

Abstract

Background: Understanding the risk factors for child maltreatment is critical to efforts to reduce its prevalence.

Objective: This study investigated the association between characteristics and circumstances of mothers during pregnancy and the subsequent identification of concerns about child maltreatment.

Participants and Setting: The study drew on two data sets: (i) data from questionnaires administered to the expectant mothers of 11,332 children born in a deprived multi-ethnic local authority in England between 2007 and 2011, for a birth cohort study, and (ii) administrative data on children referred to child welfare services.

Methods: The linkage of these two pre-existing data sets enabled the prospective study of risk factors for child maltreatment.

Results: A range of factors captured during the antenatal period were associated with an increased likelihood of subsequent recorded child maltreatment concerns, including: younger maternal age (HR=0.96; $p<.001$), lower maternal education level (HR=1.36; $p<.001$), maternal mental illness (HR=1.17; $p=.001$), maternal smoking in pregnancy (HR=1.69; $p<.001$), single motherhood (HR=1.41; $p=.022$), larger family size (HR=1.13; $p<.001$), multiple deprivation (HR=1.01; $p=.011$), social housing (HR=1.72; $p<.001$), paternal unemployment (HR=1.79; $p<.001$), and the receipt of means-tested welfare benefits (HR=1.43; $p<.001$). A greater total number of risk factors during pregnancy also increased the risk of subsequent maltreatment concerns (HR=1.45; $p<.001$).

Conclusions: The identification of multiple risk factors in this study supports claims that single targeted interventions are unlikely to be successful in preventing or reducing child maltreatment due to its multifactorial nature, and that multidimensional interventions are required.

1. Introduction

The aetiology of child maltreatment has been a focus of enquiry in child welfare research over the past 25 years or so. Child maltreatment remains a major social and public health issue that leads to long-term harms (Hughes et al., 2017), and understanding the causes of child maltreatment is critical to efforts to reduce its prevalence (Munro et al., 2014). Over the past decade in England, there has been a considerable rise in the number of children becoming involved in the child protection system. During this period, there has been a substantial increase in referrals and investigations, with the number of children subject to child protection investigations rising from 87,700 in 2009/10, to 179,160 in 2018/19 (Department for Education, 2010, 2019). Furthermore, questions have been raised about the causes of children's involvement with child welfare services in light of stark variations in the rates of child protection interventions in local authorities in England (Bywaters, 2015).

Studies conducted in several countries, including the UK and US, have drawn on theoretical frameworks to investigate factors associated with indicators of child abuse and neglect, most notably, Belsky's developmental-ecological model. This model emphasised the multifaceted nature of child maltreatment and organised risk and protective factors into distinct conceptual domains, or 'contexts of maltreatment', relating to the child, parent, family and wider community (Belsky, 1993). Factors identified in this model as being important in determining whether or not a child will experience abuse or neglect included child age, health and behaviour, parental childhood experiences and emotional stability, and societal attitudes and practices with regards to childrearing. Belsky proposed there to be many pathways to child abuse and neglect and that the balance of stressors and supports increased or decreased the probability of child maltreatment occurring.

Researchers have since provided some evidence for the role of various factors in determining maltreatment. Child factors found to be associated with maltreatment risk

include child age, ethnicity, disability and birthweight (Putnam-Hornstein & Needell, 2011; Sidebotham & Heron, 2006; White et al., 2014), while parental and familial factors identified include parental age, childhood abuse history and mental illness, domestic violence, marital status, family size and social isolation (Brown et al., 1998; Dixon et al., 2005; Li et al., 2011; Putnam-Hornstein & Needell, 2011; Sidebotham & Heron, 2006; Windham et al., 2004; Wu et al., 2004). Studies have also consistently shown strong associations between indicators of socio-economic status, including employment status, housing tenure, family income and welfare receipt, and maltreatment risk (Berger, 2004; Sidebotham & Heron, 2006).

A cumulative risk approach has also been used to study the aetiology of maltreatment. One study, which was conducted in the US, provided evidence to suggest that an accumulation of risk factors might be more important in predicting child maltreatment than the presence of specific risk factors (Begle et al., 2010). This study compared two predictive models; one which organised risk factors into separate conceptual domains (drawing on Belsky's developmental-ecological framework) and one which calculated the total number of risk factors present (the cumulative risk model). The latter of these two models was found to best describe the contribution of risk factors included in the study. A cumulative risk approach has similarly been used in the study of outcomes for those exposed to adverse childhood experiences (Appleyard et al., 2005; Felitti et al., 1998; Rutter, 1979).

Some studies have investigated the aetiology of child maltreatment through analysis of data generated by longitudinal cohort studies (Berger, 2004; Li et al., 2011; Mersky et al., 2009; Sidebotham & Heron, 2006) or health records (Putnam-Hornstein & Needell, 2011; Wu et al., 2004), gathering detailed information about children and their families early in children's lives. In most of these studies, datasets have been linked to official child welfare records to determine whether or not children in study groups have been referred to child welfare services, or received specific child welfare interventions such as being placed in out-

of-home care. This study linked data collected from expectant mothers for a large birth cohort study conducted in a deprived multi-ethnic local authority in England, to child welfare records.

The aim of our study was to investigate the association between characteristics and circumstances of mothers during pregnancy and the subsequent identification of concerns about child maltreatment. Very few studies in the UK have used a prospective approach of this kind to investigate risk factors for maltreatment. One of these studies recruited children some time ago, in the early 1990s, and was conducted with a predominantly White population (Sidebotham & Heron, 2006), while the other focuses specifically on the impact of parents' childhood abuse histories on the likelihood of child maltreatment (Dixon et al., 2005). Our study builds on and updates the existing literature on the aetiology of maltreatment using a prospective approach. Drawing on both the developmental-ecological and cumulative risk models of child maltreatment, this work examines the combined effects of parental, familial and socio-economic factors on the likelihood of subsequently recorded maltreatment concerns. Data on maternal smoking, substance use and use of prenatal supplements during pregnancy were incorporated; variables that have not been included in previous UK studies of maltreatment risk. This analysis was conducted as part of a wider piece of research examining outcomes for children involved with the child protection system in England ([Author], 2019; [Author], 2018).

2. Methods

2.1. Design

This study used a prospective design, linking two types of pre-existing data: (i) data drawn from questionnaires administered to expectant mothers during antenatal appointments between 2007 and 2011, as part of a birth cohort study, and (ii) administrative data on children referred to child welfare services. Linkage of these two datasets enabled the

identification of children in the birth cohort who had a record of maltreatment concerns. Parental, familial and socio-economic factors captured at the antenatal stage were then compared between children in the cohort with a record of maltreatment concerns and those without, in order to identify antenatal factors associated with subsequent recorded abuse or neglect.

2.2. Procedure and sample

Linkage of the cohort study questionnaire data to the administrative child welfare dataset was performed on 31 August 2015, when the children in the cohort were aged between 50 and 100 months. A data officer at the local authority matched the names, addresses and dates of birth of all children in the cohort to those of all children who had been referred to child welfare services in the local authority since the cohort study began. The data officer created a flag in the administrative child welfare dataset to indicate which of the children referred to child welfare services were part of the cohort, then provided an anonymised version of this administrative dataset to the authors.

The cohort study team shared their anonymised questionnaire data with the authors; questionnaire data were available for 11,475 children in the cohort whose mothers had completed a baseline questionnaire during pregnancy. The authors used the cohort study identification numbers contained in each dataset to link the questionnaire dataset to the administrative dataset. Children known to have died (n=143) were excluded from the combined dataset, leaving 11,332 children in the final dataset used for the analysis below.

2.3. Measures

The independent variables used in this study were drawn from the questionnaire dataset generated by the cohort study. This dataset included detailed information on the expectant mothers' socio-demographic circumstances, mental health and lifestyle, as well as some paternal factors. The variables included in the analysis are listed in Table 1, and organised

into parental, familial and socio-economic factors. The authors selected these variables from a wider set of measures included in the questionnaire dataset; they selected those which they considered likely to be associated with child maltreatment based on existing evidence of risk and protective factors (cited in the Introduction) and also considered the completeness and reliability of measures. Due to the fact that questionnaires were administered to expectant mothers for the cohort study, and only limited data were collected from expectant fathers, the variables included in the analysis focus mainly on maternal characteristics and circumstances.

Maternal mental health was measured in the cohort study using the 28-item General Health Questionnaire (GHQ-28), a screening tool for identifying minor psychiatric disorders (Goldberg & Hillier, 1979). Standardised GHQ-28 factor scores were used, which had previously been generated by the cohort study team using bi-factor analysis.

The questionnaire dataset included self-report measures of expectant mothers' alcohol consumption during pregnancy, including the frequency with which mothers had consumed five or more units of alcohol during different stages of their current pregnancy. These measures provided an indication of 'binge drinking', described by the NHS as, "*drinking lots of alcohol in a short space of time or drinking to get drunk*" (NHS, 2020). The authors derived a single dichotomous variable from these data to indicate whether or not mothers had binge drank on any occasion during their current pregnancy.

Measures of socio-economic status contained in the questionnaire dataset included the Index of Multiple Deprivation 2010 (IMD 2010) score, an overall measure of multiple deprivation experienced by people living in an area, which aims to capture several distinct dimensions of deprivation (Department for Communities and Local Government, 2011).

A 'total number of risk factors' variable was created as an indicator of cumulative risk, and was derived from the 15 variables selected from the questionnaire dataset. Drawing on procedures adopted in previous research on cumulative risk (Begle et al., 2010; Appleyard et

al., 2005), each of these 15 variables were transformed into dichotomous variables and summed to create a cumulative risk scale. For categorical variables, cases belonging to the categories most strongly associated with the outcome variable (according to the results of univariable analyses, as explained in section 2.4) were coded '1', to indicate risk. Cases in the remaining categories were coded '0', to indicate no risk. For continuous variables, cases in the 25th percentile most strongly associated with the outcome variable were coded '1' and the remaining cases coded '0'. These dichotomous variables were then summed to generate the total number of risk factors, with a maximum possible score of 15.

The outcome variable used in this study was drawn from the administrative child welfare dataset on 'children in need' (CIN). Within the English child welfare system, children are defined as being 'in need' if they have been deemed by professionals to require child welfare services following an assessment. In the majority of CIN cases, services are provided to children while they remain at home with their families, sometimes under the supervision of a child protection plan, which is a multi-agency plan agreed at a child protection conference which aims to support the family to safeguard and promote the welfare of their child (HM Government, 2018). In a minority of CIN cases, children receive support while placed in out-of-home care. Children may experience one or more episodes of need and may become 'in need' for a range of reasons, the most common being abuse and neglect, which account for over a half of all cases of CIN (Department for Education, 2019). These cases include those where children have been maltreated, as well as cases where children have been assessed as being at risk of maltreatment (due to a sibling having been maltreated, for example). The outcome measure used in this study was binary: whether or not a child had ever been recorded as being 'in need' due to abuse or neglect (from pre-birth until the date of data linkage, which was 31 August 2015). This was used as an indicator of professional concerns about child maltreatment, in the absence of data on actual incidences of maltreatment.

2.4. Statistical analysis

The characteristics of the cohort are summarised as median (interquartile range; IQR) or n (%) in Table 1, with a breakdown by whether or not children had ever been ‘in need’ due to abuse or neglect. The statistical significance of differences in characteristics between the two sample groups were examined, using Mann-Whitney U tests for continuous factors and some ordinal factors (those with numerous categories), and Chi-square tests for the remaining categorical factors.

Cox regression models were used to explore factors associated with the time to children becoming ‘in need’ due to abuse or neglect. This method of regression accounted for the range of ages of the children in the dataset (50 to 100 months), allowing all episodes of need to be included in the analysis. The time was calculated from dates of birth to the dates when they first became ‘in need’ due to abuse or neglect. Where children hadn’t ever been ‘in need’ due to abuse or neglect by the time of the data linkage, data were censored at 31 August 2015.

Univariable Cox regression models were run first, to examine which of the independent variables were associated with the time to children becoming ‘in need’ due to abuse or neglect. Those significantly associated with the outcome variable (at the 99% confidence level) were then entered simultaneously as factors in a multivariable Cox regression model, to determine the adjusted effects of these variables on the time to children becoming ‘in need’ due to abuse or neglect.

A forced-entry method was used as there was no substantive theoretical basis on which to assume certain variables were more important than others in predicting maltreatment risk. Missing data were handled using listwise deletion, as missing data were linked to procedures used during the recruitment of participants for the cohort study (e.g. the GHQ was not used in the first phase of recruitment) and were not related to mothers’ characteristics. Unadjusted

and adjusted hazard ratios and 95% confidence intervals are presented in Table 2. Reference categories are those with the largest numbers of cases. Model fit was assessed using the Chi-square statistic for the likelihood ratio test, and collinearity diagnostics were run to check for multicollinearity.

All analyses were conducted using IBM SPSS Statistics 26.

2.5. Ethical considerations

Ethical approval was given by the Research Ethics Committee of the Department of [Anonymous] at the University of [Anonymous]. Upon recruitment to the cohort study, the expectant mothers interviewed had consented to their research data being shared with other researchers for ethically approved studies.

3. Results

3.1. Descriptive statistics

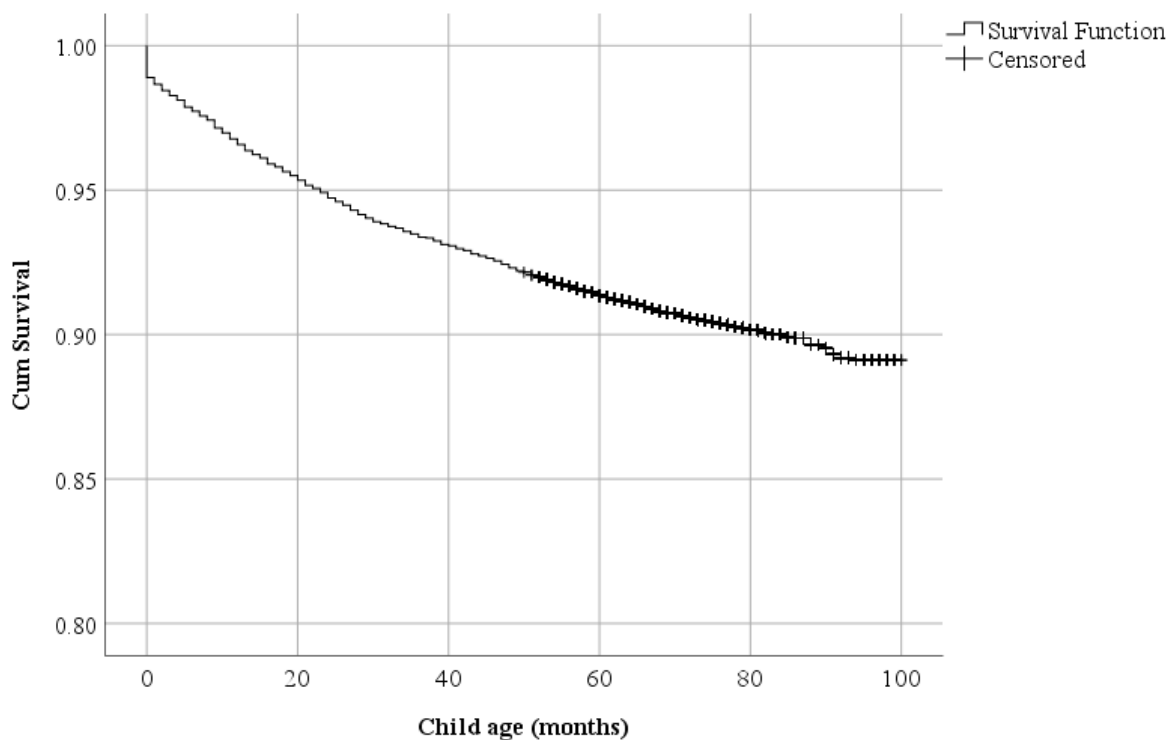
The median age of the expectant mothers interviewed for the cohort study was 27.5 years. Just over half (51.7%) came from Asian backgrounds (most of whom were of Pakistani origin), while 42.4% described themselves as White. Less than half (41.0%) of the mothers held either A-level qualifications (in exams normally taken at age 18) or higher level qualifications taken at college or university. Almost two-thirds (65.7%) were living with their partner, to whom they were married, and 60.3% lived in accommodation which they owned or were buying with a mortgage. The father of the expected child was unemployed in 8.0% of cases, and the mother was in receipt of means-tested welfare benefits in 41.1% of cases. Smoking during pregnancy was reported by 16.5% of expectant mothers, while 10.2% of expectant mothers reported binge drinking during pregnancy.

By the time of the data linkage, nearly ten per cent of the 11,332 children in the dataset had been recorded as 'in need' due to abuse or neglect (n=1,086; 9.6%). The remaining children (n=10,246; 90.4%) had never been 'in need' due to abuse or neglect by this point,

although a small number of them (n=122) had been ‘in need’ for reasons other than abuse or neglect (for example, because they were disabled or their families were experiencing acute stress). The age at which children had become ‘in need’ for abuse or neglect ranged from 0 to 95 months, with 117 (10.8%) of them having been assessed as ‘in need’ for this reason before they were born (Figure 1).

Figure 1

Distribution of age at which children became ‘in need’ for abuse or neglect (n=11,332)



The majority of those who had ever been recorded as ‘in need’ due to abuse or neglect had only received support while remaining at home (n=1,002; 92.3%), in some cases as the subject of a child protection plan (n=146), while 84 children (7.7%) had been placed in out-of-home care on one or more occasion.

There were statistically significant differences between the sample groups for all variables tested (Table 1). Mothers of children who had been ‘in need’ due to abuse or neglect were significantly younger, were more likely to be White, and had lower levels of education than

mothers of children who had never been ‘in need’ due to abuse or neglect. They also had significantly poorer mental health, were more likely to have smoked, binge drank or used recreational drugs during pregnancy, and were less likely to have taken antenatal vitamins or iron tablets in the last four months of pregnancy. Compared to other mothers, the mothers of children who had been ‘in need’ due to abuse or neglect were also more likely to be living without a partner, have moved address more recently, and have more children living in their household. Measures of socio-economic status indicated that mothers of children who had been ‘in need’ due to abuse or neglect were poorer; they had higher IMD 2010 scores (indicating greater deprivation), were more likely to be living in social housing, and more likely to be in receipt of means-tested welfare benefits. Furthermore, fathers of children who had been ‘in need’ due to abuse or neglect were more likely to have been unemployed at the antenatal stage. The total number of risk factors present was also significantly higher for expectant mothers whose children subsequently became ‘in need’ due to abuse or neglect.

Table 1

Characteristics of the cohort, by whether the child had ever been ‘in need’ due to abuse or neglect

Variable	Hadn’t ever been ‘in need’ due to abuse or neglect (n=10,246; 90.4%)		Had been ‘in need’ due to abuse or neglect (n=1,086; 9.6%)		<i>p</i> -value
	Median (IQR)	n (%)	Median (IQR)	n (%)	
<i>Parental factors</i>					
Mother’s age (years) (n=11,310)	27.8 (7.8)		24.9 (8.3)		< .001
Mother’s ethnic group (n=11,320)					< .001
White		4,208 (41.1)		587 (54.1)	
Mixed		192 (1.9)		33 (3.0)	
Black		221 (2.2)		22 (2.0)	
Asian		5,418 (52.9)		434 (40.0)	
Chinese/Other		196 (1.9)		9 (0.8)	
Mother’s highest educational qualification (n=11,059)					< .001
<5 GCSEs or equivalent		2,022 (20.2)		416 (39.4)	
5+ GCSEs or equivalent		3,078 (30.8)		375 (35.5)	
A-level or equivalent		1,548 (15.5)		98 (9.3)	
Higher than A-level or equivalent		2,775 (27.7)		115 (10.9)	
Other		581 (5.8)		51 (4.8)	
GHQ-28 factor score (n=9,476)	0.1 (1.2)		0.3 (1.2)		< .001

Mother smoked during pregnancy (n=11,311)			< .001
Yes	1,451 (14.2)	412 (37.9)	
No	8,774 (85.8)	674 (62.1)	
Mother drank five or more units of alcohol on at least one occasion during pregnancy (n=11,287)			< .001
Yes	995 (9.8)	157 (14.5)	
No	9,207 (90.2)	928 (85.5)	
Mother used recreational drugs during pregnancy (n=9,692)			< .001
Yes	84 (1.0)	42 (4.8)	
No	8,726 (99.0)	840 (95.2)	
Mother took vitamins or iron tablets in the last four weeks of pregnancy (n=11,293)			< .001
Yes	4,325 (42.4)	340 (31.4)	
No	5,886 (57.6)	742 (68.6)	
<i>Familial factors</i>			
Marital and cohabitation status (n=11,308)			< .001
Living with partner, married	6,947 (67.9)	480 (44.3)	
Living with partner, not married	1,784 (17.4)	233 (21.5)	
Not living with partner	1,493 (14.6)	371 (34.2)	
Time lived at current address (years) (n=11,323)	3.0 (5.0)	2.0 (4.4)	< .001
Number of children under 16 years in household (n=11,325)	1.0 (2.0)	1.0 (2.0)	< .001
<i>Socio-economic factors</i>			
IMD 2010 score (n=11,329)	43.8 (28.0)	48.5 (25.0)	< .001
Housing tenure (n=11,183)			< .001
Owns outright/mortgage	6,336 (62.6)	404 (37.9)	
Rent-free	781 (7.7)	65 (6.1)	
Private landlord	1,901 (18.8)	305 (28.6)	
Social housing	969 (9.6)	277 (26.0)	
Other	129 (1.3)	16 (1.5)	
Father's employment status (n=10,691)			< .001
Employed, non-manual	4,121 (42.3)	240 (25.1)	
Employed, manual	3,270 (33.6)	406 (42.5)	
Self-employed	1,516 (15.6)	97 (10.2)	
Student	167 (1.7)	17 (1.8)	
Unemployed	662 (6.8)	195 (20.4)	
In receipt of means-tested benefits (n=11,293)			< .001
Yes	3,958 (38.8)	678 (62.8)	
No	6,255 (61.2)	402 (37.2)	

<i>Cumulative risk</i>			
Total number of risk factors (n=8,397)	3.0 (3.0)	5.0 (4.0)	< .001

3.2. Cox regression analysis

The results from the univariable and multivariable Cox regression analyses are shown in Table 2. All variables entered into the univariable models were found to be significantly associated with the likelihood of a child having been ‘in need’ due to abuse or neglect.

In the multivariable analysis, 10 of the 15 factors entered were found to be associated with the child having been ‘in need’ due to abuse or neglect. The Chi-square statistic for the likelihood ratio test indicated that the model was a good fit ($X^2(28, N = 8,397) = 788.6, p < .001$).

Parental factors significantly associated with a child becoming ‘in need’ due to abuse or neglect were younger maternal age, lower maternal education level, higher GHQ scores (indicating minor psychiatric disorder), and the mother smoking during pregnancy. The odds of a child becoming ‘in need’ due to abuse or neglect were 1.7 times higher when the mother smoked during pregnancy, compared to when she did not.

Familial factors that remained significantly associated with a child becoming ‘in need’ due to abuse or neglect, once other significant factors had been taken into account, included the mother not living with a partner and there being a greater number of children in the household. The odds of a child becoming ‘in need’ due to abuse or neglect were 1.4 times higher when the mother was not living with a partner during pregnancy, compared to when she was living with her partner and married.

Four indicators of deprivation were also associated with the risk of recorded child maltreatment concerns, including higher IMD scores, social housing, paternal unemployment and receipt of means-tested welfare benefits. When the mother was living in social housing during pregnancy, the odds of her child subsequently becoming ‘in need’ due to abuse or

neglect were 1.7 higher than when the mother was living in housing that was owed/mortgaged.

The remaining five variables lost their association with the outcome variable once other factors had been accounted for, which were the mother’s ethnic group, binge drinking during pregnancy, use of recreational drugs during pregnancy, use of antenatal vitamins/iron, and the time lived at her current address.

The ‘total number of risk factors’ variable was not entered into the multivariable model, as this variable explained much of the variation accounted for by the other variables entered. In the univariable analysis conducted with just this variable, the Chi-square statistic for the likelihood ratio test indicated that the model was a good fit ($X^2(1, N = 8,397) = 638.3, p < .001$).

Table 2
Univariable and multivariable models: risk of becoming ‘in need’ due to abuse or neglect

Variable	Univariable analysis		Multivariable analysis (n=8,397)	
	Unadjusted HR (95% CI)	p-value	Adjusted HR (95% CI)	p-value
<i>Parental factors</i>				
Mother’s age (years)	0.93 (0.92, 0.94)	< .001	0.96 (0.94, 0.97)	< .001
Mother’s ethnic group		< .001		.870
White	1.72 (1.52, 1.94)		1.08 (0.84, 1.40)	
Mixed	2.14 (1.50, 3.04)		1.01 (0.62, 1.64)	
Black	1.21 (0.79, 1.86)		1.01 (0.56, 1.80)	
Asian	1.00		1.00	
Chinese/Other	0.59 (0.30, 1.13)		0.68 (0.28, 1.68)	
Mother’s highest educational qualification		< .001		< .001
<5 GCSEs or equivalent	1.63 (1.42, 1.87)		1.36 (1.14, 1.63)	
5+ GCSEs or equivalent	1.00		1.00	
A-level or equivalent	0.55 (0.44, 0.68)		0.79 (0.61, 1.02)	
Higher than A-level or equivalent	0.36 (0.29, 0.44)		0.73 (0.55, 0.96)	
Other	0.72 (0.54, 0.96)		1.00 (0.68, 1.48)	
GHQ-28 factor score	1.24 (1.15, 1.34)	< .001	1.17 (1.07, 1.28)	.001
Mother smoked during pregnancy		< .001		< .001
Yes	3.45 (3.06, 3.90)		1.69 (1.39, 2.05)	
No	1.00		1.00	

Mother drank five or more units of alcohol on at least one occasion during pregnancy		< .001		.304
Yes	1.53 (1.29, 1.81)		0.89 (0.70, 1.12)	
No	1.00		1.00	
Mother used recreational drugs during pregnancy		< .001		.100
Yes	4.39 (3.22, 5.99)		1.37 (0.94, 2.00)	
No	1.00		1.00	
Mother took vitamins or iron tablets in the last four weeks of pregnancy		< .001		.118
Yes	0.65 (0.57, 0.73)		0.88 (0.74, 1.03)	
No	1.00		1.00	
<i>Familial factors</i>				
Marital and cohabitation status		< .001		.022
Living with partner, married	1.00		1.00	
Living with partner, not married	1.86 (1.59, 2.18)		1.16 (0.89, 1.53)	
Not living with partner	3.39 (2.96, 3.88)		1.41 (1.09, 1.83)	
Time lived at current address (years)	0.97 (0.96, 0.99)	< .001	0.99 (0.97, 1.00)	.093
Number of children under 16 years in household	1.10 (1.07, 1.14)	< .001	1.13 (1.08, 1.17)	< .001
<i>Socio-economic factors</i>				
IMD 2010 score	1.02 (1.02, 1.02)	< .001	1.01 (1.00, 1.01)	.011
Housing tenure		< .001		< .001
Owns outright/mortgage	1.00		1.00	
Rent-free	1.40 (1.08, 1.82)		0.94 (0.68, 1.29)	
Private landlord	2.48 (2.14, 2.88)		1.43 (1.15, 1.79)	
Social housing	4.17 (3.58, 4.86)		1.72 (1.35, 2.18)	
Other	1.90 (1.16, 3.14)		1.65 (0.94, 2.91)	
Father's employment status		< .001		< .001
Employed, non-manual	1.00		1.00	
Employed, manual	2.04 (1.74, 2.39)		1.38 (1.13, 1.67)	
Self-employed	1.11 (0.88, 1.41)		1.05 (0.80, 1.39)	
Student	1.62 (0.99, 2.65)		1.37 (0.79, 2.38)	
Unemployed	4.60 (3.81, 5.56)		1.79 (1.41, 2.27)	
In receipt of means-tested benefits		< .001		< .001
Yes	2.56 (2.26, 2.90)		1.43 (1.21, 1.70)	
No	1.00		1.00	
<i>Cumulative risk</i>				
Total number of risk factors	1.45 (1.41, 1.49)	< .001		

Note. HR = Hazard Ratio; CI = Confidence Interval.

4. Discussion

There is very little existing research internationally on risk factors for abuse and neglect identifiable in pregnancy. This paper presents new findings on factors evident at the antenatal stage that were associated with an increased risk of subsequent recorded child maltreatment concerns. The study drew on data generated by a large birth cohort study, which provided a unique opportunity to examine the influence of a comprehensive set of factors captured antenatally before any child maltreatment had occurred, including data on maternal smoking, substance use and use of prenatal supplements during pregnancy (not included in previous UK studies of this kind). Analysis using data gathered from the expectant mothers of a cohort of 11,332 children, linked to administrative child welfare records, found support for both the developmental-ecological and cumulative risk models of child maltreatment. Maternal smoking and indicators of deprivation emerged as particularly salient risk factors.

4.1. Parental factors

The well-established link between low maternal age and child maltreatment is unlikely to be directly causal, but mediated through other factors associated with becoming a mother at a young age, including low educational achievement, unemployment, deprivation and eventual family size, all of which may contribute to ‘chronic sociodemographic stress’ (Mersky et al., 2009; Sidebotham & Heron, 2006; Zuravin, 1988). In this study, maternal age remained associated with maltreatment concerns after adjusting for mother’s education level, father’s employment status and socio-economic status, and the hazard ratio for this factor changed very little when other factors were adjusted for. This suggests that other factors, not studied here, such as the total number of children born to the mother (linked to unplanned pregnancy) or levels of social support, might be critical in explaining the association between maternal age and child maltreatment.

In the univariable analysis of mother’s ethnic group, it appeared from the hazard ratios as though children of mothers of Mixed or White ethnic groups were at a greater risk of

becoming 'in need' due to abuse or neglect, compared with other ethnic groups. This finding concurs with recent UK research that has revealed ethnic disparities in child welfare intervention rates (Bywaters et al., 2016; Mc Grath-Lone et al., 2017). However, after adjusting for other factors in the model, including measures of socio-economic status, the hazard ratios for these ethnic groups had reduced and differences in risk between ethnic groups were no longer present. This finding corresponds with the findings of researchers in the UK and US who have identified interaction effects between ethnicity and other important correlates of maltreatment, mainly deprivation, whereby a higher prevalence of certain ethnic groups (including Mixed) among deprived communities partly explains their over-representation in child-welfare intervention statistics (Bywaters et al., 2014b; Putnam-Hornstein et al., 2013; Wulczyn et al., 2013). Therefore, the relationship between ethnicity and child maltreatment appears not to be direct but is observable due to the effects of other factors closely linked to ethnicity, such as deprivation.

Although the mother's education level remained associated with maltreatment concerns in the multivariable model, the hazard ratio for the lowest education level reduced once other factors, including indicators of socio-economic status, had been accounted for. This supports existing research that suggests the effect of maternal education level on maltreatment risk is partly, though not entirely, mediated through socio-economic factors (Leung et al., 2008; Putnam-Hornstein & Needell, 2011; Sidebotham & Heron, 2006).

An association between maternal mental illness and child maltreatment has been demonstrated in other studies on the risk of maltreatment occurrence and recurrence, even once socio-demographic characteristics have been controlled for, as seen in this study (Dixon et al., 2005; Sidebotham & Heron, 2006; White et al., 2014; Windham et al., 2004). Parental mental illness is thought to affect parents' capacity to adequately protect their children due to

the difficulties they experience in organising their lives, controlling their emotions, attending to their children's physical needs and being emotionally responsive (Cleaver et al., 2011).

The finding that smoking during pregnancy was associated with subsequent recorded child maltreatment concerns builds on a very limited amount of prior research that has included this factor in predictive models. Smoking in pregnancy may be an important early indicator of maternal difficulty in acting positively to prioritise the needs of the child. This would be consistent with previous research that has identified smoking in pregnancy as a marker of problems with adaptive functioning and health related behaviours (Pickett et al., 2009). Furthermore, given that the hazard ratio for smoking in pregnancy diminished in the multivariable model, maternal smoking may also be a risk marker for other factors such as deprivation, particularly as the prevalence of smoking is higher among low socio-economic groups (Hiscock et al., 2012; Wu et al., 2004).

Although maternal binge drinking and drug use during pregnancy were not significantly associated with maltreatment concerns after taking other variables into account, some caution needs to be taken in interpreting these findings, as some under-reporting of substance use during pregnancy by expectant mothers is plausible, particularly in the context of antenatal appointments. The issue of possible under-reporting of maternal substance misuse was highlighted in a previous study of child abuse risk, which found mixed results in relation to problem alcohol use and illicit drug use (Windham et al., 2004).

This study was unique in examining the association between the use of prenatal supplements and recorded maltreatment concerns. The adjusted hazard ratio for this variable was not statistically significant, suggesting this is not a salient factor for maltreatment, but instead a risk marker for other risk factors.

4.2. Familial factors

The effect of single motherhood on the risk of child maltreatment was reduced in the multivariable model (although it remained a significant factor) and therefore appears to be partially mediated through other factors in the model. Previous research suggests that the children of single mothers may be at greater risk of maltreatment due to the financial stresses and social isolation often faced by sole parents and the lower quality caregiving environments they might provide (Berger, 2004; Seagull, 1987; Sidebotham & Heron, 2006).

The time mothers had lived at their current address was used as a measure of housing stability but was not found to be associated with maltreatment concerns in the final model. This refutes a small amount of existing research supporting the role of residential stability in child maltreatment risk (Coulton et al., 1995; White et al., 2014).

The association between larger family size and child maltreatment found here supports the findings of previous authors who have postulated that having a larger number of children, especially in a single-parent household, can put a strain on family resources and lead to poor living conditions including overcrowding, which can contribute to neglect in particular (Bebbington & Miles, 1989; Dubowitz, 1999).

4.3. Socio-economic factors

The findings of this study are consistent with an established literature on the discernible association between lower socio-economic status and higher rates of child welfare intervention (Biehal et al., 2019; Bywaters et al., 2014a; Coulton et al., 1995; Pelton, 1978). The adjusted hazard ratios for social housing and paternal unemployment were higher than for any other variable examined, suggesting that these circumstances could be particularly salient with regards to subsequent maltreatment risk. Similarly, Sidebotham and Heron (2006) identified poverty as a strong risk factor for recorded child maltreatment. The mechanisms by which low socio-economic status is associated with child maltreatment remain unclear, although there is some evidence to suggest that deprivation can negatively

impact on parental behaviour toward children (Berger, 2004). The stress and coping model of maltreatment proposes that children in poor families are more likely to experience maltreatment due to the stress that socio-economic disadvantage places on parents (Hillson & Kuiper, 1994). In England, higher rates of intervention evident among families living in more deprived neighbourhoods, together with the recent rise in the rates of children becoming involved in the child protection system, have led to concerns about inequalities in child welfare and the investigative orientation of the English child protection system (Bilson & Martin, 2016; Bywaters et al., 2014a). However, as this analysis has shown, child-welfare involved children come from families with multiple difficulties evident during pregnancy which may potentially impact upon their parenting. Other research has similarly suggested that the over-representation of poor families among child welfare-involved populations is largely driven by the increased levels of need among poorer children, rather than by any systematic class bias (Jonson-Reid et al., 2009).

4.4. Cumulative risk

The indicator of cumulative risk constructed here was associated with maltreatment concerns, with the presence of each additional risk factor measured at the antenatal stage increasing the risk of later maltreatment. The hazard ratio for this variable was higher than the adjusted hazard ratios for most variables entered into the multivariable model, which were all fairly modest. Furthermore, the Chi-square statistic for the likelihood ratio test indicated that the model including only this variable was a good fit. These findings support those of a previous study which concluded that an accumulation of risk factors may be at least as important in the prediction of maltreatment occurrence than the nature of individual risk factors themselves (Begle et al., 2010).

4.5. Consideration of sample characteristics

This study was conducted in an area with a large Asian population, and consequently, a substantial proportion of the expectant mothers recruited for the cohort study were of Asian (mainly Pakistani) background. According to census data, over a quarter of the local authority's population were of Asian background compared to just 7.5% of the population of England and Wales (Office for National Statistics, 2018). This feature of the sample might have shaped the results of this study to some degree, particularly as Asian and White groups are known to differ with respect to family composition and lifestyle behaviours (Bansal et al., 2014; Denscombe & Drucquer, 2000; Office for National Statistics, 2014). However, running the multivariable model separately for mothers of White and Asian groups yielded similar results.

The local authority in which this study was based is also one of the most deprived local authorities in England, according to Index of Multiple Deprivation scores (Ministry of Housing Communities & Local Government, 2019). Therefore, as child welfare intervention rates are closely linked to levels of deprivation (Bywaters et al., 2014a; Sidebotham & Heron, 2006), the overall rate of recorded maltreatment identified in this study might be higher than that found in other areas of England.

4.6. Strengths and limitations

Very few studies on the aetiology of child maltreatment have been conducted in the UK. A key strength of this study was its linkage of data on over 11,000 children, whose mothers took part in an epidemiological study during pregnancy, to administrative data on children with recorded concerns about abuse and neglect. Its sample was therefore representative of all children in the relevant age group with recorded maltreatment concerns, and all those for whom no such concerns had been recorded. In addition to examining individual risk factors for child maltreatment, this study examined the cumulative effect of risk variables on recorded maltreatment concerns. It also used data collected more recently than previous

prospective studies on maltreatment risk conducted in the UK, and was based on a multi-ethnic population.

This study also had some limitations. First, although a wide range of antenatal factors were captured in the cohort study questionnaire, several variables known to be relevant to child abuse and neglect, such as social support, unplanned pregnancy, parental history of childhood maltreatment, domestic violence and parenting attitudes, were not captured by the cohort study and therefore could not be included in the regression models. Also, due to the questionnaire having been administered to expectant mothers, and only limited data being collected from fathers, the variables included in the analysis focus mainly on the mother. Second, the models did not incorporate data collected since the antenatal period and therefore don't account for changes in families' circumstances. Third, further predictive modelling would be necessary to examine the complex causal pathways between factors, and to identify underlying factors that contribute to deprivation, young and lone parenthood, mental ill-health and smoking in pregnancy. Finally, this study was conducted in a single local authority so caution is needed in generalising its findings to other contexts.

4.7. Implications and conclusions

This study has important implications for child welfare policy and practice. These findings lend support to the theory that observed relationships between specific factors and child maltreatment are the result of complex interactions between multiple parental, familial and socio-economic factors. Furthermore, an accumulation of these risk factors evident at the antenatal stage appears to increase the risk of subsequent maltreatment. Therefore, as Belsky observed, individual risk factors appear to be, "*contributing rather than determining agents*" (Belsky, 1993, p.418), and the individual risk factors examined in this paper should not be interpreted as direct causal factors for child maltreatment.

The findings from this work highlight the support needs of some expectant mothers and can be used to inform the provision of preventative services which aim to reduce the risk that children of mothers who experience multiple difficulties at the antenatal stage may experience maltreatment in the early years of their lives. Any such services should be supportive, non-blaming, and seek to address inequalities, particularly in light of criticism of recent efforts to target ‘troubled families’ and concerns raised about the gendered nature of the child welfare system (Bond-Taylor, 2017; Featherstone et al., 2010). The identification of multiple risk factors in this study supports claims that single targeted interventions are unlikely to be successful in preventing or reducing child maltreatment due to its multifactorial nature, and that multidimensional interventions are required (Belsky, 1993). Such interventions should include measures to address broader social determinants including low education levels and unemployment, as well as more specific interventions aimed at reducing maternal smoking, young parenthood and mental illness.

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