ORIGINAL ARTICLE

Maternal depression, child behavior, and injury

K Phelan, J Khoury, H Atherton, R S Kahn

Injury Prevention 2007;**13**:403–408. doi: 10.1136/ip.2006.014571

See end of article for authors' affiliations

Correspondence to: Dr K J Phelan, Assistant Professor of Pediatrics, Division of Health Policy & Clinical Effectiveness, Winslow Bldg, Rm 5117, MLC 7014, Cincinnati Children's Hospital Medical Center, 3333 Burnet Avenue, Cincinnati, OH 45229-3039, USA; kieran.phelan@cchmc.org

Accepted 24 September 2007

Background: Few data exist on the effect of maternal depression on child injury outcomes and mediators of this relationship.
Objective: To examine the relationship between mothers' depressive symptoms and medically attended injuries in their children and the potential mediating role of child behavior.
Design/Methods: A cohort of mother–child dyads from the National Longitudinal Study of Youth followed from 1992 to1994. The primary exposure variable was maternal depressive symptoms as measured by the Center for Epidemiologic Studies Depression Scale in 1992. Child behavior was assessed by the Behavior Problems Index externalizing subscale. Logistic regression was used to examine the relationship between depressive symptoms, child behavior, and injury reported in the prior year in 1994.
Results: 94 medically attended injuries were reported in the 1106 children (8.5%); two-thirds were sustained in the home environment. Maternal depressive symptoms significantly increased the risk of child injury; injury risk increased 4% for every 1-point increase in depressive symptoms (adjusted OR 1.04, 95% CI 1.01 to 1.08, p = 0.02). Increasing maternal depressive symptoms also increased the risk of externalizing behavior problems (adjusted OR 1.06, 95% CI 1.03 to 1.09), but externalizing behavior problems did not significantly mediate the relationship between maternal symptoms and child injury.
Conclusions: Increasing depressive symptoms in mothers was associated with an increased risk of child injury. Child behavior did not significantly mediate the association between maternal depressive symptoms and child injury in this cohort. Greater recognition, referral, and treatment of depressive symptoms in mothers may have effects on child behavior and injury risk.

Children under the age of 6 years have the highest rates of residential injury.[1 2] Mothers with depressive symptoms consistent with clinical depression have been shown to be less likely to have functioning smoke detectors in their homes, to report use of child occupant restraint and electrical socket covers, and the back-to-sleep position for their infants compared with non-depressed mothers.[3 4] In another study, depressive symptoms in mothers of children 2–4 months of age were not associated with emergency department visits for injury 24 months later; in addition, the persistence of depressive symptoms in the mothers in this study was not associated with visits for well-child checks, acute care, or emergency department visits for care or injury in their children.[5] Therefore, it remains unclear whether maternal depression is a risk factor for injury in their children.

Maternal depression has been associated with derangements in child temperament and behavior.[6–11] Child behavior, in turn, has been associated with an increased risk of injury.[12–14] Although maternal depression has been associated with childhood injury, no studies have examined whether maternal depression may influence childhood injury through its impact on child behavior. Given the recent evidence linking maternal depressive symptoms to poor residential safety, parenting, and perturbations in child behavior, the early recognition and treatment of maternal depression may have important ramifications for the mother and her children.

The objective of this study was to examine the relationship between depressive symptoms in mothers and injury outcomes in their children in a prospective cohort. We hypothesized that depressive symptoms in mothers of young children would be associated with increased injury risk. We further hypothesized that mothers' depressive symptoms would be associated with externalizing behaviors in their children, and that child behavior would partially mediate the relationship between maternal depressive symptoms and childhood injury.

METHODS

Variables and dataset

A cohort of mother–child dyads was developed from the National Longitudinal Study of Youth (NLSY). The NLSY enrolled a cohort of teenage and young, adult women aged 14–22 years in 1979 with over-sampling of black, Hispanic, and low-income white women.[15] The children of these women have been independently followed since 1986 with biennial assessment. As US children less than 6 years have the highest rates of emergency visits for residential injury,[1] we developed a cohort of women who had children from birth through 5 years of age by randomly selecting one child less than 6 years from each maternal record in 1992 and who were followed through 1994.

We used the outcome of an injury requiring medical attention in the prior 12 months, reported in the 1994 wave of the NLSY, as the primary outcome variable for this analysis. To reduce the possibility that a prior injury in a child may have contributed to depressive symptoms in the mother, we excluded from the cohort any child who, in 1992, had a medically attended injury in the prior year or any injury ever requiring a prior hospitalization.

Maternal depressive symptoms were assessed with the Center for Epidemiologic Studies Depression Scale (CES-D) in 1992.[16 17] The 20-item CES-D ranks responses on a 3-point Likert scale resulting in scores ranging between 0 and 60, and rates the frequency with which respondents have felt depressed, feelings of helplessness, hopelessness, guilt and worthlessness, loss of energy, and problems with sleep or appetite over a 1-week period. Higher scores reflect higher levels of depressive symptoms. The Cronbach's α for the mother's CES-D items in this cohort was good ($\alpha = 0.71$) and

Abbreviations: BPI, Behavior Problems Index; CES-D, Center for Epidemiologic Studies Depression Scale; NLSY, National Longitudinal Study of Youth

Table 1 Maternal and child characteristics, National Longitudinal Study of Youth Cohort (n = 1106), 1992–94

Characteristic	Number	%
Injured in 1994		
Yes	94	8.5
No	1012	91.5
Place of injury		
Home	62	66.0
Other	32	34.0
Gender		
Male	553	50.0
Female	553	50.0
Race		
White, non-Hispanic	598	54.1
Black, non-Hispanic	308	27.8
Hispanic	162	14.6
Other	38	3.4
Number of siblings		
0	233	21.1
1	731	66.1
⩾2	142	12.8
Birth order of child		
First	333	30.1
Second	419	37.9
Third or higher	354	32.0
Total household income		
<$15 000	131	11.6
$15 000–29 999	263	23.8
$30 000–49 999	392	35.4
⩾$50 000	320	28.9
Below poverty level		
Yes	188	18.8
No	811	81.2
Insurance status (1990)		
Private	781	70.6
Medicaid	223	20.2
Other/uninsured	102	9.2
Education		
<High school	203	18.4
High school	443	40.0
>High school	460	41.6

comparable to that in other studies of maternal depressive effects on infants.[18] Only 7 items of the full 20-item scale of the CES-D was administered again in 1994. However, using the full 20-item CES-D scale in 1992, we found that the 7-item score correlated highly with the full 20-item score (Pearson correlation = 0.87). To examine the effect of more severe levels of symptoms, we examined the association of injury outcomes with CES-D scores consistent with clinical depression (CES-D⩾16).[19 20] Persistence of depressive symptoms over time may have a greater effect than intermittent ones[4]; therefore, we also examined the relationship of depressive symptoms and reported child injury in mothers who scored in the highest quartile using the 7-item CES-D in both 1992 and 1994.

To validate the top-quartile approach to symptom severity, we compared women who scored in the top quartile of the 7-item CES-D scale in 1992 with those scoring ⩾16 on the 20-item version. Only two (1%) women in this top quartile of the 7-item scale (CES-D>7) in 1992 had 20-item scores <16; both of these scores were 14. The lowest three quartiles of the short form correctly classified 99.6% of those not depressed on the more widely recognized long form of the CES-D (20-item CES-D <16). With the abbreviated, 7-item top quartile (mean 11.4, range 8–21) of the CES-D, 44% of those classified as clinically depressed (20-item score ⩾16) were captured in the top quartile of the 7-item short form. Therefore, the top-quartile of the 7-item CES-D in this cohort was a more specific subset of women with depressive symptoms consistent with clinical depression.

Maternal depression has been associated with a number of child behavior risks including attachment disorders in infants and toddlers and externalizing behavior disorders in older children.[21 22] The Behavior Problems Index (BPI), a 28-item survey included in the NLSY, measures the frequency, range, and type of childhood behavior problems in the preceding 3 months but only for children aged 4 years and over. Items were derived largely from the Achenbach Child Behavior Checklist.[23] The externalizing subscale (BPIext) is an 18-item derived measure which reflects a child's tendency to externalize behaviors.[15] The behaviors encompassed by the BPIext subscales (''impulsive, acts without thinking'', ''restless overly active, cannot sit still'', etc) describe an active and intuitively at risk child.[15] The Cronbach's α coefficient for the BPI variables in the cohort for these analyses was good (BPIext subscales $\alpha = 0.87$). Higher scores represent a greater level of behavior problems. BPIext scores in 1994 were stratified for these analyses into quartiles from the lowest to highest reported degrees of externalizing behavior: lowest (83–91, 27%), second (92–100, 27%), third (101–111, 23%), and highest (112–163, 23%) quartile.

Other covariates considered for the models of maternal depressive symptoms on childhood injury were the location of injury, gender, race, number of siblings in the household, the child's birth order, maternal education, total household income, poverty status, and medical insurance status. Covariates were included in the models on the basis of univariate and bivariate analyses and previous research. Variables with p values <0.20 in bivariate analyses or those with previous research to support associations with childhood injury were examined for inclusion.[24] As it has been reported that boys and girls have different socialization with regard to home safety[25 26] and that maternal depressive symptoms may act differentially on psychological development of boys and girls, we tested the interaction of maternal depressive symptoms on gender and behavior in the models.

Statistical analysis

Descriptive analyses and modeling of injury outcomes were performed using SAS software (V.6.12. SAS Institute, Cary, North Carolina, USA; 1996). Only maternal–child dyads with complete data for the desired descriptive and multivariate analyses were included (n = 1106). Inclusion of the child behavior variable (BPIext) in the models reduced the 1994 sample by 324 records, as the BPI is restricted to children ⩾4 years. χ^2 tests were used to examine proportions of injured children by categorical covariates, and two tailed *t*-tests were used for continuous covariates. Logistic regression was used to examine the association of maternal depressive symptoms with child injury controlling for covariates.

An approach outlined by Judd and Kenny[27] was used to determine whether externalizing child behaviors mediated the effects of maternal depressive symptoms on child injury. Firstly, we examined the associations between maternal depressive symptoms (CES-D score) and the presumed mediator externalizing child behavior. Secondly, we examined the association between maternal depressive symptoms and injury. Thirdly, we assessed how the relationship between maternal depressive symptoms and injury changed after adjustment for child behavior. The statistical analysis developed by Huang *et al*[28] for logistic models with binary outcomes (eg, injured or not) was used to quantify the mediating effect of child behavior on the relationship between exposure to maternal depressive symptoms and injury outcomes in the children. The changes in the unstandardized coefficients for maternal depressive symptoms with the mediator in and out of the models indicated the extent to which child externalizing behavior mediated the

Table 2 Risk factors for children reporting injury in 1994

Risk factor	Number injured (%)	p Value
Maternal depressive symptoms		
CES-D ⩾16 (categorical)	51 (9.9)	
CES-D <16	43 (7.2)	0.11
Child gender		
Male	52 (9.4)	0.28
Female	42 (7.6)	
Child race		
White, non-Hispanic	64 (10.7)	
White, Hispanic	6 (3.7)	
African–American	22 (7.1)	0.02
Other	2 (5.3)	
Number of siblings		
0	11 (4.7)	
1	71 (9.7)	0.06
⩾2	12 (8.4)	
Total household income		
<$15 000	12 (9.2)	
$15 000–29 999	25 (9.5)	0.53
$30 000–49 999	36 (9.2)	
⩾$50 000	21 (6.6)	
Maternal education		
<High school	18 (8.9)	
High school	36 (8.1)	0.93
>High school	40 (8.7)	
Insurance		
Private	68 (8.7)	
Medicaid	19 (8.5)	0.82
Other/uninsured	7 (6.9)	

p Value indicates the overall difference in distribution of that variable for injured compared with non-injured children.

relationship between maternal depressive symptoms and injury.

RESULTS

A total of 1106 mother–child dyads had complete data on the CES-D, injury outcomes, and the sociodemographic covariates. Half of the children in this cohort were male, and almost 80% were from families with two or more children (table 1). A total of 94 children (8.5%) in the cohort experienced a medically attended injury as reported by mothers in 1994. Almost two-thirds (n = 62) of the injuries occurred in the home environment.

Table 2 shows potential covariates for models of childhood injury available within this cohort. There was no difference in the proportion of injured and non-injured children by age (p = 0.92) or gender (p = 0.28), family income (p = 0.53), poverty status (p = 0.50), insurance coverage (p = 0.82), maternal education (p = 0.93), birth order (p = 0.32), or number of siblings in the home (p = 0.06). However, the proportion of injured children did vary significantly according to race (p = 0.02).

The mean (SD) score of the 20-item CES-D in 1992 was 16.8 (5.8). In bivariate analyses, there was a significant difference in mean CES-D scores between mothers of injured and non-injured children (18.2 (7.3) vs 16.6 (5.7), p = 0.045). About 47% of mothers in the cohort had CES-D scores ⩾16 in 1992. In bivariate analyses, the proportion of injured children was not significantly different in children of mothers with high depressive symptoms (CES-D⩾16) compared with children of mothers with lower scores (9.9% vs 7.2%, p = 0.12, table 2). In multivariate analyses, children of mothers with depressive symptoms in 1992 were at an increased risk of injury in 1994, adjusting for covariates (table 3, adjusted odds ratio (ORadj) 1.04, 95% CI 1.01 to 1.08). Those with symptoms consistent with clinical depression (CES-D ⩾16) were at greater risk (ORadj 1.34 (95% CI 0.87 to 2.08), although this was not statistically significant. Furthermore, children of mothers with high and persistent depressive symptoms (highest quartile of 7-item CES-D in both 1992 and 1994) had more than a twofold increase in their risk of reported injury compared with children of mothers whose symptoms were not high in either year (ORadj 2.10, 95% CI 1.19 to 3.72).

In logistic regression modeling, we found a significant interaction between depression and gender (p<0.01). Therefore, we examined the effect of depressive symptoms on injury outcomes in boys-only and girls-only cohorts (table 4).

Table 3 Logistic regression model of maternal depressive symptoms predicting injury outcomes 1994 (excluding externalizing child behavior, BPIext)

Variable	β	SE	OR (95% CI)	p Value
Depressive symptoms (continuous CES-D score)	0.04	0.02	1.04 (1.01 to 1.08)	0.03
Child gender				
Male	0.13	0.11	1.29 (0.84 to 2.00)	0.25
Female (reference)				
Family income				
<$15 000	0.20	0.27	1.88 (0.80 to 4.40)	0.47
$15 000–29 999	0.20	0.20	1.89 (0.98 to 3.66)	0.30
$30 000–49 999	0.03	0.12	1.59 (0.90 to 2.84)	0.86
⩾$50 000 (reference)				
Family size				
⩾2 siblings	0.81	0.46	2.24 (0.92 to 5.47)	0.08
1 sibling	0.85	0.34	2.36 (1.20 to 4.61)	0.01
No siblings (reference)				
Maternal education				
<High school	−0.04	0.20	0.83 (0.42 to 1.62)	0.84
High school	−0.10	0.16	0.78 (0.48 to 1.28)	0.50
>High school (reference)				
Child race				
White, non-Hispanic	1.30	0.45	3.67 (1.53 to 8.80)	0.004
Black	0.59	0.48	1.80 (0.71 to 4.61)	0.22
Other	0.41	0.84	1.50 (0.29 to 8.87)	0.63
White, Hispanic (reference)				
Child age				
Years (each year)	−0.02	0.06	0.98 (0.86 to 1.12)	0.74

Table 4 Adjusted logistic models of maternal depressive symptoms predicting injury outcomes including externalizing child behavior (BPIext) for the combined cohort and by gender

Dataset	β	SE	OR adj* (95% CI)	p Value
Combined (n = 782)	0.04	0.02	1.04 (1.00 to 1.09)	<0.05
Boys only (n = 396)	0.09	0.03	1.10 (1.04 to 1.16)	<0.01
Girls only (n = 386)	−0.03	0.04	0.97 (0.90 to 1.04)	0.37

*Adjusted for demographic and socioeconomic covariates from table 2 and BPIext.

The risk of injury in boys of mothers with depressive symptoms was higher than that for the full cohort (ORadj 1.04, 95% CI 1.00 to 1.09). In contrast, there was not a significant association between maternal depressive symptoms and injury in girls (ORadj 0.97, 95% CI 0.90 to 1.04).

If maternal depression is indeed linked to a young child's risk of injury, one might expect a lower or non-significant risk outside the home where exposure to parenting and supervision might be less likely (eg, a public playground) than inside. There was a similar estimate of effect to the overall cohort for maternal depressive symptoms on residential injuries (n = 62) (ORadj 1.05, 95% CI 1.01 to 1.09); however, there was not a significant effect in environments outside of the home (n = 32) (ORadj 1.03, 95% CI 0.97 to 1.09) where exposure to maternal supervision is less likely.

The mean (SD) scores of the externalizing subscales of the BPI for the cohort greater than 4 years in 1994 (n = 782) was 102.5 (14.9) (range 86–178). Children with scores in the highest quartile of the BPIext had significantly higher mean scores (122.3 (10.8) vs 95.0 (7.9), $p<0.01$) and proportions of injured (14.7% vs 6.2%, $p<0.01$) compared with children in the lower quartiles.

The risk of a highest quartile BPIext score increased by 6% for each increase in maternal CES-D symptom score (table 5). The risk was increased only for boys (ORadj 1.08, 95% CI 1.04 to 1.13). Children of mothers with high depressive symptoms (CES-D⩾16) were also at increased risk of top-quartile externalizing behaviors (ORadj 1.69, 95% CI 1.20 to 2.38). Top-quartile externalizing behaviors were, in turn, a risk factor for injury compared with children in lower quartiles (ORadj 2.22, 95% CI 1.28 to 3.87). However, children's externalizing behaviors did not appear to significantly mediate the effect of maternal depressive symptoms on childhood injury, with only 4% (ORadj 0.04, 95% CI −0.02 to 0.09) of the effect operating through the BPIext. Externalizing behaviors (BPIext) were not a significant mediator in boys or girls when stratified by gender.

DISCUSSION

Depressive symptoms in a cohort of mothers of young children in 1992 were significantly associated with an increased risk of subsequent medically attended injury. In this cohort, the risk of reported injury increased by 4% for each 1-point increase in maternal depressive symptoms on the CES-D. Furthermore, high and persistent maternal depressive symptoms in this cohort of children less than 6 years of age were associated with an even greater increase in the risk of injury. Mechanisms that may explain the effect of increasing maternal depressive symptoms on childhood injury include changes in maternal supervisory behavior,[29] ability to maintain the physical environment (increased clutter or other hazards),[30–32] and perceptions of child behavior and injury risk.[14]

Although we did not find a significant mediating effect of child behavior on the relationship between maternal depressive symptoms and injury, depressive symptoms in this cohort did increase the risk of externalizing behaviors. This is consistent with several other reports.[10 33] It is likely that externalizing child behavior does have a role in increasing a child's injury risk.[34 35] However, the BPIext may not be the ideal measure in young children under 6 years to explain the pathway from maternal depressive symptoms to childhood injury. In a recent study of the effects of maternal depressive symptoms on child behavior using the NLSY, it was found that maternal depressive symptoms had direct effects on child behavior in an older (6–9 year-old) cohort mediated through parenting behavior in white and Latino cohorts.[36]

Although we found a significant interaction between depressive symptoms and child gender, we were limited in our power to explore the mediation effects of child behavior. Studies have shown that parents will socialize and supervise their children with regard to injury risk behaviors differentially by gender, and this may partly explain the findings in this cohort.[25 26] Children, by 6 years of age, also display gender biases in perceptions of injury vulnerability, which may lead to more or less injury risk behaviors.[25] Furthermore, although we controlled for socioeconomic covariates, other unmeasured variables such as more specific measures of maternal supervisory beliefs and behavior and macro-level variables such as neighborhood social capital not present in the NLSY may have important effects on the relationship of maternal depressive

Implications for prevention

The recognition of depression in mothers of young children may have important ramifications for the development and injury risk of those children. Primary care clinicians and pediatricians need to be able to screen for, recognize, and treat (or refer for treatment) mothers with depressive symptoms in order to reduce the risk of behavioral problems and injury in their children.

Table 5 Adjusted logistic models of maternal depressive symptoms predicting externalizing behaviors (BPIext) for combined cohort and by gender

Dataset	β	SE	OR adj* (95% CI)	p Value
Combined (n = 782)	0.06	0.01	1.06 (1.03 to 1.09)	<0.01
Boys only (n = 396)	0.08	0.02	1.08 (1.04 to 1.13)	<0.01
Girls only (n = 386)	0.03	0.02	1.03 (0.99 to 1.08)	0.13

*Adjusted for demographic and socioeconomic covariates from table 2.

Key points

- Depressive symptoms in mothers were associated with injury outcomes in their children.
- For each 1-point increase in maternal depressive symptoms as measured by the Center for Epidemiologic Studies Depression Scale (CES-D), there was a 4% increase in injury risk and a 6% increase in the risk of externalizing behavior problems in the children.
- The recognition and treatment of depressive symptoms in mothers of young children may afford opportunities for the amelioration of behavior problems and medically attended injuries in their children.

symptoms and childhood injury.[37–40] Finally, we examined a young cohort of children from birth through 5 years, and it is possible that mediation effects may be most pronounced in older cohorts.

We found that maternal depressive symptoms are associated with child behavior and injury in a young cohort of children in the NLSY. Thus, a reduction in symptoms or treatment of women with depressive symptoms might reduce the risk of injury in their children. In at least one controlled trial, treatment of maternal depression was associated with an 11% decrease in the rates of psychiatric and behavioral diagnoses in children of mothers whose depression remitted.[41]

These results may not be generalizable to the larger US population, as the sample population for these analyses was a subset of the larger NLSY cohort, and weighted estimates were not developed. Our analyses were limited to depressive symptoms in 1992 and measures of externalizing behaviors and injury in 1994. To reduce the likelihood of reverse causation—that is, that previous injuries may have influenced maternal depressive symptoms—we restricted analyses to children with no reported injuries in the 1992 survey. The NLSY over-sampled from certain minority and low socio-economic groups, and almost half (47%) of mothers in this cohort of children reported depressive symptoms above the threshold for clinical depression (CES-D $\geqslant$16) consistent with several previous reports.[5 19 20 42] As the recall period for a medically attended injury in the NLSY was 12 months, we may have underestimated the effect of depressive symptoms on injury through decreasing recall of child injury after 3 months.[43] A recent report has shown that maternal depression does not alter the recall of usage of child health services.[44] The association of maternal depressive symptoms and medically attended injuries may be explained by inappropriate use of health services by depressed mothers. Although some studies may support this hypothesis,[45 46] a study by Watson and Kemper[47] found no increase in scheduled or unscheduled usage of health services by children of mothers with substance abuse, depression, or low social support.

CONCLUSIONS

Increasing depressive symptoms in mothers of young children in 1992 were significantly associated with the risk of an injury in 1994. Although depressive symptoms in mothers increased the risk of externalizing behaviors in boys, the effect of depressive symptoms of mothers on their children's risk of injury did not appear to be significantly mediated by child behavior in this cohort. Greater attention to the recognition, referral, and treatment of maternal depression may result in reductions in both child behavioral problems and injury.

ACKNOWLEDGEMENTS

We acknowledge Bin Huang PhD, Research Assistant Professor, Center for Epidemiology and Biostatistics, CCHMC for assistance with the mediation analysis using logistic models.

Authors' affiliations

K Phelan, Division of Health Policy & Clinical Effectiveness, Cincinnati Children's Hospital Medical Center, University of Cincinnati, Cincinnati, Ohio, USA
K Phelan, J Khoury, H Atherton, R S Kahn, General and Community Pediatrics, Cincinnati Children's Hospital Medical Center, University of Cincinnati, Cincinnati, Ohio, USA
J Khoury, Center for Epidemiology and Biostatistics, Cincinnati Children's Hospital Medical Center, University of Cincinnati, Cincinnati, Ohio, USA
K Phelan, J Khoury, Center for Children's Environmental Health, Cincinnati Children's Hospital Medical Center, University of Cincinnati, Cincinnati, Ohio, USA

Funding support: KP was supported by a career development award from the National Institutes of Child Health and Human Development (NICHD) 1K23HD045770-01A2. RK was supported by NICHD 1K23 HD40362.

Competing interests: None.

REFERENCES

1 **Phelan KJ**, Khoury JC, Kalkwarf HJ, *et al*. Residential injuries in US children and adolescents. *Public Health Rep* 2005;**120**:63–70.
2 **Nagaraja J**, Menkedick J, Phelan KJ, *et al*. Deaths from residential injuries in US children and adolescents, 1985–1997. *Pediatrics* 2005;**116**:454–61.
3 **McLennan JD**, Kotelchuck M. Parental prevention practices for young children in the context of maternal depression. *Pediatrics* 2000;**105**:1090–5.
4 **Chung EK**, McCollum KF, Elo IT, *et al*. Maternal depressive symptoms and infant health practices among low-income women. *Pediatrics* 2004;**113**:e523–9.
5 **Minkovitz CS**, Strobino D, Scharfstein D, *et al*. Maternal depressive symptoms and children's receipt of health care in the first 3 years of life. *Pediatrics* 2005;**115**:306–14.
6 **Field T**. Maternal depression effects on infants and early interventions. *Prev Med* 1998;**27**:200–3.
7 **Field T**. Emotional care of the at-risk infant: early interventions for infants of depressed mothers. *Pediatrics* 1998;**102**:1305–10.
8 **Hart S**, Jones NA, Field T. Atypical expressions of jealousy in infants of intrusive- and withdrawn-depressed mothers. *Child Pyschiatry Hum Dev* 2003;**33**:193–207.
9 **NICHD**. Chronicity of maternal depressive symptoms, maternal sensitivity, and child functioning at 36 months. NICHD Early Childhood Research Network. *Dev Psychol* 1999;**35**:1297–310.
10 **Civic D**, Holt VL. Maternal depressive symptoms and child behavior problems in a nationally representative normal birthweight sample. *Matern Child Health J* 2000;**4**:215–21.
11 **Kim-Cohen J**, Moffitt TE, Taylor A, *et al*. Maternal depression and children's antisocial behavior. *Arch Gen Psychiatry* 2005;**62**:173–81.
12 **Schwebel DC**, Speltz ML, Jones K, *et al*. Unintentional injury in preschool boys with and without early onset of disruptive behavior. *J Pediatr Psychol* 2002;**27**:727–37.
13 **Schwebel DC**, Brezausek CM, Ramey SL, *et al*. Interactions between child behavior patterns and parenting: implications for children's unintentional injury risk. *J Pediatr Psychol* 2004;**29**:93–104.
14 **Morrongiello BA**, Dawber T. Toddlers' and mothers' behaviors in an injury-risk situation: implications for sex differences in childhood injuries. *J Appl Dev Psychol* 1998;**19**:625–39.
15 NLSY79. Child & young adult data users guide: a guide to the 1986–2000 child data and 1994–2000 young adult data. Columbus, OH: The Ohio State University, 2002.
16 **Weissman MM**, Sholomskas D, Pottenger M, *et al*. Assessing depressive symptoms in five psychiatric populations: validation study. *Am J Epidemiol* 1977;**106**:203–14.
17 **US Department of Labor**. *NLS Handbook, 2000*. Washington, DC: US Department of Labor, 2000.
18 **Diego MA**, Field T, Hernandez-Reif M, *et al*. Prepartum, postpartum, and chronic depression effects on newborns. *Psychiatry* 2004;**67**:63–80.
19 **Zich JM**, Attkisson CC, Greenfield TK. Screening for depression in primary care clinics: the CES-D and the BDI. *Int J Psychiatry Med* 1990;**20**:259–77.
20 **Wilcox H**, Field T, Prodromidis M, *et al*. Correlations between the BDI and CES-D in a sample of adolescent mothers. *Adolescence* 1998;**33**:565–74.
21 **Lyons-Ruth K**, Easterbrooks M, Cibelli C. Infant attachment strategies, infant mental lag, and maternal depressive symptoms: predictors of internalizing and externalizing problemsw at age 7. *Dev Psychol* 1997;**33**:681–92.
22 **Luoma I**, Tamminen T, Kaukonen P, *et al*. Longitudinal study of maternal depressive symptoms and child well-being. *J Am Acad Child Adolesc Psychiatry* 2001;**40**:1367–74.
23 **Achenbach T**, Edelbrock C. Behavioral problems and competencies reported by parents of normal and disturbed children aged four through sixteeen. *Monogr Soc Res Child Dev* 1981;**46**:1–82.

24 **Hosmer DW**, Lemeshow S. *Applied logistic regression*. New York: John Wiley & Sons, 1989.
25 **Morrongiello BA**, Midgett C, Stanton K. Gender biases in children's appraisals of injury risk and other children's risk-taking behaviors. *J Exp Child Psychol* 2000;**77**:317–36.
26 **Morrongiello BA**, Dawber T. Mothers' responses to sons and daughters engaging injury-risk behaviors on a playground: implciations for sex differences in injury rates. *J Exp Child Psychol* 2000;**76**:89–103.
27 **Judd CM**, Kenny DA. Process analysis: estimating mediation in treatment evaluations. *Eval Rev* 1981;**5**:602–19.
28 **Huang B**, Sivaganesan S, Succop P, *et al*. Statistical assessment of mediational effects for logistic mediational models. *Stat Med* 2004;**23**:2713–28.
29 **Morrongiello BA**, Corbett M, McCourt M, *et al*. Understanding unintentional injury risk in young children. II. The contribution of caregiver supervision, child attributes, and parent attributes. *J Pediatr Psychol* 2006;**31**:540–51.
30 **Mott J**. Personal and family predictors of children's medically attended injuries that occurred in the home. *Inj Prev* 1999;**5**:189–93.
31 **Lyons RA**, Newcombe RG, Jones SJ, *et al*. Injuries in homes with certain built forms. *Am J Prev Med* 2006;**30**:513–20.
32 **Newman SJ**, Schnare AB. Subsidizing shelter: the relationship between welfare and housing assistance. Washington, DC: Urban Institute, 1988:88–1.
33 **Kahn RS**, Brandt D, Whitaker RC. Combined effect of mother's and fathers' mental health symptoms on children's behavioral and emotional well-being. *Arch Pediatr Adolesc Med* 2004;**158**:721–9.
34 **Schwebel DC**. The role of impulsivity in children's estimation of physical ability: implications for children's unintentional injury risk. *Am J Orthopsychiatry* 2004;**74**:584–8.
35 **Pastor PN**, Reuben CA. Identified attention-deficit/hyperactivity disorder and medically attended, nonfatal injuries: US school-age children, 1997–2002. *Ambul Pediatr* 2006;**6**:38–44.
36 **Pachter LM**, Auinger P, Palmer R, *et al*. Do parenting and the home environment, maternal depression, neighborhood, and chronic poverty affect child behavioral problems differently in different racial-ethnic groups? *Pediatrics* 2006;**117**:1329–38.
37 **Morrongiello BA**. Caregiver supervision and child-injury risk. I. Issues in defining and measuring supervision. II. Findings and directions for future research. *J Pediatr Psychol* 2005;**30**:536–52.
38 **Morrongiello BA**, Corbett M. The parent supervision attributes profile questionnaire: a measure of supervision relevant to children's risk of unintentional injury. *Inj Prev* 2006;**12**:19–23.
39 **Kitzman H**, Olds D, Henderson C, *et al*. Effect of prenatal and infancy home visitation by nurses on pregnancy outcomes, childhood injuries, and repeated childbearing: a randomized controlled trial. *JAMA* 1997;**278**:644–52.
40 **Kotch JB**, Browne DC, Ringwalt CL, *et al*. Stress, social support, and substantiated maltreatment in the second and third years of life. *Child Abuse Negl* 1997;**21**:1025–37.
41 **Weissman MM**, Pilowsky DJ, Wickramaratne PJ, *et al*. Remissions in maternal depression and child psychopathology: a STAR*D-child report. *JAMA* 2006;**295**:1389–98.
42 **Paulson JF**, Dauber S, Leiferman JA. Individual and combined effects of postpartum depression in mothers and fathers on parenting behavior. *Pediatrics* 2006;**118**:659–68.
43 **Cummings P**, Rivara FP, Thompson RS, *et al*. Ability of parents to recall the injuries of their young children. *Inj Prev* 2005;**11**:43–7.
44 **D'Souza-Vazirani D**, Minkovitz CS, Strobino D. Validity of maternal report of acute health care use for children younger than 3 years. *Arch Pediatr Adolesc Med* 2005;**159**:167–72.
45 **Mandl KD**, Tronick EZ, Brennan TA, *et al*. Infant health care use and maternal depression. *Arch Pediatr Adolesc Med* 1999;**153**:808–13.
46 **Sills MR**, Shetterly S, Xu S, *et al*. Association between parental depression and children's health care use. *Pediatrics* 2007;**119**:e829–36.
47 **Watson JM**, Kemper KJ. Maternal factors and child's health care use. *Soc Sci Med* 1995;**40**:623–8.

LACUNAE

Road incidents cost Ghana 1.6% of GDP

The deputy director of the Research, Monitoring and Evaluation of the National Road Safety Commission, David Osafo Adonteng, indicated that Ghana ''wastes'' more than 1.2 trillion cedi (€94 million, US$128 million) annually on road-traffic injuries. The cost involved in road-traffic injuries means that 1.6 percent of the country's gross domestic product per annum is channeled into solving the road-traffic injuries' situation. Ten thousand fatal traffic incidents occur annually on roads in Ghana, in which 1600 people die and 15 000 are seriously injured.

David Osafo Adonteng, who was speaking at the National Road Safety Evaluation and Strategic Workshop in Kumasi in August, said the ''Ghana Road Safety Commission was targeting a reduction of road traffic accident fatalities systematically on [a] yearly basis and also [aimed to] achieve a single digit in accident fatality rate by the year 2015,'' adding that ''such [a] feat could be achieved through prudent administrative measures, while efforts should be made to improve and enforce existing laws on road traffic regulations.''

The Evaluation and Strategic Workshop, which brought together all the stakeholders in the Road industry, such as the Motor Transport and Traffic Unit, Driver and Vehicle Licensing Authority, National Association of Driving Schools, and broadcasting industry, as well as the National Insurance Commission, sought to discuss and strategize effectively as to how to achieve the country's vision of making Ghana's road transportation system the safest in Africa. It was also to devise mechanisms as to the way forward in achieving a single-digit fatality rate in road-traffic incidents in Ghana.

Mr Adonteng disclosed that the number of road-traffic incidents, fatalities, and registered vehicles in Ghana between 2001 and 2005 indicated that road-traffic incidents increased to 11 291 in 2001 with 1660 fatalities, but in 2002 they decreased slightly to 10 718 with 1665 fatalities. In 2003, road-traffic incidents decreased further to 10 644, but fatalities rose to 1718. In 2004 they rose sharply to 12 164 and decreased slightly again to 11 305 in 2005.

The deputy director said that the Commission needed to undertake nationwide planning and development of road-safety education and maintain a comprehensive database and reports related to road safety in the country.

From *The Statesman* (http://tinyurl.com/2lbvqj). Contributed by Mike Hayes.