13.7
Missing	6	71.8	15.2	15.2
Longstanding illness				
No	14,389	70.0	19.4	19.7
Yes	3,838	68.1	15.3	17.5
Missing	7	73.9	35.7	35.7
Education				
NVQ levels 4 and 5	5,278	87.9	30.5	31.9
NVQ level 3	2,576	72.6	17.9	18.4
NVQ level 2	5,279	62.7	12.9	12.7
NVQ level 1	1,542	51.2	6.9	7.1
None	2,974	46.6	8.3	9.8
Overseas qualification	554	75.5	23.0	25.8
Missing	31	58.5	29.2	24.8

(Continues)

TABLE 2 (Continued)

Familial and individual factors	18,234 (N)[a]	Breastfeeding initiation	Exclusive breastfeeding	Any breastfeeding[b]
	n	Yes (%)	≥3 months (%)	≥6 months (%)
Ethnicity				
White	15,284	67.5	18.0	17.8
Mixed	188	86.9	29.5	30.3
Indian	470	85.4	22.6	27.6
Pakistani and Bangladeshi	1,252	78.2	17.8	21.7
Black/Black British	665	92.9	22.8	36.3
Other ethnic group	345	92.9	27.5	45.7
Missing	30	71.7	30.5	29.7

Note. Data from the Millennium Cohort Study wave 1: Proportions accounted for the survey design

[a]Sample size after exclusion criteria and deletion of missing values on breastfeeding outcomes. [b]Included babies exclusively, predominantly, or partially breastfed.

perceptions (i.e.,neighbourhood satisfaction, neighbourhood friendliness, and neighbourhood safety for the child); (c) Model 3 added to Model 2 maternal age and SES variables (i.e., income quintiles, NS-SEC, and maternal education); and (d) the fully adjusted model, additionally including maternal ethnicity, household structure, maternal general health, longstanding illness, and residential mobility. The interpretation of the models was carried out with Wald tests. Statistical significance was defined at the 0.05 level. Logistic regression results are presented as odds ratios with their 95% confidence intervals and *p* values.

3 | RESULTS

3.1 | Sample characteristics

Descriptive statistics are displayed in Tables 1 and 2. The exclusion criteria resulted in an original sample comprising 18,239 children. Missingness on outcomes totalled five observations (0.01%) that were excluded, resulting in 18,234 participants where missingness on exposures was highest (2.3%) for neighbourhood friendliness. Therefore, we conducted a complete case analysis for which a listwise deletion resulted in a final sample size of 17,308 children. Mothers with missing information for any of the exposures or covariates were more likely to live in deprived neighbourhoods, to belong to families with lower incomes, to live in households whose partners had never worked, or to have a nonclassifiable occupation (data not shown).

Breastfeeding outcomes and neighbourhood factors are displayed in Table 1. Breastfeeding decreased from the highest IMD quintile, that is, the least deprived neighbourhoods to the lowest quintile (most deprived) in a consistent stepwise fashion. Comparing the most deprived areas to the least deprived neighbourhoods, breastfeeding initiation rates were 56.0% versus 82.8%, whereas for exclusive and any breastfeeding for at least 3 and 6 months, respectively, rates were 11.2% versus 25.8% and 12.7% versus 26.6%. All three breastfeeding outcomes were more favourable among mothers who reported higher levels of neighbourhood satisfaction, who perceived their neighbours as friendlier, and who said that there were places in the neighbourhood where children could play safely. For example, breastfeeding was initiated by 74.2% of mothers who were very satisfied with their neighbourhood compared with 57.7% who were very dissatisfied.

Table 2 shows breastfeeding outcomes by household and maternal characteristics. All breastfeeding outcomes were positively associated with a two-parent household, a higher household income, and a higher social class. For example, only 8.7% of mothers in families who were in semiroutine and routine occupations exclusively breastfed for at least 3 months compared with 27.4% of those in managerial and professional occupations. Breastfeeding rates were the lowest among mothers residing in the neighbourhood up to 1 year and increased proportionally with increasing maternal age. The prevalence of each breastfeeding outcome was highest among mothers who self-reported their general health as excellent, who had no longstanding illness, whose levels of education comprised NVQ levels 4 and 5, and whose ethnicity was non-White. The exception was exclusive breastfeeding for at least 3 months, for which the prevalence was slightly lower among Pakistani and Bangladeshi mothers compared with White mothers.

3.2 | Breastfeeding initiation

In the bivariate analysis, the association between neighbourhood deprivation and breastfeeding initiation was inverse and significant (Model 1 in Table 3). Odds were lower for mothers living in the most deprived areas compared with those living in the least deprived neighbourhoods (OR = 0.25; 95% CI [0.20, 0.32]). The associations with maternal neighbourhood perceptions were positive and significant. For instance, the likelihood of breastfeeding initiation was reduced among mothers who could not express feelings about their neighbours compared with those who perceived them as friendly (OR = 0.64; 95% CI [0.49, 0.82]). This association, however, was not entirely linear. Results from the bivariate analyses for maternal neighbourhood perceptions are available as Supporting Information.

In the multivariable analysis (Table 3), controlling for maternal age and socio-economic factors (Model 3) substantially attenuated the

TABLE 3 Results of multivariable logistic regression of neighbourhood characteristics on breastfeeding initiation adjusted for familial- and individual-level factors

	Model 1 OR (95% CI)	Model 2 OR (95% CI)	Model 3 OR (95% CI)	Full adjustment OR (95% CI)
IMD				
Highest quintile	1 (Ref)	1 (Ref)	1 (Ref)	1 (Ref)
2nd highest	0.74 (0.61, 0.89)**	0.76 (0.63, 0.92)**	0.89 (0.75, 1.06)	0.87 (0.73, 1.04)
Middle quintile	0.52 (0.43, 0.63)***	0.56 (0.46, 0.67)***	0.84 (0.72, 0.99)*	0.81 (0.68, 0.95)*
2nd lowest	0.34 (0.28, 0.41)***	0.38 (0.31, 0.45)***	0.72 (0.61, 0.84)***	0.66 (0.56, 0.77)***
Lowest quintile	0.25 (0.20, 0.32)***	0.30 (0.24, 0.37)***	0.76 (0.62, 0.93)**	0.60 (0.50, 0.72)***
Neighbourhood satisfaction				
Very satisfied		1 (Ref)	1 (Ref)	1 (Ref)
Fairly satisfied		0.94 (0.85, 1.03)	1.00 (0.90, 1.11)	1.01 (0.91, 1.12)
Neither		1.06 (0.91, 1.25)	1.11 (0.94, 1.32)	1.14 (0.96, 1.35)
Fairly dissatisfied		1.16 (0.97, 1.37)	1.20 (1.01, 1.43)*	1.27 (1.06, 1.51)*
Very dissatisfied		0.99 (0.83, 1.19)	1.18 (0.98, 1.42)	1.32 (1.09, 1.61)**
Neighbourhood friendliness				
Friendly		1 (Ref)	1 (Ref)	1 (Ref)
Neither		1.14 (1.01, 1.29)*	1.22 (1.08, 1.39)**	1.20 (1.06, 1.36)**
Unfriendly		0.85 (0.68, 1.06)	1.04 (0.83, 1.31)	1.01 (0.80, 1.28)
Cannot say		0.77 (0.59, 1.01)	0.93 (0.71, 1.23)	0.88 (0.66, 1.18)
Neighbourhood safety (child)				
Yes		1 (Ref)	1 (Ref)	1 (Ref)
No		0.65 (0.59, 0.72)***	0.75 (0.68, 0.82)***	0.78 (0.71, 0.85)***
Maternal age			1.03 (1.02, 1.03)***	1.02 (1.01, 1.03)***
Household income				
Highest quintile			1 (Ref)	1 (Ref)
2nd highest			0.79 (0.66, 0.95)*	0.80 (0.66, 0.97)*
Middle quintile			0.78 (0.65, 0.94)*	0.78 (0.65, 0.95)*
2nd lowest			0.66 (0.54, 0.80)***	0.62 (0.51, 0.77)***
Lowest quintile			0.59 (0.48, 0.73)***	0.59 (0.48, 0.74)***
Household social class				
Manage and professional			1 (Ref)	1 (Ref)
Intermediate			0.74 (0.64, 0.86)***	0.73 (0.63, 0.85)***
Small and self-employed			0.81 (0.68, 0.97)*	0.77 (0.65, 0.92)**
Low sup. and technical			0.71 (0.59, 0.84)***	0.72 (0.61, 0.86)***
Semi-routine and routine			0.55 (0.48, 0.64)***	0.56 (0.49, 0.65)***
Never worked			0.67 (0.51, 0.87)**	0.55 (0.42, 0.72)***
Not classifiable			0.63 (0.42, 0.94)*	0.59 (0.39, 0.89)*
Maternal education				
NVQ levels 4 and 5			1 (Ref)	1 (Ref)
NVQ level 3			0.55 (0.48, 0.63)***	0.57 (0.49, 0.65)***
NVQ level 2			0.38 (0.33, 0.43)***	0.40 (0.35, 0.47)***
NVQ level 1			0.30 (0.25, 0.36)***	0.33 (0.27, 0.40)***
None			0.26 (0.22, 0.31)***	0.25 (0.21, 0.30)***
Overseas qualification			0.79 (0.58, 1.07)	0.58 (0.42, 0.79)**
Maternal ethnicity				
White				1 (ref)
Mixed				5.33 (3.36, 8.46)***
Indian				2.91 (1.83, 4.62)***
Pakistani and Bangladeshi				4.31 (3.38, 5.49)***
Black/Black British				11.0 (7.49, 16.2)***
Other ethnic group				6.31 (4.02, 9.91)***

(Continues)

TABLE 3 (Continued)

	Model 1 OR (95% CI)	Model 2 OR (95% CI)	Model 3 OR (95% CI)	Full adjustment OR (95% CI)
Household structure				
Two parents				1 (ref)
Single parent				0.78 (0.68, 0.88)***
Maternal general health				
Excellent				1 (Ref)
Good				0.95 (0.87, 1.05)
Fair				1.02 (0.88, 1.17)
Poor				0.98 (0.74, 1.28)
Maternal longstanding illness				
No				1 (Ref)
Yes				1.01 (0.90, 1.12)
Residential mobility				
>5 years and over				1 (Ref)
>1 up to 5 years				1.11 (1.00, 1.23)*
Up to 1 year				1.24 (1.10, 1.39)***

*p Value <.05, **p Value <.01, ***p Value <.001.

association between breastfeeding initiation and quintiles of IMD, which remained however statistically significant. Compared with Model 3, the association appeared to be slightly stronger after full adjustment (Model 4). The likelihood of breastfeeding initiation was 40% lower in the most deprived neighbourhoods compared with the least deprived areas (OR = 0.60; 95% CI [0.50, 0.72]). Very dissatisfied mothers were significantly more likely to initiate breastfeeding relative to very satisfied mothers (OR = 1.32; 95% CI [1.09, 1.61]). Odds for breastfeeding initiation were higher by 20% among mothers with neutral feelings about neighbours relative to those with feelings of friendliness (OR = 1.20; 95% CI [1.06, 1.36]). Alternatively, odds lowered by about 20% among mothers whose neighbourhoods were perceived as lacking places for children to play safely compared with those who perceived their neighbourhoods as safe to play (OR = 0.78; 95% CI [0.71, 0.85]).

Associations between breastfeeding initiation and maternal education and household income revealed a clear social gradient. Compared with those in the richest quintile, mothers in the poorest household income quintile were less likely to initiate breastfeeding (OR = 0.59; 95% CI [0.48, 0.43]). Odds were also significantly lower for families from all lower social classes compared with those in managerial and professional occupations, and for single mothers compared with those living with a partner (OR = 0.78; 95% CI [0.68, 0.88]). Odds for breastfeeding initiation were significantly higher for older versus younger mothers, and for mothers from minority ethnic groups compared with White mothers (OR for Black or Black British mothers = 11.0; 95% CI [7.49, 16.2]). Conversely, increasing the time of residence within the neighbourhood linearly reduced the likelihood of initiating breastfeeding.

3.3 | Exclusive breastfeeding for at least 3 months

In the bivariate analysis, the association between neighbourhood deprivation and exclusive breastfeeding at 3 months was inverse and significant (Model 1 in Table 4). Odds were significantly lower comparing mothers living in the most deprived areas to those living in the least deprived neighbourhoods (OR = 0.35; 95% CI [0.28, 0.45]). There was a positive and significant association with all three variables of maternal neighbourhood perceptions. With neighbourhood friendliness, only mothers who could not express feelings about their neighbours compared with those with feelings of friendliness had significantly reduced odds for breastfeeding exclusively at 3 months (OR = 0.67; 95% CI [0.47, 0.97]). Results from the bivariate analyses for maternal neighbourhood perceptions are available as Supporting Information.

In the multivariable analysis (Table 4), adjusting for maternal age and socio-economic factors (Model 3), the associations with IMD and neighbourhood satisfaction were no longer statistically significant. In the full adjustment (Model 4), mothers who perceived their neighbourhood as lacking safe play areas for children were about 16% less likely to breastfeed exclusively for at least 3 months relative to mothers with the perception of safe play areas in the neighbourhood (OR = 0.84; 95% CI [0.75, 0.95]).

Except for families where no parent (mother or father) had ever worked, odds of exclusive breastfeeding for at least 3 months were significantly lower for families from all lower social classes compared with those in managerial and professional occupations, for all lower levels of maternal education compared with NVQ levels 4 and 5, particularly for mothers with NVQ level 1 (OR = 0.33; 95% CI [0.25, 0.42]), and among single mothers compared with those living with a partner (OR = 0.70; 95% CI [0.57, 0.85]). Conversely, mothers reporting better general health presented significantly higher odds for exclusive breastfeeding for at least 3 months. Odds were also significantly higher per each year increase in maternal age (OR = 1.06; 95% CI [1.05, 1.07]), and for mothers from minority ethnic groups compared with White mothers, especially among those from Mixed ethnicity (OR = 2.46; 95% CI [1.68, 3.60]).

TABLE 4 Results from multivariable logistic regression of neighbourhood characteristics on exclusive breastfeeding ≥3 months adjusted for familial- and individual-level factors

	Model 1 OR (95% CI)	Model 2 OR (95% CI)	Model 3 OR (95% CI)	Full adjustment OR (95% CI)
IMD				
Highest quintile	1 (Ref)	1 (Ref)	1 (Ref)	1 (Ref)
2nd highest	0.91 (0.77, 1.08)	0.95 (0.80, 1.12)	1.07 (0.91, 1.25)	1.08 (0.92, 1.25)
Middle quintile	0.69 (0.56, 0.84)**	0.74 (0.60, 0.91)**	1.02 (0.84, 1.23)	1.01 (0.83, 1.22)
2nd lowest	0.47 (0.38, 0.57)**	0.54 (0.44, 0.67)***	0.90 (0.74, 1.08)	0.88 (0.73, 1.07)
Lowest quintile	0.35 (0.28, 0.45)***	0.44 (0.34, 0.58)***	0.96 (0.75, 1.23)	0.86 (0.67, 1.11)
Neighbourhood satisfaction				
Very satisfied		1 (Ref)	1 (Ref)	1 (Ref)
Fairly satisfied		0.88 (0.77, 1.00)*	0.94 (0.83, 1.07)	0.97 (0.85, 1.10)
Neither		0.83 (0.66, 1.05)	0.89 (0.69, 1.14)	0.95 (0.74, 1.21)
Fairly dissatisfied		0.80 (0.63, 1.00)	0.82 (0.65, 1.04)	0.88 (0.70, 1.11)
Very dissatisfied		0.66 (0.49, 0.90)**	0.78 (0.57, 1.07)	0.88 (0.64, 1.21)
Neighbourhood friendliness				
Friendly		1 (Ref)	1 (Ref)	1 (Ref)
Neither		0.97 (0.82, 1.14)	1.00 (0.85, 1.18)	1.03 (0.87, 1.22)
Unfriendly		1.01 (0.73, 1.39)	1.22 (0.87, 1.73)	1.28 (0.90, 1.82)
Cannot say		0.82 (0.56, 1.19)	0.95 (0.64, 1.41)	0.98 (0.66, 1.46)
Neighbourhood safety (child)				
Yes		1 (Ref)	1 (Ref)	1 (Ref)
No		0.74 (0.65, 0.84)***	0.83 (0.74, 0.93)**	0.84 (0.75, 0.95)**
Maternal age			1.06 (1.05, 1.07)***	1.06 (1.05, 1.07)***
Household income				
Highest quintile			1 (Ref)	1 (Ref)
2nd highest			0.91 (0.78, 1.06)	0.93 (0.79, 1.09)
Middle quintile			0.92 (0.76, 1.10)	0.96 (0.80, 1.16)
2nd lowest			0.99 (0.82, 1.21)	1.05 (0.85, 1.29)
Lowest quintile			0.91 (0.72, 1.14)	1.08 (0.85, 1.37)
Household social class				
Manage and professional			1 (Ref)	1 (Ref)
Intermediate			0.75 (0.63, 0.90)**	0.77 (0.64, 0.92)**
Small and self-employed			0.78 (0.62, 0.97)*	0.77 (0.61, 0.96)*
Low sup. and technical			0.60 (0.49, 0.74)***	0.64 (0.52, 0.79)***
Semiroutine and routine			0.58 (0.47, 0.71)***	0.62 (0.51, 0.76)***
Never worked			0.72 (0.49, 1.05)	0.70 (0.48, 1.03)
Not classifiable			0.53 (0.29, 0.95)*	0.54 (0.30, 0.97)*
Maternal education				
NVQ levels 4 and 5			1 (Ref)	1 (Ref)
NVQ level 3			0.70 (0.60, 0.82)***	0.73 (0.62, 0.85)***
NVQ level 2			0.50 (0.44, 0.58)***	0.52 (0.45, 0.60)***
NVQ level 1			0.31 (0.24, 0.40)***	0.33 (0.25, 0.42)***
None			0.38 (0.30, 0.49)***	0.38 (0.30, 0.48)***
Overseas qualification			1.15 (0.82, 1.61)	0.99 (0.70, 1.40)
Maternal ethnicity				
White				1 (Ref)
Mixed				2.46 (1.68, 3.60)***
Indian				1.43 (1.03, 1.98)*
Pakistani and Bangladeshi				1.96 (1.40, 2.75)***
Black/Black British				1.62 (1.22, 2.16)**
Other ethnic group				1.48 (1.01, 2.17)*

(Continues)

TABLE 4 (Continued)

	Model 1 OR (95% CI)	Model 2 OR (95% CI)	Model 3 OR (95% CI)	Full adjustment OR (95% CI)
Household structure				
Two parents				1 (Ref)
Single parent				0.70 (0.57, 0.85)**
Maternal general health				
Excellent				1 (ref)
Good				0.78 (0.70, 0.87)***
Fair				0.55 (0.44, 0.68)***
Poor				0.38 (0.25, 0.57)***
Maternal longstanding illness				
No				1 (Ref)
Yes				0.95 (0.83, 1.08)
Residential mobility				
>5 years and over				1 (Ref)
>1 up to 5 years				1.09 (0.97, 1.23)
Up to 1 year				1.06 (0.88, 1.28)

*p Value <.05, **p Value <.01, ***p Value <.001.

3.4 | Any breastfeeding for at least 6 months

In the bivariate analysis, again as neighbourhood deprivation increased, odds for continuing breastfeeding at 6 months decreased (Model 1 in Table 5). Mothers living in the most deprived areas had significantly lower odds to breastfeed at 6 months compared with those living in the least deprived neighbourhoods (OR = 0.39; 95% CI [0.29, 0.52]). There was also a positive and significant association with all three variables of maternal neighbourhood perceptions. However, the association with neighbourhood satisfaction was not entirely linear. Again, results from the bivariate analyses are available as Supporting Information.

In the multivariable analysis (Table 5), the full adjustment (Model 4) reveals that mothers living in the second most deprived neighbourhoods were around 20% less likely to continue with any type of breastfeeding for at least 6 months compared with those living in the least deprived areas (OR = 0.79; 95% CI [0.63, 0.99]). Model 4 in Table 5 also shows that mothers who perceived their neighbourhoods as lacking safe play areas for children were about 18% less likely to continue breastfeeding for at least 6 months relative to those with the perception of neighbourhoods having safe play areas (OR = 0.82; 95% CI [0.73, 0.93]).

Odds for continuing breastfeeding for at least 6 months were significantly higher per each year increase in maternal age, for all levels of household income compared with the highest quintile (i.e., the richest) except for the second highest, and for mothers from minority ethnic groups compared with White mothers, especially among those from the Other ethnic group (OR = 3.96; 95% CI [2.78, 5.64]). Conversely, apart from families in small and self-employed and with nonclassifiable occupations, odds were significantly lower for those from lower social classes compared with families in managerial and professional occupations, and for all lower levels of maternal education compared with NVQ levels 4 and 5, particularly for mothers with NVQ level 1 (OR = 0.30; 95% CI [0.23, 0.39]). The likelihood of breastfeeding at 6 months also lowered among single mothers compared with those living with a partner, and among mothers reporting fair or poor health compared with those in excellent health.

4 | DISCUSSION

To our knowledge, this is the first study in the United Kingdom that has explored the relationship between breastfeeding and neighbourhood deprivation adjusting for a comprehensive set of familial- and individual-level factors. In addition, this is the first study to explore the association between maternal neighbourhood perceptions and breastfeeding.

In the bivariate analysis, all three breastfeeding outcomes were negatively associated with neighbourhood deprivation and positively associated with more favourable maternal neighbourhood perceptions. In the full adjustment, breastfeeding initiation was independently and negatively associated with neighbourhood deprivation. There also appears to be an inverse relationship between exclusive and any breastfeeding for at least 3 and 6 months respectively and neighbourhood deprivation. All three breastfeeding outcomes were independently and positively associated with the maternal perception of the neighbourhood having safe play areas for children.

The results of this study showed that mothers living in the most deprived neighbourhoods were 40% less likely to initiate breastfeeding compared with those living in the least deprived areas. This finding was consistent with Bonet, Smith, Pilkington, Draper, and Zeitlin (2013) who revealed that in the United Kingdom (Trent) and France (Ile-de-France), breastfeeding at discharge from hospital was lower in neighbourhoods presenting the highest unemployment rates than those with the lowest, and with Oakley, Renfrew, Kurinczuk, and Quigley (2013) who found that outside London, Primary Care Trusts in the most deprived quintile had a 32% reduced

TABLE 5 Results from multivariable logistic regression of neighbourhood characteristics on any breastfeeding ≥6 months adjusted for familial- and individual-level factors

	Model 1 OR (95% CI)	Model 2 OR (95% CI)	Model 3 OR (95% CI)	Full adjustment OR (95% CI)
IMD				
Highest quintile	1 (Ref)	1 (Ref)	1 (Ref)	1 (Ref)
2nd highest	0.90 (0.75, 1.08)	0.93 (0.78, 1.11)	1.02 (0.86, 1.22)	1.01 (0.85, 1.20)
Middle quintile	0.63 (0.52, 0.76)***	0.67 (0.55, 0.82)***	0.89 (0.73, 1.08)	0.85 (0.70, 1.04)
2nd lowest	0.49 (0.39, 0.61)***	0.55 (0.43, 0.69)***	0.85 (0.69, 1.06)	0.79 (0.63, 0.99)*
Lowest quintile	0.39 (0.29, 0.52)***	0.46 (0.34, 0.63)***	0.94 (0.70, 1.25)	0.77 (0.58, 1.02)
Neighbourhood satisfaction				
Very satisfied		1 (Ref)	1 (Ref)	1 (Ref)
Fairly satisfied		0.90 (0.80, 1.02)	0.97 (0.85, 1.10)	0.98 (0.86, 1.11)
Neither		0.86 (0.68, 1.08)	0.93 (0.73, 1.17)	0.95 (0.75, 1.20)
Fairly dissatisfied		1.00 (0.80, 1.24)	1.05 (0.83, 1.32)	1.11 (0.88, 1.40)
Very dissatisfied		0.75 (0.56, 1.00)	0.88 (0.66, 1.17)	0.97 (0.73, 1.29)
Neighbourhood friendliness				
Friendly		1 (Ref)	1 (Ref)	1 (Ref)
Neither		1.01 (0.87, 1.17)	1.04 (0.90, 1.21)	1.06 (0.91, 1.23)
Unfriendly		0.96 (0.69, 1.33)	1.13 (0.80, 1.59)	1.15 (0.81, 1.64)
Cannot say		0.81 (0.56, 1.16)	0.92 (0.64, 1.34)	0.89 (0.60, 1.32)
Neighbourhood safety (child)				
Yes		1 (Ref)	1 (Ref)	1 (Ref)
No		0.72 (0.63, 0.82)***	0.81 (0.72, 0.92)**	0.82 (0.73, 0.93)**
Maternal age			1.07 (1.06, 1.08)***	1.07 (1.06, 1.08)***
Household income				
Highest quintile			1 (Ref)	1 (Ref)
2nd highest			1.11 (0.94, 1.31)	1.12 (0.95, 1.32)
Middle quintile			1.46 (1.25, 1.70)***	1.47 (1.26, 1.72)***
2nd lowest			1.42 (1.19, 1.69)***	1.40 (1.17, 1.67)***
Lowest quintile			1.40 (1.14, 1.72)**	1.54 (1.25, 1.89)***
Household social class				
Manage and professional			1 (Ref)	1 (Ref)
Intermediate			0.76 (0.63, 0.91)**	0.77 (0.64, 0.92)**
Small and self-employed			0.93 (0.74, 1.17)	0.90 (0.72, 1.13)
Low sup. and technical			0.53 (0.41, 0.67)***	0.55 (0.43, 0.70)***
Semiroutine and routine			0.54 (0.44, 0.65)***	0.57 (0.47, 0.69)***
Never worked			0.79 (0.58, 1.09)	0.69 (0.51, 0.94)*
Not classifiable			0.89 (0.51, 1.54)	0.87 (0.51, 1.49)
Maternal education				
NVQ levels 4 and 5			1 (Ref)	1 (Ref)
NVQ level 3			0.63 (0.54, 0.74)***	0.67 (0.57, 0.78)***
NVQ level 2			0.42 (0.36, 0.49)***	0.45 (0.39, 0.52)***
NVQ level 1			0.27 (0.21, 0.35)***	0.30 (0.23, 0.39)***
None			0.33 (0.26, 0.43)***	0.33 (0.26, 0.42)***
Overseas qualification			0.95 (0.68, 1.32)	0.73 (0.52, 1.02)
Maternal ethnicity				
White				1 (Ref)
Mixed				2.64 (1.77, 3.95)***
Indian				1.89 (1.32, 2.71)**
Pakistani and Bangladeshi				2.51 (1.89, 3.33)***
Black/Black British				3.18 (2.48, 4.08)***
Other ethnic group				3.96 (2.78, 5.64)***

(Continues)

TABLE 5 (Continued)

	Model 1 OR (95% CI)	Model 2 OR (95% CI)	Model 3 OR (95% CI)	Full adjustment OR (95% CI)
Household structure				
Two parents				1 (Ref)
Single parent				0.69 (0.56, 0.84)***
Maternal general health				
Excellent				1 (Ref)
Good				0.90 (0.81, 1.00)
Fair				0.66 (0.55, 0.79)***
Poor				0.66 (0.47, 0.92)*
Maternal longstanding illness				
No				1 (Ref)
Yes				1.01 (0.88, 1.17)
Residential mobility				
>5 years and over				1 (Ref)
>1 up to 5 years				1.03 (0.90, 1.17)
Up to 1 year				1.03 (0.88, 1.22)

*p Value <.05, **p Value <.01, ***p Value <.001.

odds of breastfeeding initiation compared with those in the least deprived quintile.

Additionally, there seems to be a negative relationship between both exclusive breastfeeding for at least 3 months and any type of breastfeeding for at least 6 months and neighbourhood deprivation. However, these relationships appeared less strong and not entirely linear once other variables were taken into account. Mothers living in the second most deprived neighbourhoods were about 20% less likely to continue breastfeeding for at least 6 months compared with those living in the least deprived areas. Findings for exclusive and any breastfeeding were consistent with Oakley et al. (2013) across non-London Primary Care Trusts, in which odds for exclusive and any breastfeeding at 6–8 weeks were negatively associated with deprivation at the area level measured by the 2010 Index of Multiple Deprivation. In their findings, however, the association with any breastfeeding at 6–8 weeks was stronger and linear.

Breastfeeding initiation appears to be indirectly influenced by neighbourhood deprivation. In poor quality neighbourhoods, for instance, there may not be the support systems in place to encourage mothers to initiate breastfeeding, and perhaps socialisation with family and friends for whom formula feeding is the norm could discourage breastfeeding. Moreover, there might be a lack of or insufficient encouragement from institutional support systems including health providers. Furthermore, education, social class, and some medical conditions such as obesity can potentially influence breastfeeding initiation (Jonas & Woodside, 2016; McAndrew et al., 2012; Turcksin, Bel, Galjaard, & Devlieger, 2014). The clustering of such health conditions with low education and lower social classes appear to be a characteristic of deprived areas in England (Marmot, 2010).

Neighbourhood effects on exclusive and any type of breastfeeding are also more likely to be indirect and particularly influenced by familial and individual levels. Proximal determinants such as self-efficacy, intention, and planning appear to be paramount for exclusive breastfeeding (de Jager, Skouteris, Broadbent, Amir, & Mellor, 2013; Dennis, Gagnon, Van Hulst, & Dougherty, 2014), whereas the perception of insufficient milk supply, postpartum depression, and familial support can be crucial for breastfeeding duration (Dias & Figueiredo, 2015; Thulier & Mercer, 2009). Furthermore, individual- and familial-level characteristics are likely to interact with neighbourhood characteristics (Diez Roux & Mair, 2010; Schüle & Bolte, 2015) influencing breastfeeding duration and exclusivity.

Maternal neighbourhood satisfaction was inversely associated with breastfeeding initiation. Research on the interpretation of this subjective measure of neighbourhood context seems to be scarce. However, neighbourhood satisfaction is complex as it appears to be rooted in personal, psychological, and social factors over and above the physical environment (Hur, Nasar, & Chun, 2010). Moreover, neighbourhood perceptions are likely to vary by urban/rural residence (De Vos, Van Acker, & Witlox, 2016; Salmon et al., 2013). In England and Scotland, sense of belonging and area satisfaction were perceived slightly higher among rural residents (Pateman, 2011). Neighbourhood race/ethnic composition was also reported to play a significant role in individual and neighbourhood satisfaction (Knies, Nandi, & Platt, 2016; Swaroop & Krysan, 2011). In this sample, specific institutional or social processes at the neighbourhood level that influenced mothers' levels of satisfaction were unknown. Perhaps, mothers might have perceived the area where they lived as unsatisfactory due to adverse physical environments such as traffic noise or living density, rather than accessibility to health facilities equipped with professionals trained in breastfeeding.

Breastfeeding initiation was higher among mothers who expressed neutral feelings about neighbours compared with those with feelings of friendship. This does not necessarily suggest that positive social support is negatively associated with breastfeeding initiation. Instead, mothers who live in areas where they are impersonal about the relationship with their neighbours might have stronger social networks outside the immediate neighbourhood. An example might be minority ethnic groups who are more likely to breastfeed in the United Kingdom (Baker, Garrow, & Shiels, 2011; Kelly, Watt, & Nazroo, 2006). Ethnic minority mothers may have their culture and

beliefs about initiation of breastfeeding preserved. Indeed, conviviality and friendship could induce mothers to the culture of using formula milk through a "contagious model" (Jencks & Mayer, 1990) enabling a particular behaviour to become a norm among neighbours.

The likelihood for all breastfeeding outcomes was lowered by about 20% with the maternal perception of neighbourhoods lacking safe play areas for children. Such perceptions may indicate a more general feeling that the area is not safe. Associations between maternal perceptions of unsafe neighbourhoods with unfavourable child outcomes have been previously reported in the literature, for instance, with adverse mental health (Pettit, Bates, Dodge, & Meece, 1999), obesity (Bacha et al., 2010), and asthma (Vangeepuram, Galvez, Teitelbaum, Brenner, & Wolff, 2012). Institutional resources such as the availability of safe playgrounds and the social environment (e.g., social relationships) can be plausible pathways through which neighbourhood effects are transmitted to individuals influencing behaviour and child outcomes (Christian et al., 2015; Diez Roux & Mair, 2010; Leventhal & Brooks-Gunn, 2000). In line with that, safe play areas in the neighbourhood could provide a meeting point for mothers to share positive health behaviours including breastfeeding.

This study has strengths and limitations. We used a large, nationally representative U.K. sample and, additionally, conducted comprehensive adjustments for factors at the household and individual levels including residential mobility. Moreover, the inclusion of subjective neighbourhood measures was an important step towards exploring the role of perceived neighbourhood quality and social dimensions of breastfeeding.

However, if researchers are not explicit about the causal pathways hypothesised between neighbourhood constructs analysed and breastfeeding, inference is likely to be limited. Diez Roux (2004) explained that individual-level factors can be simultaneously mediators and confounders in neighbourhood effects on health. As noted by Diez Roux and Mair (2010), the cumulative exposure to impoverished areas early in life might reduce access to education and employment and thus affect health later in life, whereas lack of education and low-paid jobs at the individual level may also be confounders to neighbourhood deprivation effects on health. Therefore, adjusting for individual- and familial-level factors in order to identify a direct effect of neighbourhood-level deprivation may have eliminated pathways that influenced exclusive and any breastfeeding for at least 3 and 6 months, respectively.

Furthermore, the dichotomisation of breastfeeding duration could have caused a loss of potentially useful information. However, we were limited by the measurement in the MCS, and additionally, a continuous variable would be subject to measurement error with peaks of reporting at the monthly intervals. Existing research demonstrates, whether for breastfeeding or unemployment spells, people find it difficult to report circumstances in continuous intervals of time. We have tested a threshold that was important at the time (i.e., 4 months) and a threshold now considered a critical point (i.e., 6 months). As previously mentioned, at the time of the first wave, only 3.4% of women in the sample were breastfeeding exclusively at 4 months; therefore, the threshold chosen was 3 months. Both thresholds (i.e., 3 and 6 months) have been used in previous studies (e.g., Gore, Emerson, & Brady, 2015; Hao et al., 2017; O'Connor, Allen, Kelly, Gao, & Kildea, 2017). Ultimately, this was a cross-sectional study, and therefore, causation cannot be inferred.

Our findings have potentially important policy implications. As a public health indicator, breastfeeding rates can be a good marker of social inequalities (Department of Health, 2016). Breastfeeding is determined by a range of interacting factors operating at different levels, therefore requiring a range of downstream, midstream, and upstream strategies. We suggest that policy makers should consider programmes to advocate breastfeeding more strongly in deprived neighbourhoods. The allocation of adequate resources such as the "Baby-Friendly Initiative" for deprived areas can be paramount to increase breastfeeding initiation; however, focusing solely at the time of birth could be reductionist. Therefore, multifaceted strategies designed on the social determinants of health inequalities concomitantly with individual and community empowerment are crucial (Marmot, 2010).

Policies to improve the physical and social environments of neighbourhoods along with the provision and maintenance of parks and amenities for children could indirectly result in an increase in the rates of breastfeeding initiation and duration. Nevertheless, the success of public health interventions relies upon targeting "all" determinants of breastfeeding including not only proximal factors such as professional support but also distal factors such as public policies promoting breastfeeding in public spaces, and the regulation of marketing practice of the infant formula industry.

In conclusion, neighbourhoods and breastfeeding are both multidimensional constructs, making it challenging to provide specific recommendations. Our main finding was that breastfeeding in the United Kingdom seems to be associated with the environment over and above individual background. Therefore, multifaceted and context-led interventions seem necessary along with strategies targeting social inequalities. Future research should aim to address the issue of selection bias inherent to residential mobility using longitudinal data and causal methods of analysis, in addition to qualitative techniques to explore women's views about initiating and maintaining breastfeeding in relation to their environment.

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CONFLICTS OF INTEREST

The authors declare that they have no conflicts of interest.

CONTRIBUTIONS

ABP conducted the data analysis and drafted the initial version of the manuscript. RGW proposed the hypothesis and contributed to the first draft. AH and SJ contributed to the data analysis. All coauthors contributed to the interpretation of the findings, critically reviewed and edited all sections of the text, and approved the final version of the manuscript.

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SUPPORTING INFORMATION

Additional supporting information may be found online in the Supporting Information section at the end of the article.

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