Maternal mental health and childhood injury: evidence from the UK Millennium Cohort Study

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ABSTRACT

Objective:

We assessed whether maternal mental health problems increased rates for child injury during the pre-school years and mid-childhood, and the extent to which associations could be accounted for by a range of potential explanatory factors.

Design:

We analysed the UK Millennium Cohort Study, a nationally-representative sample with data collected throughout childhood. Multinomial regression was used to investigate whether two measures of maternal mental health (diagnosed depression/anxiety and psychological distress) was associated with subsequent childhood injury. Models adjusted for socio-demographics, parenting, and child externalising behaviours.

Main outcome measure:

Maternal report of unintentional injuries (none, 1, 2+) recorded at three data collection periods (3-5 years; 5-7 years; 7-11 years).

Results:

The analytic sample comprised n=9240 families who participated 3-11 years with complete data on exposures and outcomes (multiply imputing missing covariates). Exposure to maternal mental health problems was associated with increased rates of subsequent childhood injuries. Associations attenuated after adjustment for potential explanatory factors, although they remained elevated. For example, high maternal distress was

associated with injuries 3-5 years (adjusted Relative Risk Ratio[aRRR]: 1 injury=1.18, 95%Confidence Interval[CI]:0.86-1.61); 2+ injuries=2.22,CI:1.22-4.02); injuries 5-7 years (aRRR: 1 injury=1.31,CI: 0.97-1.76; 2+ injuries=1.84,CI:1.09-3.09); and injuries 7-11 years: (aRRR: 1 injury=1.03,CI:0.81-1.31; 2+ injuries=1.33,CI:0.97-1.81).

Conclusions:

Children exposed to mothers with mental health problems had higher rates of childhood injury than those not exposed. If further investigation of this association suggests causality then it will be important to test measures that address mothers' mental health issues with a view to reducing injuries among their children.

INTRODUCTION

Unintentional injury is a leading cause of health service use, morbidity and death during childhood(1, 2), with potential life-long consequences(3). However, injuries are predictable and may therefore be preventable(2, 4). One potentially preventable risk factor is poor maternal mental health, which is common(5), and has been associated with childhood injury (6-8). However, the relationship between maternal mental health and childhood injury may be confounded. Maternal mental health problems and childhood injury share associations with socio-demographic risks, including low income, family breakdown, less secure housing tenure, ethnic minority status, and the presence of multiple children in the family(6, 11). These shared risk factors may provide clues to likely pathways between maternal distress and childhood injury. Other injury risk factors may be a consequence of maternal mental health problems, including lower levels of parental supervision(9) and child behavioural problems(10).

Most research has focused on injury in the early years, rather than later childhood (4, 10, 12). Few longitudinal population studies have investigated the relationship between maternal mental health and childhood injury. To address these limitations, we investigated whether maternal mental health was associated with subsequent injury at three periods during childhood (between 3-5 years, 5-7 years, and 7-11 years), using longitudinal data from a UK population cohort, the Millennium Cohort Study (MCS). We also investigated whether any association remained after accounting for potential explanatory factors, including parenting, child externalising behaviours and socio-demographic characteristics.

METHODS

Sample

The MCS is a large, contemporary cohort of UK children born between 2000 and 2002 which has been described elsewhere(13). Survey interviews were carried out in the home with the main respondent (usually the mother). Our analyses used data from successive data collection sweeps when the child was aged 3, 5, 7 and 11 years. The families of 15381 singleton children were interviewed when the child was 3 years of age. Attrition is a problem common to all cohort studies, and by age 11 years the number of families who had participated in all subsequent sweeps had declined to 10702 (70% of the sample at 3 years). Families without data on maternal mental health (ages 3, 5 and 7 years) and injury (ages 5, 7 and 11 years) were also excluded, reducing the sample to 9240. Multiple imputation was carried out on missing covariates using the Stata/SE 13 'mi impute chained' command to create 10 imputed datasets. Supplementary Appendix 1 presents observed frequency distributions and means for variables included in the analyses if any data were recorded (with no sample restrictions) compared to equivalent distributions and means in the multiply imputed sample and a complete case sample. Patterns were similar across samples. Results from a complete cases analysis (not shown) were similar to those reported in the paper using multiple imputation.

All data collection sweeps received approval from a Research Ethics Committee (14). Data were obtained from the UK Data Archive, University of Essex in March 2014.

Measures

Childhood unintentional Injuries (outcomes)

The number of childhood unintentional injuries requiring health service contact between consecutive sweeps was reported by the mother (e.g. at the 5 year sweep, the number of injuries that had occurred between ages 3-5 years). These were simple counts, notwithstanding the varying intervals between sweeps (3-5 years, 5-7 years, 7-11 years). Few children were reported as having suffered a large number of injuries. Therefore, we grouped injuries between sweeps into "no injury", "one injury" and "two or more injuries", as done elsewhere (6, 10).

Maternal mental health (exposures)

We included two measures of maternal mental health: diagnosed depression or anxiety and psychological distress, differentiating medium and high distress (7, 8).

Diagnosed depression/anxiety

Mothers were asked at every sweep whether they had *ever* been told by a doctor that they were suffering from depression or serious anxiety. In some sweeps, this question was asked only of mothers who had not reported a diagnosis previously. Therefore, the variable used in these analyses for diagnosed depression/anxiety was based on whether the mother had reported a diagnosis at *any* sweep (up to age 7 years).

Psychological distress

The mother completed a six-item measure of psychological distress during the previous 30 days (the Kessler-6 scale, K-6)(15) when the child was aged 3 years, and at subsequent

sweeps. Responses to each item were summed to a single score. Using established cut-offs(16), the score was categorized as medium distress (K-6 score >=4) or high distress (>=13) at any of the sweeps (child age 3, 5 and 7 years). In addition, summary variables were constructed indicating the highest level of maternal distress that the child was exposed to (none/low, medium, or high) during the early years: at child age 3 or 5 years; at 3, 5 or 7 years.

Potential explanatory factors

A number of variables were identified that may influence the relationship between maternal mental health and childhood injury. For factors which were assessed at every sweep, we selected the measurement at the sweep prior to the reported injuries.

Socio-demographic factors: recorded at 3 years: sex, ethnicity, maternal highest academic qualification and maternal age at child's birth; others were recorded at the sweep prior to reported injuries: household income quintiles (calculated using a modified OECD equivalence scale), lone parent status, housing tenure, number of children in the household.
Parenting factors: The Child-Parent Relationship Scale (CPRS: Short-Form)(17) was completed by the mother when the child was aged 3 years. The scale comprised 15 items assessing the mother's feelings and beliefs about her relationship with the child, and the child's behaviour to the mother. Responses were summed to produce two subscale scores: Conflicts (eight items, range 5-40, where a high score reflects greater conflict) and Closeness (seven items, range 5-35, where a higher score reflects greater closeness between mother and child). Parental discipline was reported at ages 3, 5 and 7 years, using items from the Conflict Tactics Scale(18), assessing frequency with which the mother carried out each of

four types of discipline (ignored, smacked, shouted, or told the child off) from never to daily, summed to form a scale (possible range 4-20, where a high score reflects more frequent use of these disciplinary behaviours).

Child externalising behaviours: Hyperactivity and conduct problems subscales of the Strengths and Difficulties Questionnaire (SDQ)(19) were recorded at ages 3, 5 and 7 years. Each subscale comprised five items summed to provide a score between 0-10, where a high score reflects greater hyperactivity or conduct problems.

Analyses

All analyses were conducted in Stata/SE 13 (Stata Corporation, TX), using survey and non-response weights to account for clustered sampling design and attrition up to the sweep at which each outcome was measured and imputation to account for missing covariates. We calculated percentages and means for exposure, explanatory and outcome variables. We then used multinomial logistic regression models to estimate relative risk ratios (RRRs) and 95% confidence intervals (CIs) for childhood injury (no injuries between consecutive sweeps compared to those with a single injury or two or more injuries), according to maternal diagnosed depression/anxiety ever reported up to the prior sweep. Analyses were repeated for highest level of maternal psychological distress reported up to the prior sweep. An unadjusted model [A] was followed by three models adjusting for, in turn, each group of potential explanatory factors: socio-demographics [B], parenting [C] and child externalising behaviour [D]. These were followed by a model [E] simultaneously adjusting for all explanatory factors.

RESULTS

Descriptive statistics

Most children did not have an injury requiring health service contact between sweeps. Injuries sustained on a single rather than on multiple occasions were more common (Table 1). The prevalence of the mother having ever been told by a doctor that they had depression or anxiety increased from 36% at 3 years to 44% at 11 years (Table 2). The prevalence of maternal psychological distress was relatively stable across sweeps, with almost a third of mothers experiencing at least medium distress, and between 3 and 4% experiencing high distress. Table 2 also shows descriptive characteristics for socio-demographic and parenting factors, and child externalising behaviours at ages 3, 5 and 7 years.

Maternal mental health reported between child's age 9 months - 3 years and injury 3 - 5 years

Relative risks ratios (RRRs) of injuries sustained on either single or multiple occasions were elevated among children whose mothers had been diagnosed with depression or anxiety by age 3 years (Table 3, Section 1, Model A), with attenuation most marked following adjustment for socio-demographic factors (Model B) and externalising behaviours (Model D). RRRs remained significantly elevated after full adjustment (Model E).

Medium maternal psychological distress when the child was aged 3 years was associated with a higher RRR of injury sustained on a single occasion compared to no or low levels of psychological distress (Table 3, Section 2, Model A). RRRs remained elevated in all subsequent models (Models B-E). High maternal distress was associated with a significantly

greater RRR of injury sustained on multiple occasions between 3 and 5 years, compared to no or low levels of psychological distress (Table 3, Section 3, Model A). The RRR of an injury sustained on a single occasion was also elevated, although not significantly so. Attenuation of RRRs was greatest following adjustment for socio-demographic factors (Model B) and child externalising behaviours (Model D), while adjustment for parenting factors resulted in only a small reduction (Model C). However, the RRR remained significantly elevated even after adjusting for all explanatory factors (Model E).

Maternal mental health reported between child's age 9 months - 5 years and injury 5 - 7 years

As with injuries reported by 5 years, diagnosed depression/anxiety was associated with elevated RRRs for injuries sustained on either single or multiple occasions (Table 4, Section 1, Model A). Similar to the findings for earlier injuries, attenuation was most marked following adjustment for socio-demographic factors (Model B) and externalising behaviours (Model D). The RRRs of injury remained significantly elevated after full adjustment (Model E).

Medium distress (Table 4, Section 2) was significantly associated with an increased RRR of injuries sustained on multiple occasions between ages 5 and 7 years (Table 4, Section 2, Model A), but RRRs were attenuated to non-significance in all subsequent models. High distress (Table 4, Section 3) was associated with elevated RRRs of injuries reported on single or multiple occasions (Table 4, Section 3, Model A). Attenuation was most marked following adjustment for socio-demographic factors (Model B) and externalising behaviours (Model D). For single injury, the RRR was reduced to non-significance (although elevated) only after

full adjustment (Model E). A similar pattern was observed for injuries on multiple occasions, although the association with high distress remained significant in all models.

Maternal mental health reported between child's age 9 months - 7 years and injury 7 - 11 years

Diagnosed depression/anxiety up to when the child was aged 7 years was associated with elevated RRRs for injuries on a single or (in particular) multiple occasions (Table 5, Section 1, Model A). RRRs were attenuated, but remained significant in every model and following adjustment for all explanatory factors (Model E).

Medium maternal distress when the child was aged 3, 5 or 7 years was not significantly associated with higher RRRs of injuries (Table 5, Section 2, Model A). High maternal distress was associated with a significantly higher RRR of injuries sustained over multiple occasions between ages 7 and 11 years (Table 5, Section 3, Model A). RRRs remained elevated following adjustment for socio-demographic (Model B) and parenting factors (Model C). As with injuries at younger ages, attenuation was largest (and to non-significance) following adjustment for child externalising behaviours (Model D). Adjusting for all explanatory factors (Model E) resulted in a RRR which was similar to that after adjustment for externalising behaviours alone (Model D).

As sensitivity analyses, we repeated the models using teacher-rated externalising behaviours, only available for a subsample of the MCS at 7 years. In accord with the findings presented, for all three measures of maternal mental health, adjustment for teacher-rated

externalising behaviours (Model D) resulted in the largest attenuation in RRR for injury on multiple occasions between ages 7-11 years (not shown).

DISCUSSION

Using nationally-representative, UK cohort data, we have shown that children whose mothers had been told by a doctor that they had depression or anxiety, or who reported psychological distress, particularly high distress, or, had increased rates of subsequent unintended injuries. These rates were apparent during the pre-school years through to mid-childhood (7-11 years). After potential explanatory factors were accounted for, including socio-demographic characteristics, parenting and child externalising behaviours, elevated rates associated with mental health problems were reduced, but rates, particularly for injuries sustained on multiple occasions, remained.

We found that the association between maternal mental health and injury was more consistently observed in the early years, supporting previous research focused on injury in young children(10). We have also demonstrated that the association persists, albeit weaker, into later childhood. Our findings are in line with studies which have shown an association between chronic, severe maternal distress and childhood injury (7, 8). Our analyses showed a reduction in the strength of the association when accounting for a diverse set of explanatory factors, including both likely confounders and consequences of maternal mental health problems.

As children age, the role of the parent as supervisor weakens, while individual characteristics, such as child behaviour, are likely to become increasingly important as risk

factors for injury(10). In the early years, at least, externalising behaviours have been shown not to mediate the relationship between maternal distress and injury(7). Nevertheless, in our study the attenuation associated with externalising behaviours was independent of child's age, measure of maternal mental health or informant (teacher vs. mother), suggesting a possible link between maternal distress, child behaviour and injury. In this exploratory study, we were not seeking to disentangle potentially complex causal relations between child behaviour, maternal distress and parenting(20). However, separate analyses (not shown) indicated that diagnosed maternal depression or anxiety reported before the child was aged 9 months was associated with injury at 3 years, suggesting any association predated child externalising behaviours.

Patterns of attenuation for other explanatory factors varied by age and measure of maternal mental health. Relative risk ratios were reduced after accounting for socio-economic factors, supporting evidence of potential confounding between circumstances, mental health and childhood injury (6). The lack of a consistently strong influence of parenting factors was unexpected, particularly in the pre-school period (9), and may reflect limitations of the measures of parenting in the MCS, or that data on child-parent relationships were available only at the 3 year sweep.

A particular strength of our study is the use of the large, UK-representative cohort data, which provided the opportunity to conduct one of the few longitudinal studies investigating the link between maternal distress and injury in mid-childhood. Attrition and missingness are always a concern in longitudinal research. Families of children who had experienced injuries (particularly on multiple occasions) during the interval between sweeps were less

likely to participate at every sweep, significantly so for injuries between 3-5 years and 5-7 years. If mothers reported diagnosed depression/anxiety and maternal distress at any sweep, their children were less likely to have participated at every sweep. While we used response weights to account for attrition(21) and imputation to address missing covariate data, our results may still be subject to bias due to differential attrition and missingness. The breadth of information recorded in MCS provided us the opportunity to investigate maternal mental health and a wide variety of potential explanatory factors from birth through to 7 years and injuries reported across childhood from 5-11 years. Nevertheless, we were constrained by available data. The intervals between data collection sweeps varied from two to four years, which affected estimates of injury prevalence. However, prevalence is likely to be a function of both the period over which injury was reported and the age of the child, and these cannot be disentangled in the MCS. In addition, all measures were maternal report, including maternal distress and childhood injury. Although the use of parent-report of childhood injury is common in similar studies, it may be subject to under or over reporting and does not identify the severity of each injury. Measures of parenting were also limited, in terms of timing (child-parent relationships assessed only at 3 years) and detail (disciplinary practices based on a limited set of items on frequency, potentially conflating parenting practices with child behaviour). We used two measures of maternal mental health. First, whether a doctor had ever told the mother that they were suffering from depression or anxiety. Second, maternal psychological distress, measured using the Kessler-6. We measured child externalising behaviour using SDQ subscales. Both the Kessler-6 and SDQ are validated measures, although since they were reported by the mother measurement bias and shared method variance cannot be ruled out. We carried out sensitivity analyses with the SDQ externalising behaviour subscales rated by the child's

teacher at 7 years, and results were largely replicated, suggesting low likelihood of bias. Limitations in range and quality of variables available and the potential impact of sample attrition may have led to residual confounding of results, which is difficult to assess or counter in an observational study.

Our focus was on maternal mental health and childhood injury, as mothers are likely to be the main carers for children over the period of the study (22, 23) and data on fathers have not been well measured in the MCS. However, we recognise that a positive relationship between father and child may be a protective factor against childhood injury (12). Finally, while this study has accounted for a number of potential explanatory factors, future research should investigate more fully the causal pathways that underlie the relationship between maternal mental health and childhood injury.

CONCLUSION

Poor maternal mental health is associated with injury from early to mid-childhood, and particularly injuries sustained on multiple occasions. The strong and consistent association between severe maternal mental health problems and childhood injury suggests the importance of identification and treatment of such problems. However, elevated rates of injury were also observed in children whose mothers reported medium distress. The large attenuation of relative risk ratios after adjustment for socio-demographic circumstances suggests that support for vulnerable mothers may also contribute to a reduction in the rates of injury for their children. Rather than being a direct cause, poor maternal mental health may represent broader issues about the mother's circumstances and capacities, and the wider family and social environment, potentially resulting in children themselves adopting

risky behaviours. Therefore, early support to promote mothers' capacity and skills to care for their children may also help to reduce rates of injury during childhood.

FUNDING

SH was supported by funding from the Policy Research Unit in the Health of Children, Young People and Families (funding reference 10090001). The Policy Research Unit in the Health of Children, Young People and Families is funded by the Department of Health Policy Research Programme. This is an independent piece of research commissioned and funded by the Department of Health. The views expressed are not necessarily those of the Department. JD was supported by the National Institute for Health Research (NIHR) Collaboration for Leadership in Applied Health Research and Care (CLAHRC) North Thames at Bart's Health NHS Trust. The views expressed are those of the authors and not necessarily those of the NHS, the NIHR or the Department of Health. Research at the UCL Institute of Child Health and Great Ormond Street Hospital for Children receives a proportion of the funding from the Department of Health's National Institute for Health Research Biomedical Research Centres funding scheme. The Millennium Cohort Study is funded by grants to former and current directors of the study from the Economic and Social Research Council (Professor Heather Joshi, Professor Lucinda Platt and Professor Emla Fitzsimons) and a consortium of government funders. The study sponsors played no part in the design, data analysis and interpretation of this study; the writing of the manuscript or the decision to submit the paper for publication, and the authors' work was independent of their funders.

ACKNOWLEDGEMENTS

The authors thank all the Millennium Cohort families for their participation, and the director of the Millennium Cohort Study and colleagues in the management team at the Centre for Longitudinal Studies, UCL Institute of Education. They also thank members of the Policy Research Unit in the Health of Children, Young People and Families for their comments.

AUTHORS AND CONTRIBUTORS

SH contributed to the study conceptualisation and design, devised and carried out the analyses, interpreted the results, drafted the initial manuscript, and reviewed and revised the manuscript. JD and NM contributed to the study conceptualisation and design, interpreted the results and reviewed and revised the manuscript. CL initiated the study, contributed to the study conceptualisation and design, interpreted the results and reviewed and revised the manuscript. All authors approved the final manuscript as submitted and agree to be accountable for all aspects of the work.

COMPETING INTERESTS

All authors have completed the ICMJE uniform disclosure form at http://www.icmje.org/coi_disclosure.pdf and declare no competing interests.

DATA SHARING STATEMENT

All MCS data used in this analysis are available from UK Data Service, University of Essex and University of Manchester:

- http://doi.org/10.5255/UKDA-SN-4683-4;
- http://doi.org/10.5255/UKDA-SN-5350-4;
- http://doi.org/10.5255/UKDA-SN-5795-4;
- http://doi.org/10.5255/UKDA-SN-6411-7;

- http://doi.org/10.5255/UKDA-SN-7464-3;
- http://doi.org/10.5255/UKDA-SN-7238-1
- http://doi.org/10.5255/UKDA-SN-7464-3

WHAT IS ALREADY KNOWN ON THIS TOPIC:

- Maternal mental health problems have been linked to childhood injury
- However, there is little nationally-representative evidence, and most studies have focused on the early years
- There has been scant longitudinal research across childhood which has been able to account for a diversity of potential explanatory factors

WHAT THIS STUDY ADDS:

- Maternal mental health problems were associated with raised rates for subsequent injuries from pre-school to mid-childhood
- These elevated rates remained after adjustment although there was attenuation, particularly by socio-demographic circumstances and child externalising behaviours

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TABLE 1: Prevalence of maternal reports of childhood unintentional injury between data collection sweeps, by age of child (n=9240)

		Age 3-5y %	Age 5-7y %	Age 7-11y %
Childhood injury	**0**	72.6	75.9	61.6
	1	22.6	19.6	26.6
	2+	4.8	4.5	11.8

TABLE 2: Descriptive characteristics for maternal mental health and explanatory factors by age of child (n=9240)

		Age 3 % or M (SE)	Age 5 % or M (SE)	Age 7 % or M (SE)
Diagnosed depression/anxiety (ever)	No diagnosis	64.3	59.5	55.9
	Diagnosis	35.7	40.5	44.1
Psychological distress (cross-sectional)	No/low level distress	66.2	68.2	68.6
	Medium level	30.5	28.5	27.8
	High distress	3.3	3.3	3.6
Psychological distress (highest reported up to each sweep)	No/low level distress		54.9	47.9
	Medium level		39.6	44.6
	High distress		5.5	7.5
Child's sex	Male	51.1		
	Female	48.9		
Ethnicity	White	93.4		
	Mixed	0.9		
	Indian	1.4		
	Pakistani/Bangladeshi	1.9		
	Black or Black British	1.8		
	Other	0.7		
Maternal age at child's birth	14-19y	7.8		
	20-29y	44.5		
	30-39y	45.1		
	40-49y	2.6		
Household income quintiles	Lowest quintile	17.6	16.8	16.0
	Second quintile	19.7	19.6	18.6
	Third quintile	21.0	21.3	21.0
	Fourth quintile	21.0	21.0	22.2
	Highest quintile	20.6	21.4	22.1

Maternal education	A/AS/S levels and above	38.9		
	O levels/GCSEs A-C	37.2		
	O levels/GCSEs D-G and below	23.8		
Family structure	Couple family	83.7	81.5	79.8
	Lone parent family	16.3	18.5	20.2
Housing tenure	Mortgage / own outright	66.7	67.2	67.0
	rent privately	6.9	7.5	8.8
	Social housing	23.4	22.8	22.0
	other	2.3	2.5	2.2
Number of children in household	one	24.9	16.3	13.0
	two	48.1	49.8	48.3
	three	18.6	23.2	27.0
	four or more	8.4	10.6	11.7
Parental harsh discipline[1]	Mean (SE)	12.2 (0.04)	11.03 (0.04)	10.53 (0.04)
Child-Parent Conflict[2]	Mean (SE)	17.4 (0.09)		
Child-Parent Closeness[3]	Mean (SE)	33.5 (0.03)		
Child Conduct Problems[4]	Mean (SE)	2.8 (0.03)	1.5 (0.02)	1.4 (0.05)
Child Hyperactivity[5]	Mean (SE)	3.9 (0.04)	3.3 (0.04)	3.3 (0.04)

[1] Conflict Tactics Scale items, scoring range 4-20 (high score reflects more frequent use of harsh disciplinary behaviours by mother)
[2] CPRS: Short-Form; Conflicts subscale, scoring range 5-40 (high score reflects greater conflict between mother and child)
[3] CPRS: Short-Form; Closeness subscale, scoring range 5-35 (high score reflects greater closeness between mother and child)
[4] SDQ: Conduct Problems subscale, scoring range 0-10 (high score reflects greater levels of conduct problems)
[5] SDQ: Hyperactivity subscale, scoring range 0-10 (high score reflects greater levels of hyperactivity)

TABLE 3: Relative risk ratios (95% confidence intervals) for the relationship between maternal mental health reported when the child was aged 3 years and child injury between ages 3 and 5 years (n=9240)

	% injuries 3-5y by maternal mental health (MMH)		Unadjusted	Socio-demographic factors	Parenting factors	Externalising behaviours	Fully adjusted
	No MMH problem	MMH problem	(A)	(B)	(C)	(D)	(E)
1. Lifetime maternal diagnosis of depression / anxiety (up to child age 3 years)							
None	74.5	69.2	1.00	1.00	1.00	1.00	1.00
1 injury	21.4	24.6	1.24 (1.12 – 1.37)	1.16 (1.04 – 1.30)	1.23 (1.11 – 1.37)	1.21 (1.09 – 1.35)	1.16 (1.04 – 1.30)
2+ injuries	4.0	6.2	1.66 (1.30 – 2.12)	1.56 (1.19 – 2.03)	1.63 (1.26 – 2.12)	1.57 (1.22 – 2.03)	1.54 (1.17 – 2.02)
Maternal psychological distress when the child was aged 3 years							
2. Medium maternal psychological distress							
None	74.0	70.3	1.00	1.00	1.00	1.00	1.00
1 injury	21.4	24.9	1.23 (1.09 – 1.38)	1.19 (1.06 – 1.34)	1.22 (1.08 – 1.38)	1.19 (1.06 – 1.34)	1.21 (1.07 – 1.36)
2+ injuries	4.6	4.8	1.11 (0.86 – 1.44)	1.08 (0.83 – 1.40)	1.09 (0.83 – 1.44)	1.03 (0.77 – 1.37)	1.08 (0.81 – 1.43)
3. High maternal psychological distress							
None	74.0	66.3	1.00	1.00	1.00	1.00	1.00
1 injury	21.4	23.6	1.23 (0.90 – 1.68)	1.15 (0.84 – 1.59)	1.23 (0.90 – 1.67)	1.16 (0.85 – 1.59)	1.18 (0.86 – 1.61)
2+ injuries	4.6	10.1	2.46 (1.47 – 4.13)	2.23 (1.26 – 3.94)	2.40 (1.38 – 4.17)	2.12 (1.24 – 3.61)	2.22 (1.22 – 4.02)

A: Maternal psychological distress only or Diagnosis of maternal depression/anxiety only
B: Model A + sociodemographic factors (sex of child, ethnicity, household income quintiles at 3y, maternal highest academic qualification, maternal age at child's birth; family structure at 3y, housing tenure at 3y, number of children in the household at 3y)
C: Model A + parenting factors (parental discipline (3y); CPRS closeness and conflict subscales (3y))
D: Model A + externalising behaviours (SDQ hyperactivity and conduct problems subscales (3y))
E: Fully adjusted (Model A + Models B, C and D)

TABLE 4: Relative risk ratios (95% confidence intervals) for the relationship between maternal mental health reported up to child aged 5 years and child injury between ages 5-7 years (n=9240)

	% injuries 5-7y by maternal mental health (MMH)		Unadjusted	Socio-demographic factors	Parenting factors	Externalising behaviours	Fully adjusted
	No MMH problem	MMH problem	(A)	(B)	(C)	(D)	(E)
1. Lifetime maternal diagnosis of depression / anxiety (up to child age 5 years)							
None	77.9	73.0	1.00	1.00	1.00	1.00	1.00
1 injury	18.4	21.4	1.24 (1.10 – 1.40)	1.18 (1.04 – 1.33)	1.23 (1.09 – 1.39)	1.21 (1.07 – 1.37)	1.17 (1.03 – 1.33)
2+ injuries	3.7	5.6	1.61 (1.31 – 1.98	1.36 (1.07 – 1.72)	1.56 (1.26 – 1.92)	1.43 (1.15 – 1.78)	1.32 (1.04 – 1.68)
Maternal psychological distress (highest level reported, between child's age 3-5 years)							
2. Medium maternal psychological distress							
None	74.1	71.3	1.00	1.00	1.00	1.00	1.00
1 injury	21.4	23.8	0.96 (0.85 – 1.09)	0.93 (0.82 – 1.05)	0.94 (0.83 – 1.07)	0.93 (0.82 – 1.05)	0.91 (0.80 – 1.04)
2+ injuries	4.5	4.9	1.35 (1.06 – 1.72)	1.23 (0.96 – 1.58)	1.30 (0.99 – 1.69)	1.16 (0.89 – 1.51)	1.18 (0.90 – 1.55)
3. High maternal psychological distress							
None	74.1	67.5	1.00	1.00	1.00	1.00	1.00
1 injury	21.4	25.0	1.47 (1.09 – 1.97)	1.34 (1.00 – 1.81)	1.43 (1.07 – 1.91)	1.37 (1.01 – 1.87)	1.31 (0.97 – 1.76)
2+ injuries	4.5	7.4	2.54 (1.62 – 3.98)	1.98 (1.20 – 3.26)	2.38 (1.49 – 3.82)	1.88 (1.14 – 3.08)	1.84 (1.09 – 3.09)

A: Maternal psychological distress only or Diagnosis of maternal depression/anxiety only
B: Model A + sociodemographic factors (sex of child, ethnicity, household income quintiles at 5y, maternal highest academic qualification, maternal age at child's birth; family structure at 5y, housing tenure at 5y, number of children in the household at 5y)
C: Model A + parenting factors (parental discipline (5y); CPRS closeness and conflict subscales (3y))
D: Model A + externalising behaviours (SDQ hyperactivity and conduct problems subscales (5y))
E: Fully adjusted (Model A + Models B, C and D)

TABLE 5: Relative risk ratios (95% confidence intervals) for the relationship between maternal mental health reported up to child aged 7 years and child injury between ages 7-11 years (n=9240)

	% injuries 7-11y by maternal mental health (MMH)		Unadjusted	Socio-demographic factors	Parenting factors	Externalising behaviours	Fully adjusted
	No MMH problem	MMH problem	(A)	(B)	(C)	(D)	(E)
1. Lifetime maternal diagnosis of depression / anxiety (up to child age 7 years)							
None	63.8	58.8	1.00	1.00	1.00	1.00	1.00
1 injury	25.7	27.8	1.18 (1.06 – 1.31)	1.15 (1.03 – 1.28)	1.17 (1.05 – 1.30)	1.17 (1.05 – 1.30)	1.14 (1.02 – 1.28)
2+ injuries	10.5	13.4	1.38 (1.19 – 1.60)	1.31 (1.12 – 1.52)	1.35 (1.16 – 1.57)	1.30 (1.12 – 1.50)	1.26 (1.08 – 1.48)
Maternal psychological distress (highest level reported, between child's age 3-7 years)							
2. Medium maternal psychological distress							
None	62.1	61.8	1.00	1.00	1.00	1.00	1.00
1 injury	27.0	26.2	0.98 (0.87 – 1.09)	0.97 (0.87 – 1.09)	0.96 (0.85 – 1.08)	0.97 (0.86 – 1.08)	0.96 (0.85 – 1.08)
2+ injuries	10.9	12.0	1.10 (0.95 – 1.29)	1.07 (0.91 – 1.25)	1.05 (0.90 – 1.24)	1.03 (0.82 – 1.29)	1.01 (0.86 – 1.19)
3. High maternal psychological distress							
None	62.1	57.4	1.00	1.00	1.00	1.00	1.00
1 injury	27.0	26.6	1.07 (0.86 – 1.33)	1.06 (0.84 – 1.34)	1.03 (0.82 – 1.30)	1.02 (0.87 – 1.20)	1.03 (0.81 – 1.31)
2+ injuries	10.9	16.0	1.59 (1.18 – 2.13)	1.48 (1.10 – 2.01)	1.48 (1.10 – 2.01)	1.32 (0.97 – 1.78)	1.33 (0.97 – 1.81)

A: Maternal psychological distress only
B: Model A + sociodemographic factors (sex of child, ethnicity, household income quintiles at 7y, maternal highest academic qualification, maternal age at child's birth; family structure at 7y, housing tenure at 7y, number of children in the household at 7y)
C: Model A + parenting factors (parental discipline (7y); CPRS closeness and conflict subscales (3y))
D: Model A + externalising behaviours (SDQ hyperactivity and conduct problems subscales (7y))
E: Fully adjusted (Model A + Models B, C and D