Swansea University
Prifysgol Abertawe
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MSc/PGDip/PGCert Health Data Science

Assignment cover sheet

Module: **(Please tick the appropriate box).**	☐ PMIM102/J Scientific Computing in Healthcare ☒ PMIM202/J Health Data Modelling ☐ PMIM302 Introductory Analysis of Linked Health Data ☐ PMIM402/J Machine Learning in Healthcare ☐ PMIM502/J Health Data Visualisation ☐ PMIM602 Advanced Analysis of Linked Health Data
Module part (if applicable):	
Title of assignment:	Research Report
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Sociodemographic & Psychiatric Risk Factors of Breastfeeding Intention & Duration

Lay Summary

The World Health Organisation recommends that babies are breastfed for their first 6 months of life due to the health benefits it provides to both mother and baby. Despite this, only a quarter of babies in Wales are breastfed at 6 months. Increasing this statistic will consequently improve the health of Wales's population. The aim of this study was to identify risk factors of breastfeeding intention and duration so that at-risk mothers can be identified for additional support within the health service. Data from 744 women in Wales was analysed for relationships to breastfeeding intention and duration using statistical methods. It was found that married or partnered mothers and those with non-severe anxiety were significantly more likely to intend to breastfeed. Conversely, mothers with moderately severe depression and who had a previous child were significantly less likely to intend to breastfeed. Mothers who experienced low mood were also significantly more likely to stop breastfeeding early, as were healthy weight, overweight or obese mothers (compared to underweight). Surprisingly, mothers with a previous child and those with a history of smoking were significantly less likely to stop breastfeeding early. Education level was not a significant predictor of breastfeeding intention, nor were household income or low-income status significant predictors of breastfeeding intention or duration. Although a number of these results disagree with past studies' findings, it can be suggested with some confidence that expectant mothers who are not married/partnered, have previous children and/or have depressive symptoms are particularly at risk of not intending to breastfeed and/or stopping breastfeeding early. Expectant mothers with these characteristics should be prioritised for more support and guidance to increase their likelihood of intending to breastfeed and of breastfeeding for as much of the babies' first 6 months as possible.

Introduction

In Wales, nearly 64% of expectant mothers intend to breastfeed but only 26% of babies are breastfed at 6 months (Welsh Government, 2023). This is despite the World Health Organisation (WHO, 2024) recommending exclusive breastfeeding for the first 6 months, and a Welsh Government (2019) 'Five Year Action Plan' to increase breastfeeding intention and duration. Given the well-established health benefits of breastfeeding (Binns et al., 2016), the current study focuses on the factors that influence mothers' intention and duration of breastfeeding in Wales, to inform more effective initiatives.

Of the lesser disputed variables of interest, marriage or cohabitation has been found to be positively associated with breastfeeding, for example studies of 2,690 and 46,474 women in the USA found that those who were married or cohabiting were 1.97 and 1.43 times as likely to intend to breastfeed respectively (Chertok et al., 2011; Lee et al., 2005), so replication of these findings in a Welsh sample is of interest. Similarly, Lee et al.'s (2005) finding that lower maternal education was negatively associated with intention to breastfeed is congruent with other studies. For example, an Australian study of primiparous (first-time) mothers found an association between higher education and awareness of breastfeeding recommendations, and that those with this awareness were 5.6 times more likely to adhere to the WHO's recommendation (Wen et al., 2009). Multiparity is itself another variable of interest in the current study, as Lee et al. amongst other researchers have found primiparous women to be more likely to intend/initiate breastfeeding (Ladomenou et al., 2007). Additionally, there is a substantial amount of literature supporting an association between smoking and a lower prevalence and duration of breastfeeding (Fernandes & Höfelmann, 2020; Gutierrez-de-Terán-Moreno et al., 2022), warranting its inclusion as a potential predictor of mothers' breastfeeding behaviours in Wales.

Of the variables with mixed findings, the literature has typically supported the notion that higher maternal income increases the likelihood of breastfeeding, often attributed to higher income mothers having less need to quickly return to work outside the home which minimises one's ability to continue breastfeeding (T. Baumgartner et al., 2020; Persad & Mensinger, 2008). Lee et al. (2005) however did not find support for household income being predictive of intention to breastfeed, so this will be investigated in the current study. Another disputed variable is anxiety, with a systematic review of studies on prenatal anxiety and breastfeeding suggesting that sample sizes and measures were insufficient to support the negative association found (Fallon et al., 2016). These studies used low anxiety as the referent rather than an absence of anxiety, revealing a potential gap in the research. The link between depression and breastfeeding has similarly been met with mixed findings, with some studies finding a negative association (Fairlie et al., 2009; Kehler et al., 2009), but others finding no significant association (Chung et al., 2004; Pippins et al.,

2006). The literature generally agrees that there is an association between high maternal weight and shorter breastfeeding duration, with obese women being at increased risk of early cessation of breastfeeding, whether exclusive or not (Crimmins et al., 2023; Hauff et al., 2014). However, studies of maternal weight and breastfeeding do not typically investigate underweight mothers, instead focusing on comparing 'healthy' to 'overweight', leaving a gap in the understanding of how this demographic variable may influence breastfeeding behaviours.

The main objective was to identify key factors which are predictive of intention to breastfeed in a sample of mothers in Wales. It was hypothesised that relationship status, depression severity, anxiety severity, smoking history, education level, household income, and whether the mother had previous children (multiparity) would be predictive of intention to breastfeed. A secondary aim was to identify whether certain factors affect the duration of breastfeeding. It was hypothesised that low mood (any presence of depressive symptoms), BMI, smoking history, low-income, and multiparity would affect the duration of breastfeeding after birth.

Methods

Design and Participants

Secondary data analysis of a cohort study by the National Centre for Population Health and Wellbeing Research was conducted. The sample consisted of opportunity-sampled women who satisfied the inclusion criteria of being pregnant, aged 16 or over, and living in Wales. Participants provided informed consent to begin the study, were allowed to withdraw at any point, and their data were anonymised. Participants answered a questionnaire and were followed up after birth. The original sample consisted of 753 women, but due to extensive missing data 9 were excluded from this study which produced a sample of 744 women. Table 1 contains a summary of the sample's demographics.

Statistical Analyses

The first aim was to identify key factors which are predictive of the intention to breastfeed. As such, the dependent variable in this part of the study was the expectant mothers' intention to breastfeed, whilst the independent variables were relationship status, depression severity (PHQ-9: Kroenke et al., 2001), anxiety severity (GAD-7: Spitzer et al., 2006), smoking history, education level, household income, and multiparity. A multivariable logistic regression was used, and the model was determined using manual backward stepwise selection. To compare against the logistic regression results, a decision tree was also used to determine the factors predictive of intention to breastfeed.

In the second part of the study, the aim was to identify whether certain factors affect the duration of breastfeeding. Survival analyses were performed on each independent variable. The

dependent variable for Kaplan-Meier analysis was the number of days babies were breastfed after birth, whilst the dependent variable for Cox regression was mothers stopping breastfeeding. The independent variables were low mood, BMI, smoking history, low-income, and multiparity.

Table 1 *Summary of study population demographics*

	Intending to breastfeed (n = 610)	Not intending to breastfeed (n = 134)	Total (n = 744)
White ethnicity	584	133	717
British nationality	581	134	715
BMI (mean, SD)	27.74 (6.88)	29.55 (7.57)	28.06 (7.04)
History of smoking	197	45	242
Has previous child/children	237	69	306
Relationship status			
Single	24	17	41
Dating or engaged	29	8	37
Married or living with partner	557	109	666
PHQ-9 depression severity			
None	282	60	342
Minimal	76	10	86
Mild	131	25	156
Moderate	87	20	107
Moderately severe	22	12	34
Severe	12	7	19
GAD-7 anxiety severity			
None	61	20	81
Minimal	245	43	288
Mild	179	35	214
Moderate	82	16	98
Severe	43	20	63
Level of education			
None	3	0	3
GCSE/equivalent	43	20	63
A level/equivalent	78	29	107
Diploma/equivalent	55	16	71
Undergraduate degree	420	69	489
Master’s degree/equivalent	5	0	5
PhD/equivalent	6	0	6
Household income			
Less than £10,000	27	11	38
Between £10k and £20k	48	22	70
Between £20k and £30k	87	16	103
Between £30k and £40k	96	16	112
Between £40k and £50k	99	29	128
More than £50,000	253	40	293

Results

Predictors of Intention to Breastfeed

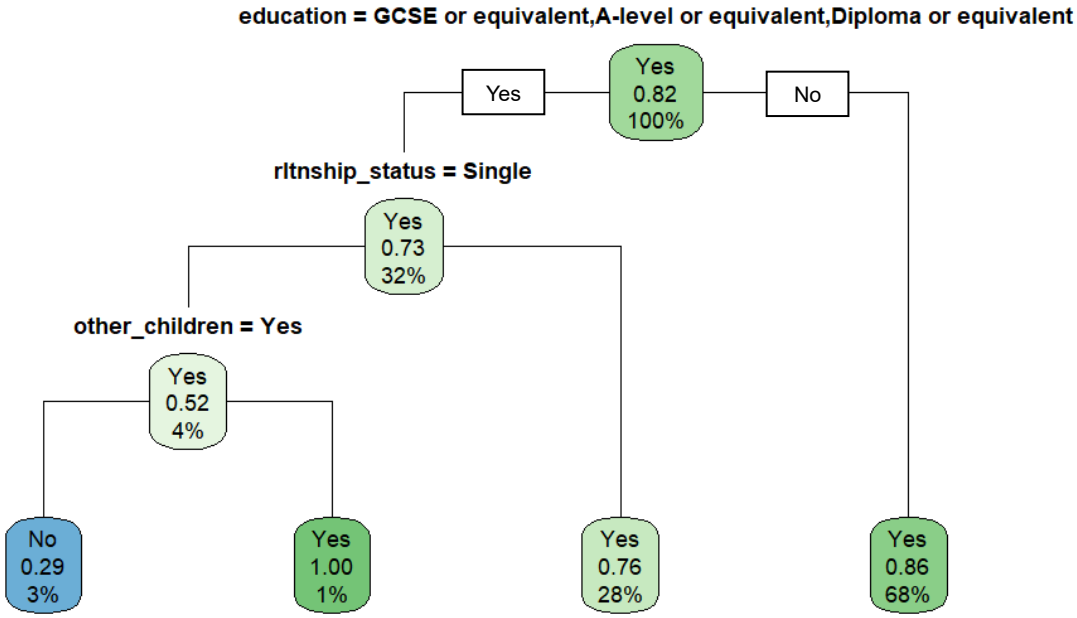
The logistic regression assumptions of a binary independent variable, independence of observations, a sufficiently large sample size, and no multicollinearity (VIF values all below 5) were satisfied. The final logistic regression model revealed that marriage/partnership status, non-severe anxiety, moderately severe depression and multiparity were significantly associated with intending to breastfeed. Married/partnered women had 3.49 times the odds of intending to breastfeed compared to single women. Women with minimal, mild or moderate anxiety had 2.07, 2.22 and 2.40 times the odds of intending to breastfeed respectively compared to women with no self-reported anxiety. Conversely, women with moderately severe depression had 0.36 times the odds of intending to breastfeed compared to non-depressed women, and those with a previous child had 0.64 times the odds of intending to breastfeed compared to those with no previous children. The full results of the logistic regression can be found in table 2.

Table 2 *Logistic regression model results*

Characteristic	Odds Ratio	95% Confidence Interval	*p*-value
Relationship status			
Single	-	-	-
Dating or engaged	2.78	0.99, 8.29	.057
Married or partnered	3.49	1.72, 6.95	<.001
Depression severity			
None	-	-	-
Minimal	1.42	0.71, 3.11	.342
Mild	1.11	0.63, 1.98	.731
Moderate	1.05	0.52, 2.18	.885
Moderately severe	0.36	0.14, 0.94	.035
Severe	0.77	0.21, 2.96	.696
Anxiety severity			
None	-	-	-
Minimal	2.07	1.12, 3.77	.018
Mild	2.22	1.12, 4.37	.021
Moderate	2.40	1.03, 5.69	.044
Severe	1.34	0.51, 3.64	.556
Previous children			
No	-	-	-
Yes	0.65	0.44, 0.96	.032

A decision tree analysis found that of the same variables included in the initial logistic regression model, education level, relationship status and multiparity were most predictive of intention to breastfeed. The decision tree can be viewed in Figure 1.

Figure 1 *Decision tree of variables predictive of intention to breastfeed*



Predictors of Duration of Breastfeeding

Multiple individual survival analyses found that low mood and increasing BMI were negatively associated with time spent breastfeeding, whilst a history of smoking and multiparity were positively associated with time spent breastfeeding. Log-rank p-values were all significant. Figures 2-5 contain survival curves for these variables.

Figure 2 *Kaplan-Meier plot of time spent breastfeeding stratified by BMI*

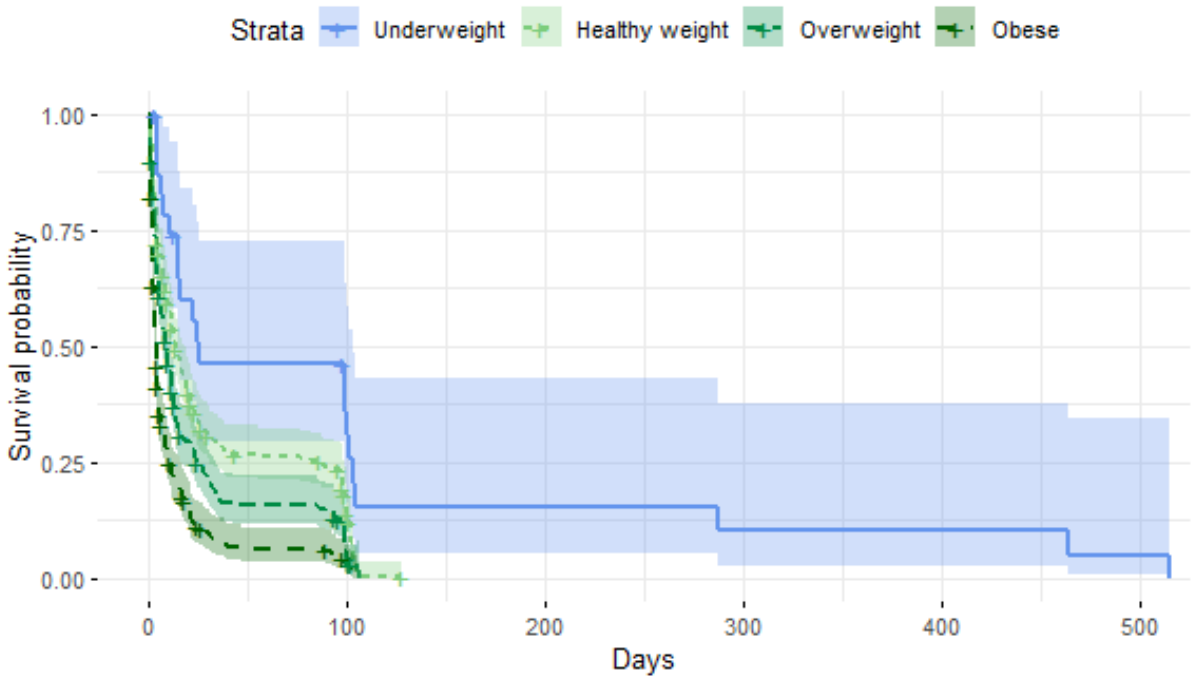


Figure 3 *Kaplan-Meier plot of time spent breastfeeding stratified by low mood*

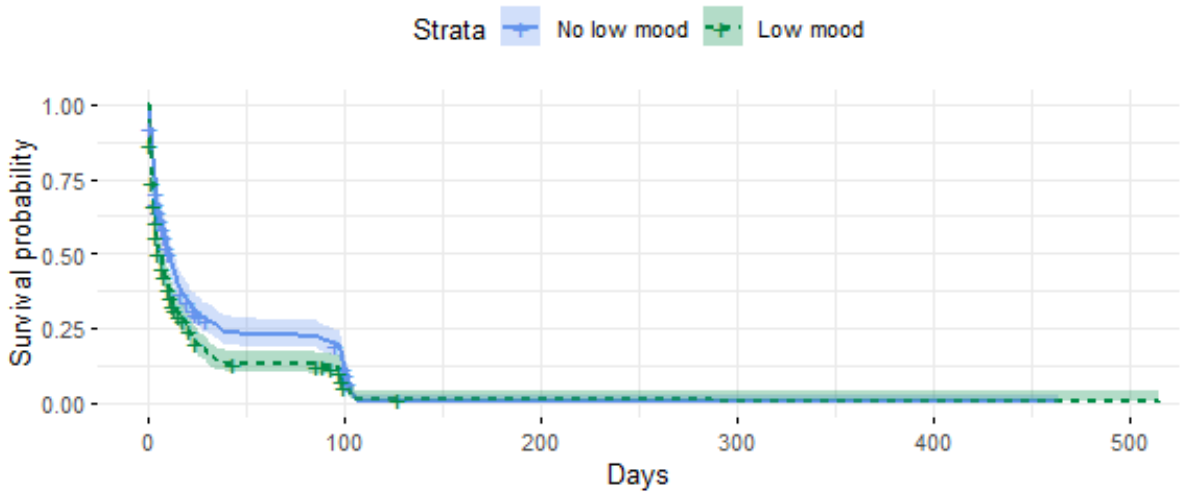


Figure 4 *Kaplan-Meier plot of time spent breastfeeding stratified by smoking history*

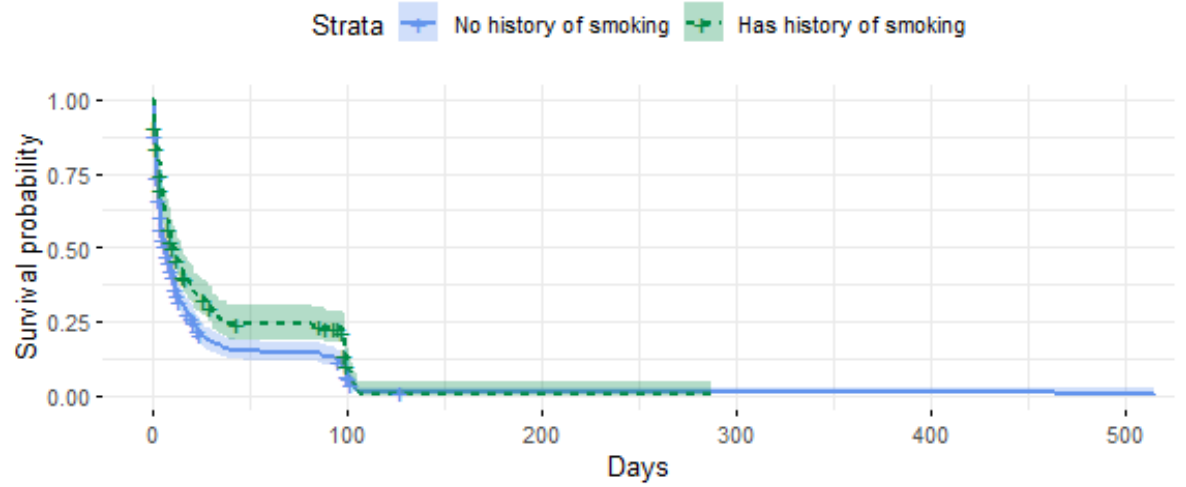
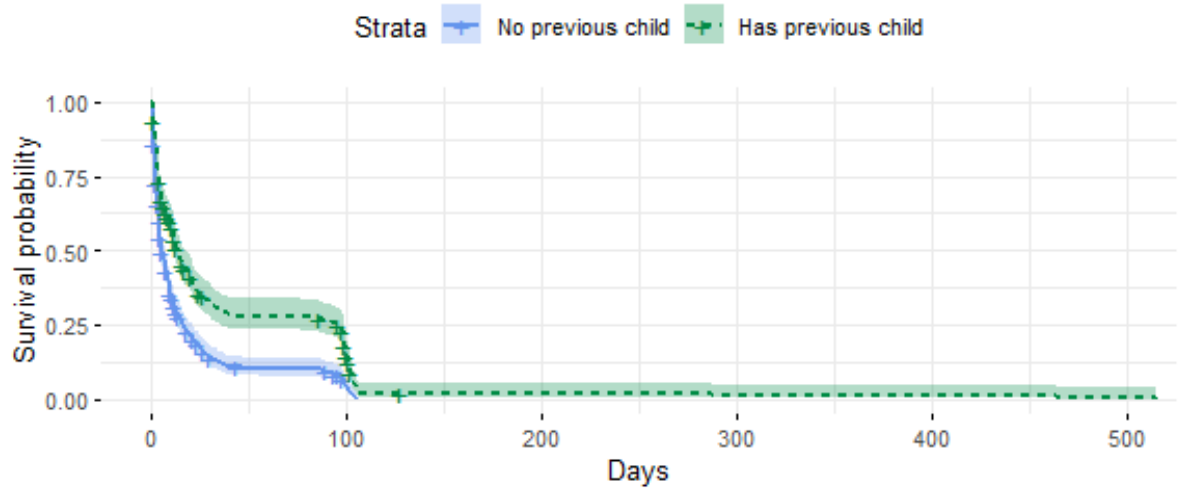


Figure 5 *Kaplan-Meier plot of time spent breastfeeding stratified by parity*



For Cox regression analysis, the variables satisfied the assumption of proportional hazards after observing Schoenfeld residuals plots. Univariable cox regression results are available in Table 3. The upper confidence interval of the low-income variable was 1.00 meaning it cannot be said that there is a true difference between groups despite a slightly significant p-value.

Table 3 *Univariable Cox regression results*

Characteristic	Hazard Ratio	95% Confidence Interval	*p*-value
Low mood			
No	-	-	-
Yes	1.30	1.12, 1.52	<.001
Smoking history			
No	-	-	-
Yes	0.76	0.65, 0.90	.001
Previous children			
No	-	-	-
Yes	0.57	0.48, 0.66	<.001
Low income			
No	-	-	-
Yes	0.80	0.64, 1.00	.048
BMI			
Underweight	-	-	-
Healthy weight	2.02	1.24, 3.28	.004
Overweight	2.74	1.68, 4.48	<.001
Obese	4.47	2.73, 7.30	<.001

Discussion

Regarding the first aim, it was found that marriage/partnership and non-severe anxiety were significantly positively predictive of intention to breastfeed, whilst moderately severe depression and multiparity were negatively predictive of intention to breastfeed. For the second aim it was found that low mood and primiparity had a negative effect on the duration of breastfeeding, as did a higher BMI and lack of smoking history.

Greater confidence can be had in relationship status and multiparity as predictors, as the logistic regression and decision tree support these findings. Married/partnered mothers were 3.49 times as likely to intend breastfeeding which is congruent with previous studies where stability of marriage/partnership rather than dating was highlighted (Fernandes & Höfelmann, 2020; Lee et al., 2005). Multiparous mothers had 0.64 times the odds of intending to breastfeed which is also consistent with previous findings and has been suggested as being due to past negative experiences breastfeeding and/or multiparous women having greater time constraints (Lee et al., 2005). The latter matches the decision tree's suggestion that single multiparous mothers of low-medium education are most likely to not intend to breastfeed as they do not have a co-parent to

manage other children whilst breastfeeding. Despite this, multiparous mothers breastfed for a longer duration, with 15% breastfeeding at 100 days compared to only 3% of primiparous mothers. This may be due to a smaller subset of multiparous women with positive past experiences of breastfeeding increasing the overall duration of breastfeeding for the group.

Non-severe anxiety increased the odds of intending to breastfeed by 2.07-2.40 times which is a relatively novel discovery as previous studies used low-moderate anxiety as the referent level and found severe anxiety to be negatively associated with breastfeeding intentions (Fallon et al., 2016). Baumgartner & Hartmann's (2011) finding that health anxiety may be related to an increase in online health information searching provides a potential explanation for the current study's finding. This increased health awareness may increase their likelihood to breastfeed, as in Wen et al.'s (2009) study, but this area requires further research as highlighted previously by Fallon et al.

Moderately severe depression was associated with significantly decreased odds of intending to breastfeed, and low mood was associated with a significantly increased risk of stopping breastfeeding. This is congruent with the literature which has found a negative association between depression and breastfeeding, though inconsistently (Chung et al., 2004; Kehler et al., 2009). Greater confidence can be had in the latter finding as its subgroups more evenly split the study population, whereas the depression finding may lack validity due to only 4% of the study population being classed as 'moderately severely depressed'. Further research into psychiatric factors affecting breastfeeding would be beneficial.

Increasing BMI was found to significantly increase the risk of stopping breastfeeding. 15% of healthy weight mothers were breastfeeding at 100 days, compared to 5% of overweight and 2% of obese mothers. This is consistent with the literature on higher maternal weights, but interestingly 29% of underweight mothers were breastfeeding at 100 days (Crimmins et al., 2023). However, the underweight sample size was approximately 10 times smaller than the other groups and all confidence intervals are wide. There is little confidence in exactly how large an effect weight has on breastfeeding, but this exploration of underweight maternal weight is novel and should be further investigated.

Education level was susceptible to sparse data bias due to only 14 observations of women in the lowest and two highest education levels, of which all intended to breastfeed. It would be useful to repeat the analysis with a recoded education variable to gain more confidence in the decision tree's sole identification of education as a predictor. Similarly, smoking status only had a significant effect on duration of breastfeeding, with non-smokers unexpectedly breastfeeding for less time than those with a smoking history (7% and 10% at 100 days respectively). This does not conform with a vast literature, leading to the possibility of being produced by bias or error (Gutierrez-de-Terán-Moreno et al., 2022).

Overall, it can be said that the aims of identifying factors predictive of intention and duration of breastfeeding were achieved. This study has consolidated past findings, as well as highlighted novel findings and identified areas for future research.

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