Original investigation

Using Birth Cohort Data to Assess the Impact of the UK 2008–2010 Economic Recession on Smoking During Pregnancy

Eleonora P. Uphoff PhD^{1,2}, Neil Small PhD³, Kate E. Pickett PhD²

¹Bradford Institute for Health Research, Temple Bank House, Bradford Royal Infirmary, Duckworth Lane, Bradford, UK; ²Department of Health Sciences, Seeborn Rowntree Building, University of York, Heslington, York, UK; ³Faculty of Health Studies, University of Bradford, Richmond Road, Bradford, UK;

Corresponding Author: Eleonora P. Uphoff, PhD, Bradford Institute for Health Research, Temple Bank House, Bradford Royal Infirmary, Duckworth Lane, Bradford, UK. Telephone: 01904 32 1612; E-mail: noortje.uphoff@york.ac.uk

Abstract

Introduction: Despite the well-known link between stress and smoking, evidence for associations between economic recession, financial stress, and smoking is contradictory. In this study, we assess whether women were more likely to continue smoking during pregnancy if they were exposed to the UK 2008–2010 economic recession during pregnancy than those who were unexposed, and whether this relationship is mediated by financial stress.

Methods: We used cross-sectional data on 2775 pregnant women who were regular smokers before pregnancy and who were enrolled in the UK Born in Bradford cohort study between March 2007 and December 2010. The cutoff date for exposure to recession was set as August 1, 2008, based on local and national economic data. Multivariable logistic regression analysis included potential confounders: maternal age, parity, cohabitation, ethnicity, and maternal age. The mediating role of financial stress was analyzed using “worse off financially” and a “difficult financial situation” as indicators of financial stress in Sobel–Goodman mediation tests with bootstrap resampling.

Results: After taking into account potential confounders, exposure to recession was associated with continued smoking during pregnancy ($OR = 1.19$, 95% CI = 1.01 to 1.41, $p = 0.03$). A worse financial situation and a difficult financial situation were identified as mediators, explaining 8.4% and 17.6%, respectively, of the relationship between exposure to recession and smoking during pregnancy.

Conclusions: Smoking during pregnancy is associated with exposure to the UK 2008–2010 economic recession during pregnancy, and this relationship is partly mediated by financial stress.

Implications: Health inequalities in smoking during pregnancy are affected by economic recession, as those who are most likely to smoke are also most likely to experience the financial stress resulting from economic recession. Socioeconomic conditions at the societal and individual level are important targets when aiming to reduce rates of smoking during pregnancy.

Introduction

Social Gradients in Tobacco Smoking

Tobacco smoking in pregnancy is more prevalent among those who have a lower socioeconomic status as indicated by a range of socioeconomic measures ranging from education and employment status

to poor childhood circumstances, housing tenure, and job strain.^{1–4} In an analysis of continued smoking during pregnancy in 15 European countries, Smedberg and colleagues² found an average prevalence rate of 26.2%, compared with 43.2% in the lowest educational category. In England, a combination of socioeconomic indicators showed a

very steep social gradient with 6% of women smoking during pregnancy in the highest and 62% of women smoking in the lowest socioeconomic group.⁴ An analysis of data from the Millennium Cohort Study showed that smoking and heavy smoking during pregnancy were associated with a range of factors more common among lower socioeconomic groups, including leaving school before eighteen, not having a bank account, and financial difficulties.⁵

Tobacco Smoking and Financial Stress

Financial stress appears to play a significant role in explaining these social gradients, although most of the evidence comes from smoking in the general population. In Australia, financial stress according to an eight-item scale relating to shortage of money was associated with a lower likelihood of quitting and a higher likelihood of relapse.⁶ This finding was confirmed in a survey with data from the United States, United Kingdom, Canada, and Australia. Smokers experiencing financial stress had an increased interest in quitting but were less likely to make an attempt, and consequently their odds of succeeding was half that of the group without financial stress.⁷ Involuntary job loss among older workers was associated with increased odds of a relapse in smoking, defined as reported smoking point prevalence after quitting.⁸ A US community-based sample was used to demonstrate that women are less likely to quit smoking in response to an adverse financial event, and more likely to relapse as a result of such an event.⁹

Tobacco Smoking During the 2008–2010 Economic Recession

Given that financial stress affects those of lower socioeconomic status disproportionately, and macro-economic circumstances such as economic recession can evoke financial stress, it is reasonable to assume that the economic recession, which hit Europe between 2008 and 2010, would have increased rates of smoking during pregnancy. Women who were regular smokers may have been less able to quit smoking as financial strain placed a burden on their cognitive, social, and emotional capacities. The evidence, however, which is largely based on tobacco use in the general population, is contradictory.

Based on US economic data, Ruhm concluded that smokers, especially heavy smokers, cut down on smoking during economic downturns.¹⁰ Others have showed that increased wages lead to increased cigarette use,¹¹ and larger than expected declines in smoking during the economic recession have been found in Iceland^{12,13} and in Greece.¹⁴

These findings have come with nuances and reservations. The authors of the Greek study pointed out that more effective enforcement of tobacco control legislation may partly explain their findings.¹⁴ Gallus and colleagues argued that the number of unemployed people grows during a recession, so that a small decrease in smoking is seen at the ecological level because the downward trend in smoking prevalence for employed people is slightly larger than the increase in smoking among the unemployed during economic recession.¹⁵ In a study of UK parents, financial strain during the recession was associated with an increased risk of persistent tobacco use and relapse.¹⁶

In summary, most of the literature would suggest that experiences of financial stress, which are likely to result from an economic recession, might increase the likelihood of continued smoking during pregnancy. Although these associations are plausible, the literature on recession and smoking suggests an effect in the opposite direction. An analysis specifically testing associations between economic

recession and smoking during pregnancy, including the mediating effect of financial stress, might clarify previous findings.

Hypothesis

In a deprived UK community hit hard by the UK 2008–2010 economic recession, women who smoke regularly will be more likely to continue smoking during pregnancy if they were exposed to the recession during pregnancy compared with those unexposed, and this relationship is mediated by financial stress.

Methods

This study follows guidance on reporting set out in the STROBE statement ([Supplementary Table A1](#)).

Data

The Born in Bradford (BiB) cohort was set up to examine the impact of social, environmental, psychological, behavioral, and biological factors on maternal and child health and well-being.¹⁷ Pregnant women ($N = 12\,450$) were recruited around 26 to 28 weeks of pregnancy at Bradford's only maternity unit when attending universal screening for gestational diabetes, between March 2007 and December 2010.¹⁸ Ethical approval for data collection was granted by Bradford Research Ethics Committee (Ref 07/H1302/112).

After excluding pregnancies without baseline questionnaire data ($N = 2\,377$), stillbirths ($N = 61$), second and third pregnancies to the same mother in the cohort ($N = 1\,323$), and twins and triplets ($N = 142$), a dataset of 10\,035 mother–infant pairs was obtained. A dataset with complete data for the exposure variable and covariates was used. This dataset of 8\,952 pregnant women was used to explore relationships between exposure to recession and financial stress. In this dataset, 2\,775 women were regular smokers and reported information on smoking during pregnancy and relevant covariates.

Setting

Bradford is a deprived and ethnically diverse city in the North of England with a population of over half a million.¹⁹ Employment is more reliant on manufacturing industry than the UK average and this sector has been in decline for decades, making the city particularly vulnerable to the effects of economic recession. There was a sharp increase in the proportion of claimants for Job-Seeker's Allowance (JSA) (the main form of financial support for unemployed people identified as actively seeking work) in Bradford from August 2008, with a peak in JSA claimants at 5.0% in September 2009 ([Figure 1](#)).²⁰ In November 2007, JSA-claimant-rates in Bradford were 133% higher than for England as a whole; by November 2015, rates were 181% higher in Bradford than the average for England.

Main Exposure

The definition of recession as “A period of temporary economic decline during which trade and industrial activity are reduced, generally identified by a fall in GDP in two successive quarters”²¹ may not correspond with the lived experience of recession. We used reports in national and local media²² ([Supplementary Box A1](#)) in combination with data on unemployment related benefit claims²¹ ([Figure 1](#)) to inform the decision of a cutoff date for recession start date to be the first of August 2008; an estimated conception date from August 01, 2008 onwards was therefore classified as “exposed.” No “end of

Figure 1. Percentage JSA claimants as a proportion of the resident population aged 16–64.

Figure 2. Percentage of pregnant women reporting to be worse off financially by year and quarter of recruitment.

exposure” cutoff was used as Figure 1 indicates the economic impact of the recession lasted well beyond the study recruitment period.

The percentage of study participants reporting to be financially worse off than a year ago increases from 15.3% ($N = 60$) at the beginning of May 2008 to 24.2% ($N = 88$) around the beginning of June 2008 (Figure 2). In an exploration of different measures of exposure, we found no evidence for an annual worsening of individual's financial situation (analyses available upon request). A binary cutoff before and since August 01, 2008 was therefore considered an appropriate measure of exposure to recession.

Mediating Factors

Financial stress was operationalized through two variables; perceived financial situation and change in perceived financial situation. Women were asked how well they and their partner were managing financially, with response categories ranging from “living comfortably” to “difficult” (“very difficult” and “just about getting by” were merged with “difficult”). Change in perceived financial situation was measured with the question “Compared to a year ago, how would you say you and your husband/partner are doing financially now?,” with answer categories “better off,” “about the same” or “worse off.”

Table 1. Participant Characteristics by Exposure Group

Participant characteristics	Unexposed N = 1362	Exposed N = 1413	Total N = 2775	p value test of difference between groups*
Maternal age (years)	25.79	26.13	25.97	0.06
Parity				0.03
Nulliparous	50.44%	54.56%	52.57%	
Multiparous	49.56%	45.44%	47.43%	
Ethnicity				0.35
White British	77.97%	76.57%	77.26%	
Pakistani	12.19%	11.89%	12.04%	
Other	9.84%	11.54%	10.70%	
Maternal education				<0.01
<5 GCSE	25.40%	23.50%	24.43%	
5 GCSE	38.11%	36.73%	37.41%	
A level	13.44%	18.75%	16.14%	
>A level	14.54%	15.64%	15.10%	
Other	8.52%	5.38%	6.92%	
Cohabiting				0.11
Yes	69.53%	66.67%	68.07%	
No	30.47%	33.33%	31.93%	
Financial situation				0.02
Comfortable	23.79%	21.80%	22.77%	
Doing alright	40.53%	37.30%	38.88%	
Difficult	35.68%	40.91%	38.34%	
Change in financial situation				<0.01
Same/better off	74.23%	69.57%	71.86%	
Worse off	25.77%	30.43%	28.14%	
Continued smoking during pregnancy				0.14
Yes	53.52%	56.33%	54.95%	
No	46.48%	43.67%	45.05%	

* χ^2 test for categorical variables and *t*-test for continuous variables.

Table 2. Exposure to Recession in Relation to Smoking During Pregnancy

	Model 1. Bivariate “exposure recession” N = 2775		Model 2. Multivariate “exposure recession” N = 2775	
	OR	95% CI	OR	95% CI
Exposure recession	1.12	0.96; 1.30	1.19	1.01;1.41*
Maternal age			0.93	0.92; 0.95***
Parity				
Multiparous			1.37	1.14;1.65**
Ethnic group (vs. White British)				
Pakistani			0.61	0.48;0.79***
Other			0.79	0.61;1.04
Maternal education (vs. <5 GCSE)				
5 GCSE			0.50	0.40;0.63***
A level			0.40	0.31;0.53***
>A level			0.19	0.14;0.25***
Other			0.33	0.24;0.47***
Cohabitation				
Yes			0.53	0.44;0.64***

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

Outcomes

Data on maternal smoking were obtained from the study baseline questionnaire. A binary variable of continued smoking during pregnancy for those who reported to smoke regularly was derived from questions

on smoking during pregnancy 3 months before pregnancy, in the first 3 months of pregnancy and since the beginning of the fourth month. Women who reported to have stopped smoking in the first month of pregnancy and did not report smoking any cigarettes since the beginning of the fourth month were counted as nonsmokers during pregnancy.

Covariates

The Directed Acyclic Graph created in DAGitty V2.3 and published on the Dagitty Web site (<http://dagitty.net/mLWfIRw>) shows the hypothesized causal relationships between exposure to recession, continued smoking during pregnancy and covariates.²³ Parity (nulliparous vs. other), maternal age, cohabitation with a partner (yes/no) ethnic group (White British, Pakistani, other), and education of the mother (<5 GCSE, 5 GCSE, A level, >A level, other, or equivalents of these qualifications) were identified as potential confounders.

Statistical Analyses

Firstly, sample characteristics were explored and differences tested between the subsample exposed to recession during pregnancy and the unexposed group. Chi-square tests were used for binary variables and *t*-tests for continuous variables.

Multivariable logistic regression analysis was used to model the relationship between exposure to economic recession and continued smoking during pregnancy, after which mediation analysis was performed to assess the role of financial stress.

The mediating role of financial stress was tested with Sobel–Goodman mediation analyses in Stata 12, using the “sgmediation” and “bootstrap” commands.²⁴ This method has been found to be

Table 3. Results of Sobel–Goodman Test With Bootstrap Analysis

	Coefficient	SE	95% CI
Model with mediator “worse financial situation” (N = 2775)			
Indirect effect*	0.003	0.001	0.000 to 0.001
Direct effect	0.031	0.017	−0.003 to 0.066
Model with mediator “difficult financial situation” (N = 2775)			
Indirect effect**	0.006	0.002	0.002 to 0.011
Direct effect	0.028	0.018	−0.007 to 0.063

*Proportion of the effect that is mediated: 0.084. **Proportion of the effect that is mediated: 0.176.

more rigorous and more likely to identify a true mediation effect than the widely used causal steps outlined by Baron and Kenny.^{25–27} We avoided violation of the normality assumption of the Sobel–Goodman test by performing a bootstrap analysis with 5000 sampling repetitions.²⁶

Results

The sample consists of 2775 women who were regular smokers before pregnancy, and Table 1 shows an overview of their characteristics. As opposed to those recruited before the economic recession, pregnant women who were recruited after the start of the recession and were thus exposed were more likely to be nulliparous (first child), to have a higher level of education, to be in a difficult financial situation, and to be worse off than a year ago. Prevalence rates of smoking during pregnancy varied from 40.0% among those who reported to be managing well financially, to 65.2% among mothers who reported their financial situation was difficult/very difficult.

Multivariable Analysis

After taking into account potential confounders, exposure to recession was associated with continued smoking during pregnancy (OR = 1.19, 95% CI = 1.01 to 1.41, $p = 0.03$) (Table 2). All other factors being equal, this represents a 3.7% difference in smoking prevalence, with 53.1% of women in the unexposed and 56.8% of women in the exposed group smoking during pregnancy.

Mediation Analysis

Results of the mediation analysis are summarized in Table 3.

When a worse financial situation than a year ago is used as the indication of financial stress, bootstrap results for the Sobel–Goodman test suggests a modest mediation effect (observed coefficient = 0.003, 95% CI = 0.00 to 0.01). Of the total relationship between exposure to recession and continued smoking during pregnancy, 8.4% is estimated to be mediated by the effect of a worse financial situation.

When financial stress is operationalized as a current difficult financial situation (compared to comfortable/doing alright), a modest mediation effect is again present (observed coefficient = 0.006, 95% CI = 0.00 to 0.01). The proportion of the relationship between exposure to recession and continued smoking during pregnancy mediated by the effect of a difficult financial situation is 17.6%.

By taking into account the influence of financial stress, either through the inclusion of a worse or difficult financial situation variable, the direct effect of exposure to the economic recession on smoking during pregnancy is no longer statistically significant.

Conclusions

This study demonstrates that exposure to economic recession is associated with continued smoking during pregnancy for regular smokers and that this relationship is partly mediated by financial stress.

Exposure to the UK 2008–2010 economic recession during pregnancy was associated with a difficult financial situation and being worse off than a year ago for women in the Born in Bradford cohort study who were regular smokers. After taking into account key confounders, pregnant women exposed to recession were more likely to continue smoking during pregnancy than those not exposed. Mediation analyses showed that the relationship between exposure to recession and continued smoking during pregnancy was partly explained by financial stress, either measured by a difficult or worsened financial situation of the household. With the inclusion of financial stress in the model, the relationship between exposure to recession and smoking during pregnancy was no longer statistically significant.

Limitations

Even though covariates were included to adjust for differences between the “exposed” and “unexposed,” there might be alternative explanations for our findings.

Couples who get pregnant during an economic recession may be different from those who choose not to. This may explain differences between the unexposed and exposed group shown in Table 1. Economic recession and unemployment have been found to be associated with a decline in fertility rates, particularly for young women having their first child,^{28,29} and fertility rates in England and Wales declined between 2008 and 2010 in all age groups except for mothers aged 35 and above.³⁰ If couples who were more strongly affected by recession were more likely to delay pregnancies, we have underestimated the relationship between economic recession, financial stress, and smoking during pregnancy.

Our study is limited by missing data and by its cross-sectional design. Despite our careful considerations of the cutoff for exposure to recession by using area-specific and national data, it is possible that we did not identify correctly after which date people were likely to experience the economic recession in their lives. In addition to misspecification of the exposure cutoff, data on key covariates may be influenced by date of data collection, as researchers will have gradually become more experienced in the administration of the questionnaire. It is likely that data are not missing at random.

Finally, smoking during pregnancy is a stigmatized behavior that is likely to be underreported when relying on self-report measures, which means our prevalence rates of smoking during pregnancy are likely to underestimate true prevalence rates.

Implications for Research and Society

This study contradicts findings which suggest a beneficial effect of economic recession on smoking, and fits with literature on the role of stress, including financial stress, in a person’s ability to quit smoking and prevent relapse.^{5–9,16}

In our sample, prevalence rates of smoking during pregnancy increased over time, whereas there is a slow but steady decline in smoking during pregnancy nationally.³¹ In Scotland, the introduction of a smoking ban in public places led to reduced rates of smoking during pregnancy.³² Our data show no such effect on smoking during pregnancy around the time the smoking ban took effect in England in July 2007. Any downward trends in smoking prevalence may have been counteracted by the larger impact of the economic recession.

All women in this study were sampled from a UK city characterized by deprivation and health inequalities. The increased burden placed on this already disadvantaged community was by no means unavoidable. Research shows that strong social policies can prevent health impacts of recession.^{33,34} Our study shows that socioeconomic conditions, both at the societal and individual level, are important targets when aiming to reduce rates of smoking during pregnancy. If there is ever a time to invest in protecting the vulnerable to the advantage of society as a whole, the period during and after recession is such a time.

Supplementary Material

Supplementary Table A1 and Box A1 can be found online at <https://academic.oup.com/gerontologist/>.

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Declaration of interests

The authors report no conflicts of interest.

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