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FOOD INSECURITY AND MENTAL HEALTH: AN ANALYSIS OF ROUTINE PRIMARY CARE DATA OF PREGNANT WOMEN IN THE BORN IN BRADFORD COHORT

Corresponding author

Correspondence to: Madeleine Power, University of York, Research Centre for the Social Sciences, 6 Innovation Close, Heslington, York, YO10 5ZF, UK, msp517@york.ac.uk.

Author addresses and affiliations

Madeleine Power, Department of Health Sciences, Seebohm Rowntree Building, University of York, Heslington, York, YO10 5DD, UK
Dr Eleonora Uphoff, Department of Health Sciences, Seebohm Rowntree Building, University of York, Heslington, York, YO10 5DD, UK
Dr Brian Kelly, Bradford Institute For Health Research, Bradford Royal Infirmary, Duckworth Lane, Bradford, BD9 6RJ, UK
Professor Kate Pickett, Department of Health Sciences, Seebohm Rowntree Building, University of York, Heslington, York, YO10 5DD, UK

ABSTRACT

Background Since 2008, use of food banks has risen sharply in the UK, however evidence on the epidemiology of UK food insecurity is sparse. The aim of this study was to describe the trajectory of common mental disorder across the pre-pregnancy, pregnancy and postnatal period for food secure compared to food insecure women.

Methods Data from the Born in Bradford cohort, the nested BiB1000 study and primary care records were linked based on NHS numbers. Data linkage was completed for 1297 and primary care records were available from 18 months prior to 40 months after birth of the cohort child. Incidence rates of common mental disorders per 1000 Patient Years At Risk were compared between food secure and food insecure women, and for Pakistani compared to White British women, in ten six-month periods around pregnancy. Poisson regression was used to calculate Incidence Rate Ratios, adjusted for ethnicity and exposure.

Results Food insecurity was significantly associated with an increased risk of common mental disorder before and during pregnancy (Incidence Rate Ratio 1.9, 95% confidence interval 1.3 to 2.8, p=0.001) and after giving birth (Incidence Rate Ratio 1.3, 95% confidence interval 1.0 to 1.7, p=0.029).

Conclusions Our study shows that food insecure women have worse mental health than food secure women, and that this difference is most pronounced for White British pregnant women. These findings provide evidence for concerns expressed by public health experts that food insecurity may become the next public health emergency.

INTRODUCTION

Between the 1st of April 2015 and the 31st of March 2016 well over one million people were given three days' worth of emergency food supplies from the Trussell Trust's UK network of foodbanks,[1] which is a forty-fold increase from 2008 to 2009. The fact that food banks are more likely to open in local authorities with greater welfare cuts and higher unemployment rates suggests that this rise is due to demand, rather than supply.[2] Apart from the associations between food insecurity and poverty,[3-7] food insecurity has also been found to be associated with poor mental health among adults in Canada, Australia and the US.[4, 8-10] Pregnant women are at higher risk of food insecurity than the general population,[11-13] and associations between food insecurity and perceived stress, anxiety and depression may negatively impact on health and development of the child.[14, 15] However, previous studies have relied heavily on cross-sectional data, and the clinical implications of food insecurity in relation to poor mental health in the UK are unknown.

Ethnic variations in food insecurity have received virtually no attention in the UK, while studies addressing food insecurity in the US and Canada show that certain minority ethnic groups are more likely to experience food insecurity.[9, 16-19] However, the ethnic density hypothesis suggests that some ethnic minority groups, despite often being in a low socio-economic position, have better health outcomes than expected due to support within their social networks.[20] This protective ethnic density effect has been found in relation to psychosis,[21] common mental disorder,[22] and other health behaviours and outcomes.[23] The relationship between mental health and food insecurity, a poverty-related stressor, might fit this hypothesis.

In this study, we aim to describe the trajectory of common mental disorder across the pre-pregnancy, pregnancy and post-natal period for food secure compared to food insecure women, making use of cohort data on food insecurity in combination with routinely collected primary care data in an ethnically diverse and deprived population.

METHODS

We analysed data from the Born in Bradford birth cohort, which aims to examine the impact of environmental, psychological and genetic factors on maternal and child health,[24] and combined this with data from the nested BiB1000 study and GP medical records.

Bradford is a northern English city with high levels of socioeconomic deprivation and ethnic diversity. Over 12000 women were recruited at the Bradford Royal Infirmary at 26 to 28 weeks pregnancy between 2007 and 2010. Enrolled women completed a questionnaire on aspects related to health, health behaviours and social determinants of health, and they consented to linkage of routine primary care data.[25] Ethics approval for the data collection was granted by Bradford Research Ethics Committee [Ref 07/H1302/112].

We matched data from the baseline Born in Bradford questionnaire with data on food insecurity, which was available for a subsample of 1280 women in the nested BiB1000 study,[26] and data from primary care records spanning the period from 18 months prior to 40 months after birth of the cohort child.

Food insecurity questionnaire

Household food insecurity was assessed when babies were approximately 12 to 18 months old using the 18 item US National Household Food Security Survey Measure.[27] Women were identified as food secure or food insecure based on the classification suggested in the literature,[27] and 313 women were excluded from the analysis due to missing data or responding 'don't know' or 'refuse to answer'.

GP records

SystmOne electronic primary care records were matched to Born in Bradford data by a third-party data provider using NHS numbers (90.8% matched). We defined cases of common mental disorder as having a Read code for depression; or anxiety; or depression and anxiety; or treatment for common mental disorder; or follow up for these Read codes; and/or prescriptions for common mental disorder drugs, in the included period. We excluded cases with Read codes indicating serious mental illness in the included period, screening for common mental disorder or history of common mental disorder.

Statistical analysis

We describe the sample by maternal age, socioeconomic status as indicated by occupation of the father, receiving means-tested benefits, and self-assigned ethnicity (7 largest groups).

For comparisons of characteristics between groups, Pearson's chi-squared test and t-tests were used. We calculated incidence rates of common mental disorder adjusted for exposure (proportion of time registered with GP practice) per 1000 Patient Years At Risk among food secure compared to food insecure women in ten six-month periods. We used Poisson regression to calculate adjusted Incidence Rate Ratios.

Because the White British and Pakistani origin groups were the only two ethnic groups large enough to justify stratified analyses, we calculated prevalence and Risk Rate Ratios of prenatal and postnatal common mental disorder by food insecurity status for White British and Pakistani women. All analyses were conducted using Stata 14.

Participant involvement

The Born in Bradford study disseminates findings to participants through newsletters, online media and meetings, and an active Parent Governors group which meets quarterly to contribute to the design and dissemination of studies. Although no participants were involved in the design or conduct of this particular study, the results will be communicated to Born in Bradford participants through the established channels.

RESULTS

Maternal characteristics according to household food security status

Table 1 shows demographic and socioeconomic characteristics of the total sample and by household food security status. 179 out of 1280 women in the sample reported food insecurity.

Table 1. Maternal characteristics according to household food security status.

|	Full sample (n=1593) (sd/%)	Food secure (n=1101) (%)	Food insecure (n=179) (%)	Difference between food secure and food insecure groups	
				t test statistic /Chi2	P value
Maternal age in years mean (SD)	27.66 (5.6)	27.77 (5.6)	27.00 (5.4)	0.61	0.433
Means-tested benefit receipt				31.5	<0.001
Yes	646 (40.6)	408 (79.4)	106 (20.6)		
No	947 (59.5)	693 (90.5)	73 (9.5)		
Occupation of the father					
Non-manual	669 (42.1)	485 (89.2)	59 (10.8)		
Manual	494 (31.1)	328 (82.4)	70 (17.6)	8.8	0.003*
Self-employed	187 (11.8)	141 (93.4)	10 (6.6)	2.3	0.125*
Unemployed	177 (11.1)	107 (77.0)	32 (23.0)	14.2	< 0.001*
Other (Don't know/student)	62 (3.9)	25 (80.6)	6 (19.3)	2.1	0.146*
Ethnic group					
White British	480 (37.5)	393 (81.9)	87 (18.13)		
Pakistani	624 (48. 8)	560 (89.7)	64 (10.3)	14.1	< 0.001[†]
Indian	56 (4.4)	53 (94.6)	3 (5.4)	5.8	0.016[†]
Bangladeshi	24 (1.9)	21 (87.5)	3 (12.5)	0.5	0.483[†]
White Other	26 (2)	20 (76.9)	6 (23.1)	0.4	0.525[†]
Black	25 (2)	17 (68.0)	8 (32.0)	3.0	0.084[†]
Other	44 (3.4)	36 (81.8)	8 (18.2)	0.0	0.993[†]

* Compared to non-manual occupation

† Compared to other ethnic groups

Mental health trajectories and regression analyses of food secure versus food insecure women

The number of cases of common mental disorder by six-month period, running from 18 months before giving birth to 40 months after birth, dipped sharply around birth before rising steeply and remaining fairly constant in the 40 months after birth, for the food secure and food insecure group (fig 1).

Household food insecurity was preceded by poor mental health and succeeded by poor mental health. Household food insecurity was associated with a consistently increased risk of common mental disorder except for the postnatal period of 24 to 30 months (fig 1), and this increased risk was statistically significant for all three periods up to giving birth and three out of seven periods after birth. Combining the three pre-birth periods and seven post-birth periods, food insecurity was associated with an increased risk of common mental disorder before and during pregnancy (Incidence Rate Ratio 1.9, 95% confidence interval 1.3 to 2.8, p=0.001) and after giving birth (Incidence Rate Ratio 1.3, 95% confidence interval 1.0 to 1.7, p=0.029).

Figure 1. Exposure-adjusted incidence rates of common mental disorder per 1000 Person Years At Risk (PYAR)
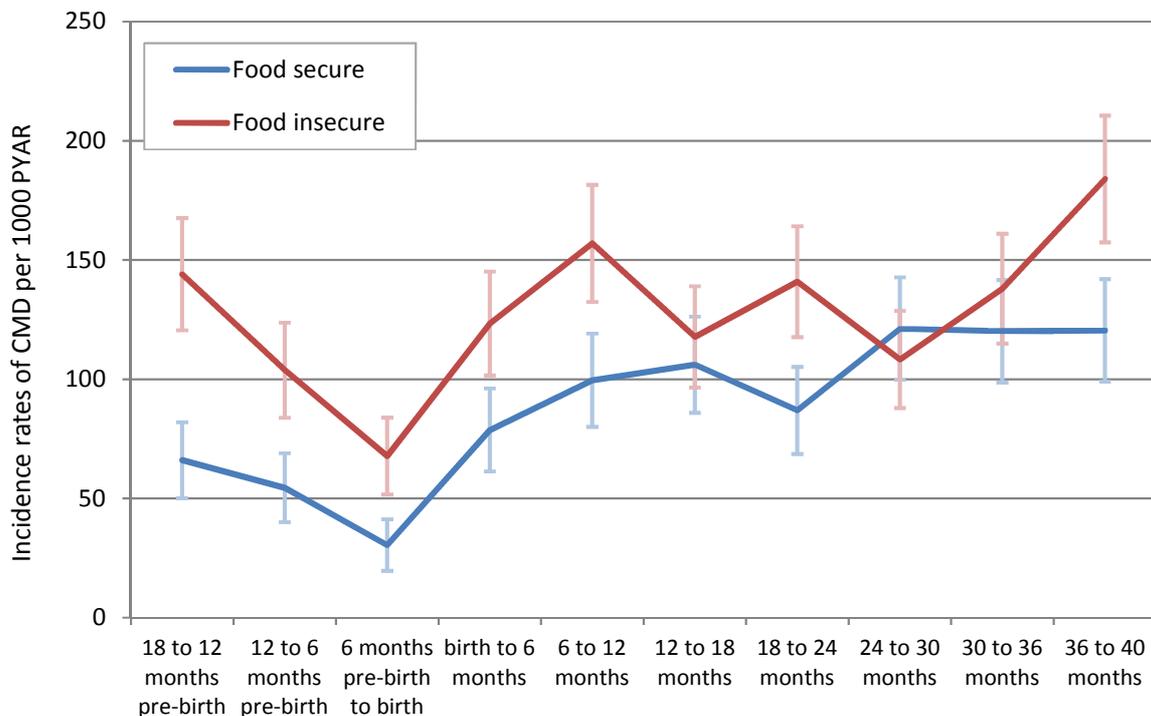
Ethnic differences in common mental disorder by food insecurity status
White British women were up to three times more likely than Pakistani women to be a common mental disorder case. Figure 2 shows that the increased likelihood of common mental disorder is consistent across the 58 month study period, bar a sharp levelling prior to birth.

Figure 2. Number of common mental disorder cases by period for White British and Pakistani women
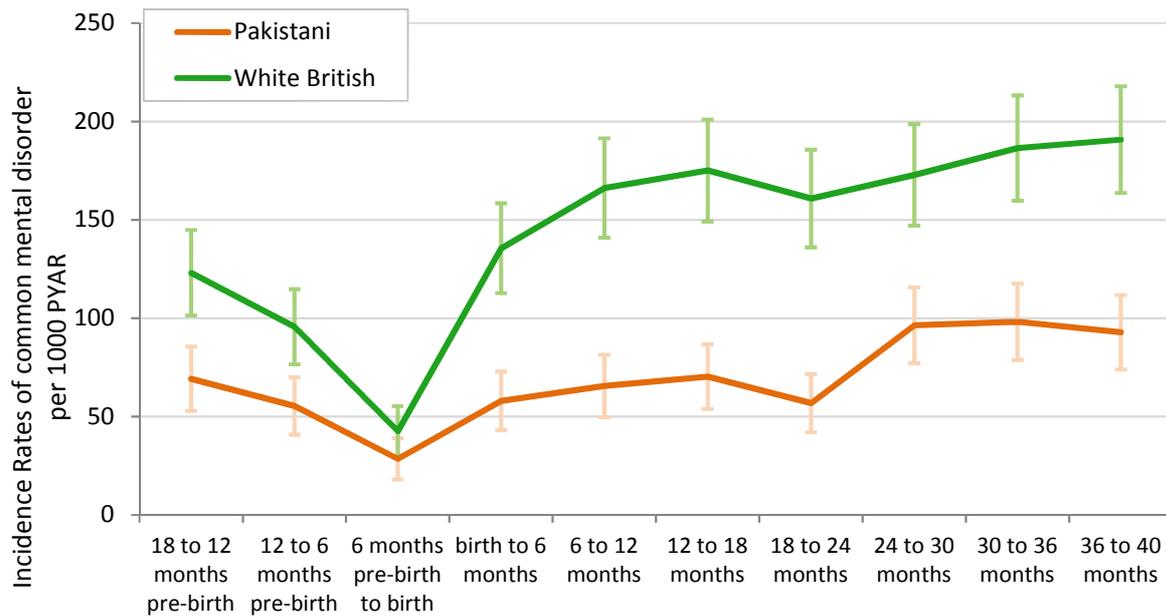
The increased risk of common mental disorder for Pakistani food insecure compared to food secure women was not statistically significant either before birth (Incidence Rate Ratio 1.8, 95% confidence interval 0.9 to 3.6, p=0.087) or after birth (Incidence Rate Ratio 1.2, 95% confidence interval 0.8 to 2.0, p=0.341). In contrast, for White British food insecure versus food secure women the increased risk of common mental disorder was statistically significant before birth (Incidence Rate Ratio 1.70, 95% confidence interval 0.2 to 2.8, p=0.043) but not after birth (Incidence Rate Ratio 1.3, 95% confidence interval 0.9 to 1.9, p=0.099).

DISCUSSION

In our low income, multi-ethnic UK sample 14% was food insecure. Food insecurity was associated with other markers of socioeconomic status, including paternal manual occupation and receipt of means-tested benefits. Mothers of Pakistani and Indian ethnicity were less likely to report food insecurity. In the full sample, food insecurity was preceded and succeeded by poor mental health. The highest risks of poor mental health for food insecure compared to food secure women were found before and during, rather than after pregnancy. For Pakistani women, poor mental health was not statistically significant in relation to food insecurity at any point in time in the included period.

Strengths and weaknesses

This study is one of the first on food insecurity to be conducted in the UK population, and the first to look at food insecurity in relation to mental health over an extended period spanning conception, pregnancy and early infancy. We had a unique opportunity to combine routinely collected primary care data with detailed information on food insecurity, and the ethnically diverse sample allowed us to examine differences in the association between common mental disorder and food insecurity by White British and Pakistani ethnic group. At the same time, the use of this data brings with it some limitations. Our identification of 'cases of common mental disorder' relied on the quality of GP records, hence it is possible that we have misclassified or missed cases. There is for example evidence to suggest that minority ethnic women with common mental disorder are twice as likely as White British women to be missed in primary care.[28] Also, mother's socio-demographic data were collected in late pregnancy while food security was assessed when the child was 12-18 months old,

by which point occupation of the father or receiving means-tested benefits might have changed. Although we provide robust evidence of differences in the association between common mental disorder and food insecurity by ethnic group, sample size limitations meant that only the White British and Pakistani groups could be included in the stratified analyses.

The prevalence of food insecurity found in our study (14.0%) was higher than the prevalence found in the Southampton Women's Survey (SWS) cohort study (4.6%) and the E-Risk Study (9.7%), and lower than that observed in the Low Income Diet and Nutrition Survey (29%).[7, 13, 29] However, differences in methodology used for the assessment of food insecurity across the UK studies and socio-demographic differences between the cohorts make direct comparisons difficult. In addition, the Southampton Women's Survey and E-Risk cohorts collected data on food insecurity four [chronological] years before Born in Bradford and in the period after birth, rather than before or during pregnancy. Given the high demand at ten food banks in Bradford, the high percentage of food insecurity we identified is likely to reflect a contemporary high need for support. Our finding of an increased risk of poor mental health for food insecure women is in line with results from the E-Risk Study and other studies in Canada and the US.[9, 30, 31] Rather than relying on cross-sectional data, the use of longitudinal primary care data means we can be confident that food insecurity 12 months after birth was associated with poor mental health before, during and after pregnancy. While we cannot comment on the direction of the relationship between food insecurity and mental health, studies from Canada and the US suggest both that the chronic illness in adults may render their household more vulnerable to food insecurity [10] and that food insecurity is a risk factor for stress and anxiety.[32, 33] Ethnic variations in food insecurity [34]and ethnic differences in the association between food insecurity and health status have been reported outside the UK [9, 16-19]. Similar to our finding of a stronger association between food insecurity and common mental disorder in the White British than in the Pakistani group, Stuff and colleagues found the associations between food insecurity and general physical and mental health to be stronger in the Black American than in the White American group.[9]

Meaning of the study

The key aim of our study was to assess the mental health trajectories of food secure versus food insecure women. The finding that food insecure women have worse mental health, and that this is most pronounced during pregnancy, has important implications for clinicians. Poor maternal mental health negatively impacts on both the mother and the baby,[14, 15, 34] while poor maternal nutrition in pregnancy has long-term implications for the child.[35, 36] Both the prevalence of food insecurity and the prevalence of common mental disorder were lower in the Pakistani sub-sample, and the associations between food insecurity and mental health did not reach statistical significance. This may be a result of measurement bias or under-diagnosis of common mental disorder, or alternatively, it may be a reflection of the protective role of strong social networks within ethnic minority groups providing a buffer against the detrimental effects of poverty on health.

Unanswered questions and implications

Our study provides evidence for concerns expressed by public health experts in 2013, who warned that food insecurity may become the next public health emergency.[37] Additional research is now urgently needed to determine the direction of the effect between food security and maternal mental health in pregnancy. Depending on this direction, it will be crucial to test either whether interventions addressing women's food security can improve women's mental health symptoms during and after pregnancy, or whether action on women's mental health symptoms can reduce the burden of food insecurity. Better understanding of ethnic differences in food insecurity and mental health will be fundamental to understanding whether there is a protective effect of ethnicity on food

insecurity and mental health or whether, at present, we are underestimating the risk of food insecurity in ethnic minority groups such as the Pakistani group.

What is already known on this subject

- The use of food banks has risen sharply in the UK and food insecurity has been called a potential public health emergency, but evidence on relationships between food insecurity and health is mostly limited to cross-sectional studies from the USA, Canada and Australia.

- Minority ethnic group status may be protective against the detrimental effects of poverty on mental health in the UK, but there is no longitudinal evidence to support this hypothesis for mental health in relation to food insecurity, a poverty-related stressor.

What this study adds

- Food insecurity is associated with poor mental health for White British women during pregnancy and after birth, but not for Pakistani women; the latter group have lower levels of food insecurity, and fewer common mental disorders before, during and after pregnancy.

- The highest risks of poor mental health for food insecure women, compared to food secure women, are found before and during, rather than after pregnancy, suggesting that food insecurity may not only increase the burden on mental health services but also affect maternal health at a phase in life crucial to child development.

- Transparency: The lead author (Power) affirms that the manuscript is an honest, accurate, and transparent account of the study being reported; that no important aspects of the study have been omitted; and that any discrepancies from the study as planned have been explained.
- As this study is a research report a research reporting checklist is not required.

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