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## Original Research

# The maternal health behaviours of non-Irish nationals during pregnancy and the effect of time living in Ireland

R. Palmer <sup>a,b,\*</sup>, R. Layte <sup>b,c</sup>, J. Kearney <sup>a</sup><sup>a</sup> School of Biological Sciences, Technological University for Dublin, Dublin 2, Ireland<sup>b</sup> School of Medicine, Trinity College Dublin, The University of Dublin, Dublin 2, Ireland<sup>c</sup> Economic and Social Research Institute, Dublin 2, Ireland

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## ABSTRACT

**Objectives:** Maternal health behaviours (MHBs) can influence pregnancy outcomes. Despite efforts internationally to encourage positive MHBs, women often fail to comply with pregnancy guidelines. International studies show differences in MHBs between nationalities and an effect of time spent in the host country. There is limited Irish data in this area, with no previous research relating to the effect of time in Ireland.

**Study design:** This study is a cross-sectional analysis of the Growing Up in Ireland infant cohort, a nationally representative longitudinal study.

**Methods:** Examination of the MHBs of non-Irish nationals during pregnancy and the effect of time in Ireland on the said behaviours.

**Results:** An association was found between time spent in Ireland and increased alcohol consumption prevalence. Those living in Ireland for  $\leq 5$  years were 60.8% less likely to consume alcohol during pregnancy (0.000) and 29.3% less likely to take folic acid before conception (0.021). Those who smoked during pregnancy were 98.6% more likely to consume alcohol (0.000) and those who consumed alcohol were 95.2% more likely to smoke during pregnancy (0.000).

**Conclusions:** The results demonstrate differences in MHBs and the influence of time living in Ireland. These findings are of relevance for policy and intervention planning to optimise pregnancy outcomes among non-nationals.

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## Introduction

Maternal health behaviours (MHBs) have a significant effect on pregnancy outcomes.<sup>1</sup> Although research has shown that

alcohol consumption<sup>2</sup> and smoking<sup>3</sup> during pregnancy have negative effects on pregnancy outcomes and that folic acid (FA) supplementation has positive effects,<sup>4</sup> there is still a significant proportion of women failing to comply with public

\* Corresponding author. School of Biological Sciences, Dublin Institute of Technology, Dublin 2, Ireland.

E-mail address: [rachel.e.palmer@hotmail.com](mailto:rachel.e.palmer@hotmail.com) (R. Palmer).

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health recommendations.<sup>5</sup> Irish women are advised to abstain from alcohol consumption<sup>6</sup> and to cease smoking<sup>7</sup> for the duration of their pregnancy and to take a 400 µg FA supplement daily for 12 weeks before conception and during the first trimester.<sup>8</sup>

The 2016 Irish Census revealed that ~11.6% of the Irish population comprised non-Irish nationals.<sup>9</sup> Studies internationally have found differences in MHBs between different nationalities<sup>10–12</sup> and that duration of time living in the host country plays a role in behaviours.<sup>11,13,14</sup> Research in the area of MHBs among non-Irish nationals is limited, and to the author's knowledge, there is no Irish research investigating the effect of time living in Ireland on MHBs.

Thus, the aim of the present study was to determine the MHBs of non-Irish nationals during pregnancy and the influence of time living in Ireland by carrying out a cross-sectional analysis of the 'Growing Up in Ireland' (GUI) infant cohort wave 1.

## Methods

### Study design and sample

The Irish Child Benefit Register was used as a sampling frame, selecting 16,136 mothers; of which, 11,134 (69%) mothers were recruited.<sup>15</sup> The data collected from this group of 11,134 mothers was used for analysis in this study. A cohort of primary caregivers (*n* 11,134), the majority of whom were the infant's mother and will be referred to as mother from here onwards, was recruited as part of the GUI study (2007–2008) and interviewed when their study infant was 9 months of age. Approximately 84.7% of this sample were Irish nationals, and 15.3% were non-Irish nationals. This nationality distribution is similar to that seen in the 2006 Irish census (on which, the data in this cohort was weighted) which found that 90.1% of the population was Irish and 9.9% of the population was non-Irish.<sup>16</sup>

### Questionnaires and measurements

Trained fieldworkers conducted face-to-face interviews when the study infant was 9 months of age. When more than one caregiver was present at the interview, one caregiver was self-nominated as the primary caregiver, that being the individual who spent the most time with the study infant, usually the infant's mother.<sup>17</sup> Interviews were conducted using a combination of computer-assisted personal interviewing and computer-assisted self-interviewing.<sup>15</sup>

### Statistical analysis and dependent variables

All statistical analyses were conducted using IBM SPSS Statistics, version 24.0. A weighting factor was applied to the data set to allow adjustment for the contribution of certain variables, giving a more accurate representation of data based on earlier census figures. The 2006 Irish census and the Child Benefit Register for children born in 2008 were used for weighting. A total of 11 main characteristics of the infant and his/her family were used in the generation of the weights.

From the literature, independent variables considered as risk factors for MHBs during pregnancy were selected, as well as other potential predictors and confounding variables available in the data set.<sup>18</sup>

The data extracted were analysed using cross tabulations and chi-squared analysis. Independent variables found to be significant in the bivariate analysis were used in the multivariate analysis to adjust for confounding. Statistical significance was assumed at a *P* value of <0.05. Multivariate analysis was used to determine whether MHBs could be accounted for by citizenship held and time living in Ireland after adjustment for several other predictors. Four dependent variables were used in multivariate analysis: alcohol consumption during pregnancy, smoking during pregnancy, FA compliance before conception and FA compliance during the first trimester.

### Definition of covariates

Maternal characteristics were used for conducting analysis as >99.0% of respondents were the infant's mother. Maternal education status was coded as no formal education/primary level education, second level education and third level education/technical or vocational qualification. Maternal age group was coded as ≤25 years, 26–35 years and 36+ years. Family social status was coded as professional/managerial, other non-manual/skilled manual, semiskilled/unskilled manual, all others gainfully occupied and unknown and never worked at all—no class. Ethnicity was coded as Caucasian, black, Asian and other (including mixed background). As the number of reported religions consisted of a long list of religious denominations with very small numbers in some categories, the religion variable was coded as Christian, Muslim and 'other religion'. Duration of time in Ireland was coded as those living in Ireland for ≤5 years, 6–10 years and ≥11 years, showing the spread of individuals who moved to Ireland shortly before the interview, several years before the interview and greater than a decade before the interview. All variables analysed are categorical or have been coded to become categorical variables.

## Results

### Characteristics of the study cohort

Table 1 shows the characteristics of mothers. Non-Irish nationals were found to be younger than Irish nationals (*P* < 0.001), in line with findings that Irish nationals tend to give birth at an older age than non-Irish nationals.<sup>19</sup> The majority of Irish nationals who answered the question relating to duration of time living in Ireland were living in Ireland for ≥11 years (68.4%).

### Maternal health behaviours of Irish nationals, Non-Irish nationals and naturalised Non-Irish born

Table 2 shows the MHBs of mothers living in Ireland. Irish nationals had a higher prevalence of alcohol consumption (22.0% v 9.6%; *P* < 0.001) and smoking (19.5% v 11.5%; *P* < 0.001) during

**Table 1 – Characteristics of mothers by nationality grouping (n = 11,134).**

Characteristic	Nationality		
	Irish (%)	Non-Irish (%)	P
<b>Age Group n 9422, 1703*</b>			
≤25 years	14.1	21.1	
26–35 years	59.5	61.7	
≥36 years	26.4	17.2	0.000
<b>Gender n 9422, 1702</b>			
Female	99.7	99.5	
Male	0.3	0.5	0.288
<b>Education n 9422, 1703</b>			
No formal education/primary level education	3.1	6.0	
Second level education	39.9	35.6	
Third level education/technical or vocational qualification	57.0	58.1	0.000
<b>Marital status n 9422, 1703</b>			
Married and living with husband/wife	70.0	72.2	
Married and separated from husband/wife	1.4	2.7	
Divorced/widowed	0.7	1.7	
Never married	27.9	23.4	0.000
<b>Social class n 9422, 1703</b>			
Professional/managerial	50.0	36.9	
Other non-manual/skilled manual	32.3	35.0	
Semiskilled/unskilled manual	8.6	16.4	
All others gainfully occupied and unknown	0.3	1.8	
Never worked at all—no class	8.8	10.0	0.000
<b>Time spent living in Ireland n 771, 1695</b>			
≤5 Years	8.7	60.8	
6–10 Years	23.0	30.7	
≥11 Years	68.4	8.4	0.000
<b>Nationality n 1644</b>			
Non-Irish European	–	64.7	
American and Canadian	–	3.0	
Australian and New Zealander	–	1.3	
African	–	14.8	
Asian	–	15.0	
Other/dual citizenship	–	1.3	–
<b>Religion n 8687, 1545</b>			
Christian	96.1	96.4	
Muslim	1.8	1.7	
Other religion	2.1	1.9	0.865
<b>Ethnicity n 9421, 1672</b>			
Caucasian	99.1	68.2	
Black	0.4	15.2	
Asian	0.4	14.2	
Other (Incl. mixed background)	0.1	2.3	0.000

P = Pearson Chi-squared.

\*n represents the number of Irish and non-Irish nationals that responded to each question.

Data derived from wave one (2007–2008) of the Growing Up in Ireland (GUI) infant cohort.

pregnancy compared to non-Irish nationals. Irish nationals had better compliance to FA guidelines compared to non-Irish nationals prior to (64.3% v 52.9%;  $P < 0.001$ ) and during pregnancy (94.3% v 87.4%;  $P < 0.001$ ). It was found that naturalised non-Irish born mothers living in Ireland for ≥11 years behaved more closely to Irish nationals than non-Irish nationals.

## Maternal health behaviours during pregnancy and time living in Ireland

Fig 1 shows the effect of time living in Ireland on MHBs during pregnancy. Duration of time in Ireland was associated with an increase in the prevalence of alcohol consumption during pregnancy, rising from 7.8% among those living in Ireland ≤5 years to 23.0% among those living in Ireland for ≥11 years. Smoking prevalence during pregnancy fluctuated with duration of time in Ireland. An association was found between increased duration of time in Ireland and improved FA compliance.

The results of the multivariate analysis used to investigate the effect of time living in Ireland on MHBs, adjusting for factors which could confound the relationship, are seen in Table 3. Duration of time living in Ireland remained a significant predictor of alcohol consumption during pregnancy ( $P < 0.001$ ) and FA compliance before conception ( $P = 0.021$ ) after adjustment for several other factors. It was found that those living in Ireland for ≤5 years were 60.8% less likely to consume alcohol during pregnancy and 29.3% less likely to take FA before conception compared with those living in Ireland for ≥11 years. Multivariate analysis showed that those who smoked during pregnancy were 98.6% more likely to consume alcohol during pregnancy compared with non-smokers ( $P = 0.000$ ). Those who consumed alcohol during pregnancy were 95.2% more likely to smoke during pregnancy compared with those who abstained from alcohol consumption ( $P = 0.000$ ). These findings suggest that these MHBs may occur in tandem with each other.

## Discussion

### Main findings of this study

#### Alcohol consumption during pregnancy

This study resulted in some significant findings. It was found that non-Irish nationals had a lower prevalence of alcohol consumption during pregnancy compared with Irish nationals (22.0% v 9.6%,  $P < 0.001$ ). Irish nationality was a strong predictor of alcohol consumption during pregnancy, possibly due to the strong alcohol-consuming culture in Ireland. It was estimated in 2016 that approximately three quarters of the Irish population aged ≥15 years consume alcohol, with approximately 41% consuming alcohol at least once per week.<sup>20</sup> Multivariate analysis found that those living in Ireland for ≤5 years were less likely to consume alcohol during pregnancy compared with those living in Ireland for longer durations. The lower prevalence of alcohol consumption during pregnancy among the non-Irish nationals cohort may be due to lower prevalence of alcohol consumption among non-Caucasian women and non-smokers.<sup>21</sup>

#### Smoking during pregnancy

Non-Irish nationals also had a lower prevalence of smoking during pregnancy compared with Irish nationals (19.5% v 11.5%,  $P = 0.000$ ). Irish nationality was again a strong predictor of smoking during pregnancy ( $P < 0.001$ ). Results of multivariate

**Table 2 – The maternal health behaviours of Irish nationals, non-Irish nationals and naturalised non-Irish born.**

Health behaviour	Irish nationals (%)	Non-Irish nationals (%)	P	Naturalised non-Irish born <11 Years (%)	Naturalised non-Irish born ≥11 Years (%)	P
	n 9153	n 1597		n 235	n 516	
<b>Alcohol consumption</b>						
Alcohol consumption at any time during pregnancy	22.0	9.6	0.000	18.3	24.0	0.080
Alcohol consumption during 1st trimester of pregnancy	11.0	5.8	0.022	9.4	12.6	0.877
Alcohol consumption during 2nd trimester of pregnancy	15.9	5.8	0.003	11.9	19.4	0.030
Alcohol consumption during 3rd trimester of pregnancy	15.5	5.8	0.011	12.8	19.2	0.175
	n 9152	n 1598		n 236	n 515	
<b>Smoking</b>						
Smoking at any time during pregnancy	19.5	11.5	0.000	12.7	16.9	0.142
Smoking during 1st trimester of pregnancy	17.5	10.4	0.000	11.4	20.0	0.606
Smoking during 2nd trimester of pregnancy	16.5	7.7	0.000	8.5	14.6	0.037
Smoking during 3rd trimester of pregnancy	16.1	7.8	0.000	8.1	12.6	0.337
	n 9218	n 1668		n 236	n 513	
<b>Folic acid</b>						
Folic acid compliance before conception	64.3	52.9	0.000	58.1	65.9	0.136
Folic acid compliance during the 1st trimester of pregnancy	94.3	87.4	0.000	89.8	93.4	0.089

P = Pearson Chi-squared; n = the number of mothers who answered each question.

analysis found no significant association between smoking during pregnancy and duration of time spent living in Ireland. The lower smoking prevalence among non-Irish nationals during pregnancy may be a result of smoking levels in the general population being lower in certain countries.<sup>22</sup>

#### FA compliance

Non-Irish nationals had a lower prevalence of FA compliance both before (64.3% v 52.9%,  $P < 0.001$ ) and during pregnancy (94.3% vs 87.4%,  $P < 0.001$ ) compared with Irish nationals. Differing FA compliance between Irish and non-Irish nationals may be due to reduced knowledge relating to FA supplementation among those who newly move to Ireland and women living in deprivation.<sup>23</sup> This result was surprising as one would assume that a lower prevalence of negative MHBs among non-Irish nationals would correlate with higher FA compliance among this group.

#### Maternal health behaviours and time living in Ireland

Duration of time spent living in Ireland was found to have an effect on alcohol consumption during pregnancy and FA compliance before conception. Our study found that increasing duration of time in Ireland had a positive linear relationship with alcohol consumption, showing almost a three-fold increase, suggesting that those who move to Ireland begin to adopt the alcohol consuming behaviours of Irish nationals. Those living in Ireland for  $\geq 11$  years had a higher prevalence of alcohol consumption during pregnancy compared with Irish nationals (23.0% vs 22.0%, respectively)—a serious public health concern. Increased duration of time in Ireland was associated with increased FA compliance before conception. Those living in Ireland for  $\geq 11$  years had marginally better compliance than Irish nationals (65.6% vs

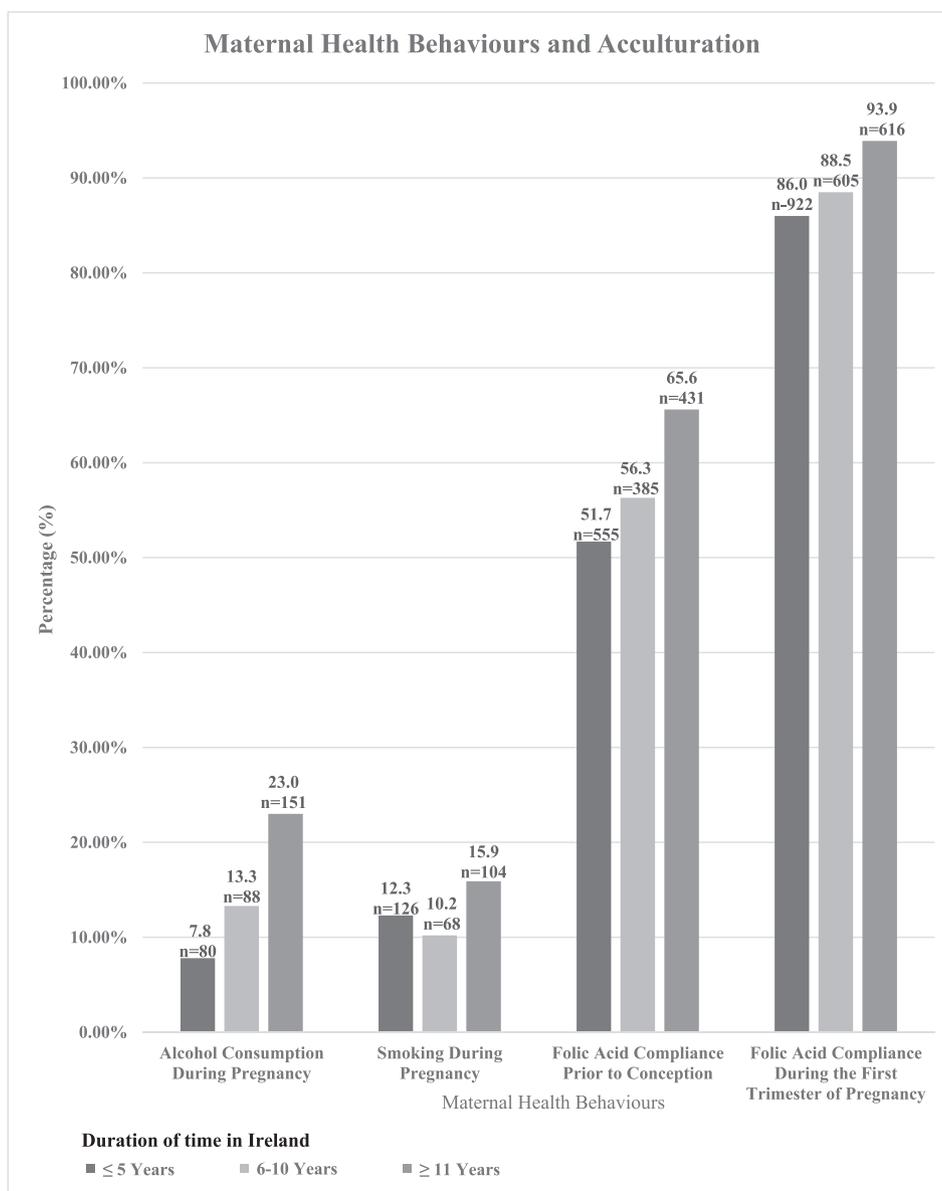
64.3%, respectively). This is a positive outcome as those who move to Ireland are adopting a beneficial, healthful behaviour.

#### What is already known on this topic?

Limited Irish research addressing the MHBs of non-Irish nationals during pregnancy and, to the author's knowledge, no Irish research relating to the effect of time living in Ireland on MHBs exist. Research at an international level suggests that differences exist in MHBs between the host country and non-nationals during pregnancy and that duration of time living in the host country has an effect on MHBs.<sup>5,11,24</sup>

#### Alcohol consumption during pregnancy

An Irish study carried out in the Coombe Women and Infants University Hospital (CWIUH) found that non-nationals had lower alcohol consumption prevalence than Irish nationals (14.3% vs 37.9% respectively),<sup>5</sup> agreeing with the findings of our study. Internationally, studies conducted in the United Kingdom (UK)<sup>11</sup> and the United States of America (USA),<sup>24</sup> found that non-nationals had lower alcohol consumption prevalence than residents of the host country, a pattern which was also seen in our results. Hawkins et al.<sup>11</sup> found that ethnic minority groups had a lower prevalence of alcohol consumption during pregnancy compared with British/Irish white women (14% vs 37%, respectively). One USA study found that foreign-born women were 38% less likely to consume alcohol than their USA counterparts.<sup>24</sup> There is little international research relating to alcohol and the effect of time spent living in the host country, with one study finding no association.<sup>11</sup> Our study, however, found that increased duration of time living in Ireland did have an effect on alcohol consumption during pregnancy.



**Fig. 1 – Maternal health behaviours and the effect of acculturation—health behaviour patterns with duration of time spent living in Ireland.**

#### Smoking during pregnancy

The aforementioned Irish study found that 23.2% of Irish nationals smoked during pregnancy versus only 2% of non-Irish nationals,<sup>5</sup> significantly less than Irish nationals, differing from our results where a closer prevalence was seen among the two groups (19.5% vs 11.5%, respectively,  $P = 0.000$ ). In a UK study, it was observed that 37.0% of nationals smoked during pregnancy compared with 15.0% of non-nationals. It was observed that every additional five years spent living in the UK lead to a 31% increase in the likelihood of smoking during pregnancy, suggesting an effect of increasing duration of time living in the host country.<sup>11</sup> The findings from our study agree with previous studies<sup>10,11</sup> showing differences in smoking prevalence between nationals and non-nationals of a country.

#### FA compliance before conception and during pregnancy

Again, looking at the results of the Irish study in the CWIUH, it was found that 44.4% of pregnant women complied with FA recommendations before conception.<sup>5</sup> Our study found a higher prevalence of FA compliance before conception, suggesting improved reported compliance among our cohort. A study examining Mexican women living in America found that FA supplement usage increased with duration of time spent in America, suggesting an effect of increased time living in the host country, corroborating with our findings.<sup>25</sup>

#### What this study adds

This study investigates the MHBs of non-Irish nationals during pregnancy and is the first Irish study to investigate

**Table 3 – Models showing binary logistic regression analysis of health behaviours and predictors including the acculturation variable—‘Time spent living in Ireland’.**

Predictor	Alcohol consumption during pregnancy n 2708		Smoking during pregnancy n 2704		Folic acid before conception n 2704		Folic acid during first trimester n 2704	
	Adjusted OR	P	Adjusted OR	P	Adjusted OR	P	Adjusted OR	P
<b>Primary caregiver age group</b>								
≤25 years	1.0*		1.0*		1.0*		1.0*	
26–35 years	1.023		0.647		1.746		0.712	
≥36 years	1.161	0.684	0.477	0.005	2.003	0.000	0.669	0.183
<b>Time spent living in Ireland</b>								
≤5 years	0.392		0.753		0.707		0.680	
6–10 years	0.635		0.891		0.773		0.673	
≥11 years	1.0*	0.000	1.0*	0.255	1.0*	0.021	1.0*	0.194
<b>Primary caregiver education</b>								
No formal/primary level education	1.0*		1.0*		1.0*		1.0*	
Second level education	0.975		1.003		0.733		3.274	
Third level education/technical or vocational qualification	1.123	0.645	0.479	0.000	0.788	0.407	4.980	0.000
<b>Primary caregiver ethnicity</b>								
Caucasian	1.0*		1.0*		1.0*		1.0*	
Black	0.685		0.123		0.715		0.548	
Asian	0.342		0.286		1.006		0.412	
Other (incl. mixed background)	0.635	0.006	0.578	0.000	2.082	0.039	0.118	0.000
<b>Marital status</b>								
Married and living together	1.0*		1.0*		1.0*		1.0*	
Married and separated	1.628		1.277		0.551		3.283	
Divorced/widowed	1.182		4.525		0.397		2.195	
Never married	1.028	0.663	2.282	0.000	0.625	0.000	0.585	0.001
<b>Family social class</b>								
Professional/managerial	1.0*		1.0*		1.0*		1.0*	
Other non-manual/skilled manual	0.371		1.448		0.850		0.662	
Semiskilled/unskilled manual	0.461		1.928		0.884		0.394	
All others gainfully occupied and unknown	0.704		0.425		0.616		0.151	
Never worked at all—no class	0.306	0.000	1.875	0.017	0.655	0.240	0.521	0.000
<b>Alcohol consumption during pregnancy</b>								
Yes	–	–	1.952		1.012		–	–
No	–	–	1.0*	0.000	1.0*	0.933	–	–
<b>Smoking during pregnancy</b>								
Yes	1.986		–	–	0.617		0.768	
No	1.0*	0.000	–	–	1.0*	0.001	1.0*	0.219
<b>Folic acid before conception</b>								
Yes	1.0*		1.0*		–	–	1.0*	
No	1.058	0.684	0.635	0.003	–	–	0.083	0.000
<b>Folic acid first trimester</b>								
Yes	–	–	1.0*		1.0*		–	–
No	–	–	1.173	0.465	0.088	0.000	–	–

OR = odds ratio; CI = confidence interval.

1.0\* denotes the reference group.

the effect of time living in Ireland on MHBs, an area which has the potential to influence policy development. Research in this area exists at an international level but is lacking in the Irish context. This area is of particular interest for policymakers as it addresses the MHBs of women residing in Ireland and highlights those at particular risk of adverse pregnancy outcomes as a result of the adoption of negative MHBs.

This study identified that Irish nationals have a higher prevalence of alcohol consumption and smoking during pregnancy than non-Irish nationals. This finding puts into perspective the MHBs of Irish women compared with that of

their non-Irish counterparts. The study found that increased time living in Ireland was associated with increased prevalence of alcohol consumption during pregnancy among those who moved to Ireland. With this concerning association in mind, efforts must be taken to minimise the adoption of this behaviour. To limit the adoption of negative MHBs by those who move to Ireland, efforts must be made to improve the MHBs of Irish nationals so that positive rather than negative MHBs are adopted. In tandem, focus needs to be put on the MHBs of non-Irish nationals to prevent the adoption of negative MHBs, for example, ensuring that Irish and non-Irish women of child-bearing age and those who are

pregnant are aware of the adverse effects of alcohol consumption during pregnancy.

After analysis, it was found that FA compliance before conception was poor among Irish and non-Irish nationals. Only 64.3% of Irish nationals and 52.9% of non-Irish nationals complied with FA recommendations before conception. As Ireland has one of the highest rates of neural tube defects (NTDs) in Europe (1–1.5 per 1000 births nationally),<sup>26</sup> it is evident that further efforts are required to raise awareness of the benefits of FA supplementation, not just during pregnancy but also in the periconceptual period to minimise the number of births affected by NTDs. Highlighting this lack of compliance has the potential to direct greater focus on the importance of provision of periconceptual information to women, so that they are aware of the importance of FA supplementation before conception.

### Study strengths and limitations

The large study sample is robust, providing great statistical power and precision to detect differences in MHBs between Irish and non-Irish nationals. The study sample was chosen at random from the Child Benefit Register, meaning that the sample is an accurate representation of infants and their families living in Ireland. The application of weights to the data allows the results to be applied at a population level, making the results valuable for researchers and policy makers.

A limitation of this study is the accuracy of the reported sensitive MHBs: smoking and alcohol consumption during pregnancy. Sensitive information was collected via a sensitive questionnaire on a laptop provided by the GUI fieldworker. Owing to social stigma surrounding these behaviours, it is possible that underreporting occurred. The retrospective study design may also have affected the results due to recall bias, with mothers having to recall MHBs from >9 months before the interview. Our study found that FA supplementation was more prevalent than in other studies, which may be a result of recall bias. Univariate and bivariate analysis found that some variables had a large percentage ( $\geq 2.0\%$ ) of missing data. It was also noted that there were differences in missing data between Irish and non-Irish nationals, which could lead to an exaggeration of the differences in MHBs between Irish and non-Irish nationals.

### Conclusion

This study found differences in MHBs between Irish and non-Irish nationals during pregnancy. It was observed that increasing duration of time living in Ireland had an effect on MHBs among the non-Irish cohort. Efforts must be made to reduce the prevalence of alcohol consumption and smoking during pregnancy and to improve compliance to FA supplementation among Irish and non-Irish nationals. To limit the adoption of negative MHBs by those who move to Ireland, efforts must be made to improve the MHBs of Irish nationals so that positive behaviours are adopted. In tandem, focus must be put on the MHBs of non-Irish nationals to prevent the adoption of negative MHBs.

## Author statements

### Author contributions

R.P. carried out the data analysis, data interpretation and wrote the article. J.K. assisted in interpreting results and provided feedback on drafts of the article. R.L. contributed in feedback on statistical analyses and drafts of the article. All authors approved the final version of the article.

### Ethical approval

This study did not require ethical approval. Data used in this study had already been collected by the GUI team, with necessary ethical approval obtained. As no direct contact was made with the participants in this study, ethical approval was not required.

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### Competing interests

The authors declare no conflict of interest.

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