Maternal health problems correlate with increased risk of early childhood injury in the UK

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Abstract

In contemporary western societies unintended injuries are the most common cause of early childhood mortality, and research showing associations between risk factors and childhood injury is therefore needed. Even though maternal health problems may increase the risk of childhood injury, not enough studies have looked at the association between different maternal health problems and childhood injury. We investigated the associations between maternal health factors and injuries having occurred in the home to children between the ages of 9 months and 3 years. We used the British Millennium Cohort Study (n = 12,150 children) where mothers have answered questions concerning their own health as well as injuries to their children. We studied the associations between maternal health factors and childhood injury using binary logistic regression analysis. After controlling for several potential confounding factors, we found that mothers' poor general health and longstanding illness were associated with children's increased probability of injury. In addition, several maternal health problems (e.g. migraine and depression) correlated with a higher likelihood of early childhood injury. Thus, improving maternal health is important when the aim is to reduce injuries during the early years of childhood.

Introduction

In modern western societies unintended injuries are the most common cause of mortality in early childhood, and in recent decades many social and public policy interventions have been directed towards preventing toddler injuries (UNICEF, 2001; 2007). A great number of accidents in early childhood tend to occur in the home environment, and in the last years family-related risk factors have been studied extensively. A growing body of research has identified several family-related risk factors that correlate with childhood injuries. Studies have shown, for instance, that children from single-mother families tend to experience more injuries than children from two-parent biological families (e.g. Kendrick et al., 2005; Myhre et al., 2012). In addition, several other characteristics, e.g. maternal age, educational level and socio-economic position are found to correlate with injuries to young children (e.g. Hong et al., 2009; Reading et al., 2008). However, only a limited number of studies concerning the association between maternal health and early childhood injury have been carried out.

Maternal health problems may influence the ability of mothers to function and thus to protect their children from accidents (WHO, 2008). Several studies show that maternal depression increases the risk of childhood injury. Using data from over 10,000 English families, O'Connor and colleagues (2000) found that maternal depression correlated with a higher probability of injury in 2-year-olds. Using a sample of over 26,000 Norwegian families, Myhre and colleagues (2012) showed that toddlers whose mothers experienced mental health problems (i.e. depression and anxiety) had a higher risk of accidents than other toddlers. Similar results were also found in a U.S. study involving over 1,100 children age 5 and younger (Phelan et al., 2007). Finally, a study of more than 1,300 U.S. children showed that maternal chronic depression correlated with an increased risk of childhood accidents from birth to age 3 but not from age 3 to the first grade of school (Schwebel & Brezausek, 2008).

To conclude, evidence shows associations between maternal health problems and children's accidents. However, studies concerning types of health problems other than maternal depression are scarce. Here we analysed with British data the association between several maternal health factors and childhood injuries occurring at home between the age of 9 months and 3 years. We chose to examine toddler injuries because

previous studies have shown that maternal health may be a particularly important factor in children up to the age of 3 (e.g. Schwebel & Brezausek, 2008). We controlled for several potential confounding factors including maternal socioeconomic characteristics, family-related factors as well children' temperament together with emotional and behavioural symptoms.

Study Subjects, Materials and Methods

Participants

We examined data from the Millennium Cohort Study (MCS), a longitudinal survey of more than 18,000 children carried out in the UK. The MCS collects information on children born between September 2000 and January 2002 in England, Wales, Scotland and Northern Ireland. The first interview was conducted when the target children were approximately 9 months old and the second at approximately age 3. In the MCS, parents or parental figures answer questions concerning themselves and their cohort member children. The content of the MCS has been described in more detail elsewhere (Hansen, 2010).

Our analytic sample included cases where the main respondents were the biological mothers of the target child (over 99% of all main respondents). Only cases where the mothers lived in the same household as the cohort member child were included. In cases of twins and triplets, only one child of the set was included. These exclusions left us with a sample of 12,150 children.

Measure of injuries

The dependent variable measured the target child's unintentional injuries. In the MCS, mothers were asked whether their child had been injured between age 9 months and 3 years for which he/she had been taken to a doctor, health centre or hospital. Mothers were also asked to report where the injury had occurred. We included only those injuries that occurred in the home environment. Altogether 24.4% of the children in the study sample were reported to have had an injury at home between age 9 months and 3 years.

Measures of maternal health

The explanatory variables measured maternal health problems (Table 1). In the MCS, mothers were asked to describe their general health on a 4-point scale (from poor to excellent). In addition, they were asked whether they had any longstanding illnesses, disabilities or infirmities. The mothers were then asked whether a doctor or nurse had ever informed them that they had migraine, hay fever, bronchitis, asthma, eczema, a back disorder, fits, convulsions or epilepsy, diabetes, cancer, digestive or bowel disorders, or depression. Finally, they were asked whether they had felt low or sad for a period of time lasting two weeks or longer since the target child was born.

Potential Confounding Variables

In the adjusted models we controlled for child's sex, ethnicity, temperament (i.e. positive mood, reactivity to novelty and rhythmicity measured by Carey Infant Temperament Scale where higher scores indicate more cheerfulness, less distress and more regularity: see Carey, 1972; Carey & McDevitt, 1978), emotional and behavioural problems (measured by the Strengths and Difficulties Questionnaire, SDQ where the higher the score the greater the number of problems: see Bourdon, Goodman, Rae, Simpson, & Koretz, 2005; Goodman, 1997, 2001; SDQ, 2012), number of siblings, maternal age, educational and socioeconomic status, number of safety practices, the presence of a biological father and number of adults in the household (Table 2). These variables were selected because they have been shown to correlate with child injury risk (e.g. Myhre et al., 2012; Reading et al., 2008; Schwebel & Brezausek, 2008; Tanskanen et al., 2015).

Analysis

We used binary logistic regression analysis. We estimated minimally and maximally adjusted odds ratios (OR) and 95% confidence intervals (CI) on the associations between maternal health measures and childhood injuries. We ran separate analyses for the different maternal health factors. All analyses were conducted with the statistical software Stata version 12.0.

Table 1. Maternal health problem variables (%) (n = 12,150)

Maternal general health	
Poor	2.7
Fair	14.0
Good	52.1
Excellent	31.1
Maternal longstanding illness	
No	78.4
Yes	21.6
Maternal migraine	
No	79.2
Yes	20.8
Maternal hay fever	
No	75.3
Yes	24.7
Maternal bronchitis	
No	92.2
Yes	7.8
Maternal eczema	
No	82.9
Yes	17.1
Maternal back pain	
No	78.7
Yes	21.4
Maternal fits, convulsionsor epilepsy	
No	97.7
Yes	2.3
Maternal diabetes	
No	98.3
Yes	1.8
Maternal cancer	
No	99.2
Yes	0.8
Maternal digestive or bowel disorders	
No	91.0
Yes	9.0
Maternal sadness	
No	66.7
Yes	33.3
Maternal depression	
No	76.0
Yes	24.0

Table 2. Descriptive statistics (%/mean) (n = 12,150)

	%/mean	SD
Child's sex (%)		
Boy	50.0	
Girl	50.0	
Child's ethnic background (%)		
White	84.9	
Mixed	2.8	
Indian	2.4	
Pakistani/Bangladeshi	5.8	
Black	3.0	
Other	1.1	
Positive mood (mean)	18.9	3.53
Reactivity to novelty (mean)	9.0	3.65
Rhythmicity (mean)	16.9	3.20
Child's emotional and behavioral problems (mean)	8.8	5.14
Number of siblings (mean)	0.9	1.06
Maternal age (mean)	29.7	5.86
Maternal education (%)		
Nvg level 1	8.1	
Nvg level 2	29.1	
Nvg level 3	14.5	
Nvg level 4	28.3	
Nvg level 5	3.6	
Other	16.4	
Maternal socioeconomic circumstance (%)		
Semi-routine, routine and not working	44.0	
Lower supervisory and technical	5.6	
Small employers and own account	3.7	
Intermediate	17.6	
Managerial and professional	29.1	
Number of safety equipments (mean)	2.2	1.17
Number of adults in household (mean)	2.0	0.47
Biological father in household (%)		
No	14.9	
Yes	85.1	

n = 12,150

Results

Table 3 shows that in both the minimally and maximally adjusted models boys were more likely to have had injuries than girls, and children belonging to the ethnic majority more likely than children belonging to an ethnic minority. When emotional and behavioural problems increased, so did the risk of injury. Children with more siblings and with younger mothers had more injuries than those with less siblings and older mothers. Children with mothers whose educational level is Nvg 2 had higher risk of injury than children whose mothers' educational level is Nvg 1. Children whose mothers were in higher socio-economic positions had a lower probability of injury than children whose mothers were in a lower socioeconomic position. In addition, the

Table 3. Associations between control variables and childhood injuries (odds ratios) (n = 12,150)

	Minimally adjusted					Maximally adjusted				
	OR	SE	p	lower	upper	OR	SE	p	lower	upper
Child's sex										
Boy	1.00					1.00				
Girl	0.74	0.03	< .001	0.69	0.81	0.76	0.03	< .001	0.70	0.83
Child's ethnic background										
White	1.00					1.00				
Mixed	0.93	0.12	0.556	0.72	1.19	0.93	0.12	0.546	0.72	1.19
Indian	0.41	0.07	< .001	0.29	0.58	0.45	0.08	< .001	0.32	0.65
Pakistani/Bangladeshi	0.69	0.07	< .001	0.57	0.83	0.74	0.08	0.003	0.60	0.90
Black	0.64	0.09	0.001	0.49	0.84	0.62	0.09	0.001	0.47	0.82
Other	0.79	0.16	0.246	0.52	1.18	0.88	0.19	0.552	0.58	1.33
Positive mood	1.001	0.01	0.921	0.99	1.01	1.001	0.01	0.927	0.99	1.01
Reactivity to novelty	0.99	0.01	0.048	0.98	0.999	0.99	0.01	0.112	0.98	1.002
Rhythmicity	0.996	0.01	0.542	0.98	1.01	0.99	0.01	0.458	0.98	1.01
Child's emotional and behavioral problems	1.03	0.004	< .001	1.02	1.04	1.03	0.004	< .001	1.02	1.03
Number of siblings	1.07	0.02	0.001	1.03	1.12	1.06	0.02	0.012	1.01	1.11
Maternal age	0.97	0.003	< .001	0.96	0.98	0.97	0.004	< .001	0.96	0.98
Maternal education										
Nvg level 1	1.00					1.00				
Nvg level 2	1.19	0.10	0.034	1.01	1.40	1.31	0.11	0.001	1.11	1.54
Nvg level 3	0.98	0.09	0.809	0.82	1.17	1.14	0.11	0.169	0.95	1.37
Nvg level 4	0.97	0.08	0.693	0.82	1.14	1.19	0.11	0.069	0.99	1.42
Nvg level 5	0.91	0.13	0.482	0.69	1.19	1.18	0.18	0.276	0.88	1.58
Other	0.997	0.09	0.976	0.84	1.19	1.04	0.09	0.662	0.87	1.24
Maternal socioeconomic circumstance										
Semi-routine, routine and not working	1.00					1.00				
Lower supervisory and technical	0.93	0.09	0.402	0.77	1.11	0.89	0.08	0.228	0.74	1.07
Small employers and own account	0.91	0.11	0.391	0.72	1.14	0.90	0.11	0.370	0.71	1.13
Intermediate	0.80	0.05	< .001	0.71	0.90	0.79	0.05	< .001	0.70	0.90
Managerial and professional	0.83	0.05	0.001	0.75	0.93	0.85	0.06	0.015	0.74	0.97
Number of safetyequipments	1.07	0.02	< .001	1.03	1.11	1.04	0.02	0.035	1.002	1.08
Number of adults in household	0.80	0.04	< .001	0.73	0.87	0.88	0.05	0.032	0.80	0.99
Biological father in household										
No	1.00					1.00				
Yes	0.81	0.05	< .001	0.72	0.91	0.93	0.07	0.329	0.79	1.08

Minimally adjusted = Univariate association, adjusted for maternal age

Maximally adjusted = Multivariate association, all of the covariates are adjusted

Table 4. Associations between maternal health variables and childhood injuries (odds ratios) (n = 12,150)

	Minimally adjusted					Maximally adjusted				
	OR	SE	p	lower	upper	OR	SE	p	lower	upper
Maternal general health										
Poor	1.00					1.00				
Fair	0.95	0.12	0.693	0.74	1.23	0.97	0.13	0.839	0.75	1.26
Good	0.77	0.09	0.033	0.61	0.98	0.80	0.10	0.082	0.63	1.03
Excellent	0.67	0.08	0.002	0.53	0.86	0.72	0.09	0.011	0.56	0.93
Maternal longstanding illness										
No	1.00					1.00				
Yes	1.20	0.06	< .001	1.09	1.32	1.14	0.06	0.010	1.03	1.26
Maternal migraine										
No	1.00					1.00				
Yes	1.16	0.06	0.004	1.05	1.28	1.12	0.06	0.031	1.01	1.23
Maternal hay fever										
No	1.00					1.00				
Yes	1.02	0.05	0.708	0.93	1.12	1.01	0.05	0.897	0.91	1.11
Maternal bronchitis										
No	1.00					1.00				
Yes	1.14	0.09	0.082	0.98	1.33	1.08	0.08	0.345	0.92	1.25
Maternal eczema										
No	1.00					1.00				
Yes	1.29	0.07	< .001	1.16	1.43	1.22	0.07	< .001	1.10	1.36
Maternal back pain										
No	1.00					1.00				
Yes	1.28	0.06	< .001	1.16	1.41	1.26	0.06	< .001	1.14	1.39
Maternal fits, convulsionsor epilepsy										
No	1.00					1.00				
Yes	1.15	0.15	0.282	0.89	1.50	1.06	0.14	0.684	0.81	1.38
Maternal diabetes										
No	1.00					1.00				
Yes	1.12	0.18	0.469	0.82	1.53	1.16	0.18	0.365	0.85	1.58
Maternal cancer										
No	1.00					1.00				
Yes	1.25	0.27	0.300	0.82	1.93	1.16	0.26	0.511	0.75	1.79
Maternal digestive or bowel disorders										
No	1.00					1.00				
Yes	1.20	0.09	0.011	1.04	1.38	1.16	0.08	0.039	1.01	1.34
Maternal sadness										
No	1.00					1.00				
Yes	1.27	0.06	< .001	1.17	1.38	1.20	0.05	< .001	1.10	1.31
Maternal depression										
No	1.00					1.00				
Yes	1.36	0.06	< .001	1.24	1.50	1.24	0.06	< .001	1.13	1.36

Minimally adjusted = Univariate association, adjusted for maternal age
Maximally adjusted = Multivariate association, all of the covariates are adjusted

likelihood of injury increase when the number of safety practices in the household increased. When the number of adults in households increased the probability of injury decreased. Only in minimally adjusted model lower reactivity to novelty was associated with higher probability of injury. As well, only in minimally adjusted model did

children living in households with biological fathers had a lower likelihood of injury than children in households without biological fathers.

In both the minimally and maximally adjusted models, children whose mothers' health was excellent had a lower probability of injury compared with children whose mothers' general health was poor (Table 4). Children living with mothers having a longstanding illness had a higher risk of injury than others. Children whose mothers had migraine, eczema, back pain or depression had a higher probability of injury than those whose mothers were without such health problems. In addition, children whose mothers had felt low or sad had a higher likelihood of injury compared to the reference group. Finally, children with mothers having digestive or bowel disorders have a higher risk of injury compared with children whose mothers did not have these disorders.

Discussion

We analysed the associations between maternal health factors and early childhood injury. Using UK data, we found maternal health problems to be associated with increased injury rates in children. In line with several previous studies, we also found maternal depression to correlate with childhood injury (e.g. Myhre et al., 2012; Phelan et al., 2007; Schwebel & Brezausek, 2008). The present study, however, has expanded previous findings as we covered not only maternal depression but also other maternal health factors. Our study showed that children whose mothers have migraine, eczema, digestive or bowel disorders or back pain had a higher probability of injury than those whose mothers were without these health problems. In addition, children whose mothers' general health was poor had a higher probability of injury than children whose mothers' health was excellent. Finally, children having mothers with longstanding illnesses had a higher likelihood of injury than those whose mothers were without such illnesses.

Compared with previous research, the present study has several strengths. The Millennium Cohort Study provides extensive data including many measures concerning maternal health. The data also include several potential confounders that we were able to control for. In addition, the survey collected information on injuries occurring exclusively in the home, and one may conclude that mothers have more opportunities to

prevent injuries at home than outside the home (e.g. in childcare centres, etc.). Finally, the data include information concerning children approximately aged 3 and younger, which is important because previous studies have shown that maternal health problems may predict childhood injury, particularly when children are toddlers (e.g. Schwebel & Brezausek, 2008).

Our study has also limitations. The reported childhood injuries were based on maternal accounts, and some mothers may have either understated or overstated the injuries. However, previous evidence suggests that mothers tend to recall their children's injuries quite well and, for instance, regardless of their socioeconomic background (Cummings et al., 2005; Pless et al., 2005). We were not able to determine whether all mothers were present when injuries occurred. Even though toddlers tend to spend a great amount of time with their mothers, we cannot be completely sure that the mothers were actually present at the time of the accidents. Finally, the correlations do not claim causality, which means that it is possible that our results can be explained by factors other than maternal health problems. However, we controlled for several potential confounding factors, which did not remove the correlations between maternal health factors and childhood injury.

Our study also has policy implications. Since maternal health problems tend to increase childhood injuries, local authorities (e.g. clinicians and pediatricians) should pay attention to mothers' health problems and refer the mothers for treatment if needed. In addition, it is important to provide guidance for mothers that can help them to recognize their own health risks. To conclude, improving maternal health may be crucial when the aim is to reduce early childhood injuries.

Acknowledgements

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