Periconceptional Folic Acid Supplementation in a Nationally Representative Sample of Mothers

Abstract:

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Abstract
This study reports recent trends in periconceptional folic acid use in Ireland using archived data from Growing Up in Ireland â the National Longitudinal Study of Children. Of a sample of 10,891 mothers, 6,936 (64%) reported taking folic acid before conception and 10,157 (93%) reported taking folic acid during the first trimester of pregnancy. Younger (OR=0.38, 95% CI=0.29-0.50), lower income (OR=0.59, 95% CI=0.51-0.68), lower educated (OR=0.77, 95% CI=0.66-0.89), and single mothers (OR=0.46, 95% CI=0.40-0.52) were less likely to have taken folic acid pre-conception. A similar pattern was found post-conception with younger (OR=0.58, 95% CI=0.40-0.84), lower income (OR=0.40, 95% CI=0.30-0.53), lower educated (OR=0.50, 95% CI=0.38-0.66), and single mothers (OR=0.74, 95% CI=0.60-0.91) less likely to have taken folic acid post-conception. The findings highlight an ongoing need for targeted promotional campaigns to increase supplementation rates among younger and socially disadvantaged mothers.

Introduction
Neural tube defects (NTDs) are a serious and common type of birth defect, encompassing a broad range of congenital spine and spinal cord defects [1]. Up to 70% of neural tube defects can be prevented by taking folate in its synthetic form, folic acid, before conception and in the first 28 days of pregnancy [2-4]. While Ireland has one of the highest incidence rates of NTDs in Europe, the incidence of NTDs in Ireland has however been in steady decline [5]. This is thought to be due to increases in the voluntary fortification of some foods and increased intake of multivitamin supplements [6]. The Food Safety Authority of Ireland (2008) conducted a study of the blood folate levels of subgroups of the Irish population and found that 93% of its sample of childbearing women (n=259) had an adequate folate status, with 52% of the sample of women having optimal levels of folate for the prevention of NTDs. Despite an increase in folate levels and a decrease in the occurrence of NTDs in Ireland, researchers have identified a need for campaigns that promote folic acid supplementation in Ireland, with accurate and clear promotion of the importance of taking folic acid [7].

Ireland has a supplementation policy with regard to increasing folic acid intake among women of childbearing age [8]. Rates of folic acid supplementation during the periconceptional period are estimated to be quite low [9]. However, recent Irish studies of folic acid use in obstetric populations report high percentages of mothers using folic acid during pregnancy including reports of 84% [10], 85% [11] and 88% [7]. Reports of folic acid intake in the recommended period immediately before and during the first trimester of pregnancy have been much lower ranging from 19%10 to 44% [7]. Greater awareness and use of folic acid supplements is associated with higher income and education [12], being in a relationship and being older [13]. Pregnancy intention [14], consultation with a healthcare provider [14], and smoking and drinking behaviours [13] are additional maternal characteristics associated with supplementation.

Using archived data from Growing Up in Ireland â the National Longitudinal Study of Children (GUI), this study aimed to add to knowledge about folic acid use in Ireland by providing recent data on the prevalence of, and trends in, folic acid use among a nationally representative sample of mothers in Ireland. GUI is the largest survey of its kind to be conducted in Ireland and the archived data available at the Irish Social Science Data Archive (ISSDA) provides a rich source of information on factors affecting childrenâ s development in Ireland, including maternal health behaviours before and during pregnancy. GUI implemented a strict sampling procedure [15] to ensure that the sample was representative of children and their families from different locations in Ireland and from different social and economic backgrounds. This study sought to capitalise on available socio-demographic data from this large sample to examine predictors of folic acid use, including maternal income, education, age, and relationship status.

Methods
The infant cohort sample of GUI consisted of 11,134 nine-month-olds and their families who were resident in Ireland between September 2008 and April 2009. The project was subject to ethical approval by a Research Ethics Committee convened by the Department of Health and Children. Using the Child Benefit register as a sampling frame, sample selection was determined by a systematic random sampling procedure, using a random start and a constant sampling fraction [15]. The sample was pre-stratified by marital status, county of residence, nationality, and number of children in the child benefit claim.

A team of trained interviewers carried out interviews with primary caregivers at home, nine months after the birth of the study child. Primary caregivers were asked to complete a main questionnaire and a sensitive questionnaire. Data from the main questionnaire were archived in an anonymised microdata file (AMF), and include information on folic acid use, maternal characteristics and socio-demographic variables. Sensitive data regarding pregnancy intention, and maternal smoking and drink behaviours were not included in the AMF and are therefore not included in this analysis. Primary caregivers completed a detailed questionnaire regarding several aspects of the infantâ s development, including parental behaviours before, during, and after the birth of the child. 11,093 mothers completed the primary caregiver questionnaire (mean age = 31.6). As part of the questionnaire, mothers were asked by the interviewer to report: (1) whether or not they took folic acid or folate before becoming pregnant with the study child; and (2) whether or not they took folic acid or folate during the first trimester of pregnancy. Ninety-eight percent of mothers responded to both of these questions (n = 10,891) and the following analysis is based on this sample population.

Data were re-weighted prior to analysis to compensate for any imbalances in the current sample as compared with the overall population. The data were adjusted using the GROSS programme [15] which calibrated the sample to 73,662 infants aged less than one year who were on the Irish Child Benefit Register in 2008. Data were initially examined to determine the frequency of folic acid/folate use among mothers in Ireland. Data were then examined using binary logistic regression to determine the manner in which motherâ s age, income, education, relationship status, and location (urban or rural) successfully predicted folic acid use. Binary logistic regression was used to calculate the adjusted and unadjusted odds ratios (ORs) with 95% confidence intervals (CIs) as estimates of effects, with folic acid use as the outcome variable. Logistic regressions were carried out on the data: (1) to examine the maternal characteristics associated with pre-conceptional folic acid use; and (2) to examine the maternal characteristics associated with folic acid use in the first trimester of pregnancy. The category which had the largest number of participants was chosen as the reference category for each variable in the regression model16. Statistical analysis was performed using PASW statistics 18 for Windows Release 18.0 (SPSS Inc, Chicago, IL).

Results
Pre-conceptional Folic Acid Use
Results indicated that 64% of mothers took folic acid prior to becoming pregnant. The largest disparity in terms of folic acid use was seen with regard to maternal age. Seventy-four percent of the women from the older age group (over 35) used folic acid prior to becoming pregnant, compared with 29% of the younger age group (under 20). Adolescent mothers were least likely to take folic acid prior to conception (OR = 0.38, 95% CI = 0.29-0.50). As shown in Table 1, analysis using a Binary Logistic Regression indicated that mothers with a higher income, education, and age, and those in a relationship were significantly more likely to take folic acid prior to becoming pregnant. Mothers living in rural locations were more likely than mothers living in urban locations to report taking folic acid before pregnancy but this difference was not significant in the fully adjusted model.

First Trimester Folic Acid Use
Results indicated that 93% of mothers reported taking folic acid in the first trimester of pregnancy. Table 2 presents the maternal characteristics that predicted folic acid use during this period. As with pre-conceptional use, mothers with a higher income, education, and age, and those in a relationship were significantly more likely to take folic acid during pregnancy. Mothers living in rural locations were more likely than mothers living in urban locations to report taking folic acid during pregnancy but again this difference was attenuated in the fully adjusted model.

Discussion

Almost two thirds of mothers interviewed reported taking folic acid before pregnancy while the vast majority of mothers reported taking folic acid during the first trimester of pregnancy. The high percentage of mothers who reported folic acid use during pregnancy in the current study is similar to recent supplementation studies in Ireland [7,10] However, the percentage of mothers who reported pre-conceptional folic acid use is much higher than previous studies [10,11]. Research suggests that retrospective reporting of maternal health behaviours results in higher estimates [17], and it is likely that maternal reports of folic acid use nine months after the birth of the study child are subject to recall bias. Previous Irish studies which investigated folic acid use in obstetric populations conducted interviews during pregnancy [10,11] and were therefore less subject to recall bias. The GUI sample may also differ from these studies by having a high percentage of mothers with some third level education (57%) and a high percentage of older mothers (61% aged 31 years or older). Higher levels of education and being older is associated with greater compliance with folic acid recommendations [12] and the reports of pre-conceptional folic acid use may be affected by the education status and age of the participants in the study.

Higher reports of folic acid use before pregnancy may also be due to the non-specification of the type of preparation and dose of folic acid in the studyâ s questions regarding folic acid use, with mothers potentially reporting multivitamin supplementation or other less effective forms of folic acid intake. The timing of folic acid use during the first trimester of pregnancy was also not specified. Thus while the vast majority of mothers reported folic acid use during the first trimester of pregnancy, many of these may have begun to take it too late (post day 28) or not enough (<.4mg) to gain protective effects. Finally, the current study does not include analysis of maternal characteristics which are associated with folic acid supplementation, such as pregnancy intention, and smoking and drinking behaviours [14]. Future research on the role of these variables in folic acid supplementation using a large cohort sample such as GUI would greatly contribute to current knowledge regarding folic acid practices in Ireland.

Despite these limitations the data provide us with information on folic acid use for a nationally representative sample of Irish mothers. Trends reported here regarding socio-demographic factors affecting folic acid use are in keeping with findings from other studies regarding health inequalities in folic acid supplementation [13,18]. The current study found that women of lowest income, education, and age are most at risk for inadequate intake of folic acid prior to conception and during the first trimester of pregnancy, and that single mothers are also significantly less likely to report having participated in these health behaviours. These findings highlight a group of mothers currently most at risk for non-compliance with folic acid health recommendations in Ireland, and provide significant support for previous calls for targeted awareness campaigns that can reach this group of disadvantaged mothers [6,7].

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