Risk for Minor Childhood Injury: An Investigation of Maternal and Child Factors

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Objective To examine how maternal and child characteristics interact to moderate injury rate and injury severity for young children. Methods In this study, 149 mothers reported their toddlers' injuries over a 6-month period during biweekly interviews. Mothers completed questionnaires assessing parenting behaviors, psychological characteristics, and their children's injury-relevant behaviors. Results Maternal locus of control was found to moderate the association between children's risky behavior and child injury rate. Specifically, an external locus of control was associated with increased child injury rate for high-risk but not for low-risk children. Conclusion These findings illuminate the potential importance of parental locus of control in moderating high-risk injury-relevant behavior.

Key words unintentional injury; children; parental locus of control; prevention; risky behavior.

Although childhood deaths from unintentional injury declined by 45.3% between 1979 and 1996, unintentional injuries remain the leading cause of death for children in the United States (Centers for Disease Control, 1990; Rivara, 1999). Moreover, approximately 13.5 per every 100,000 children in the United States died of unintentional injury in the year 2001 (National Center for Injury Prevention and Control, Office of Statistics and Programming, 2002). Thus, more research on child unintentional injuries is needed to reduce this serious threat to children’s health and well-being.

Research on the etiology of unintentional child injury has focused on both child factors and parental factors, but little attention has been given to the effects of potential interactions between these variables on children’s risk for injury. Bell (1968, 1979) was one of the first scientists to note that children’s development is not only shaped by their parents’ behavior toward them but rather by reciprocal interactions with their parents.

Child characteristics that have been examined as predictors of injury rate include behavior, gender, and age. For example, children with behavior problems, such as those who are more active, aggressive, inattentive, temperamentally difficult, or low on inhibitory control have been found to be at increased risk for injury (Bradbury, Janicke, Riley, & Finney, 1999; Jaques & Finney, 1994; Matheny, 1987; Schwebel & Plumert, 1999; Schwebel, Speltz, Jones, & Bardina, 2002). Other investigators have shown that children’s risky behavior significantly predicts child injury rates (Speltz, Gonzales, Sulzbacher, & Quan, 1990) and that child gender is associated with child injury rate as well as risk appraisal. Boys have been found to rate injury risk as lower than girls (Hillier & Morrongiello, 1998), to have a higher overall rate of injury, and to be more likely to sustain certain types of injuries, such as falls and bicycle injuries (Armson & Pollard, 1986; Rivara, Bergman, Lo Gerfo, & Weiss, 1982; Rosen, & Peterson, 1990). Research suggests that younger child age is a significant predictor of increased injury rate (Bradbury et al., 1999) and that younger children, such as toddlers, have higher mortality rates from unintentional injuries than do older children (Baker, O’Neill, Ginsburg, & Li, 1992; Fingerhut & Kleinman, 1989).
Prior research also has focused on maternal characteristics, including maternal mental health, maternal stress level, and maternal developmental knowledge. Several studies have indicated that the presence of psychopathology in one or both parents significantly increases the likelihood of child injury. One study investigating the family background of children with a history of repeat injuries found that serious psychiatric or physical illness was present in 50% of the parents (Husband & Hinton, 1972). Other researchers have found a relationship between both maternal anxiety (Bradbury et al., 1999) and depression (Russell, 1998) and increased child risk for injury. For example, maternal personality characteristics, such as neuroticism, have been implicated in increased risk of child injury (Davidson, Hughes, & Richards, 1987). Similarly, Matheny (1987) found that the likelihood of child injuries was lower for mothers who were emotionally stable, more energetic, and more actively engaged in the world.

Maternal stress also has been found to be an important contributor to child injury rate or severity. For example, some studies have found that children who live in homes headed by single mothers (McCormick, Shapiro, & Starfield, 1981; Rivara & Barber, 1985) or in divorced households (Dawson, 1991) tend to sustain higher rates of injury. Other research suggests that disadvantaged economic status is related to higher injury rate (Rivara & Barber, 1985).

Related to maternal stress (MTSR) are mothers’ beliefs about their ability to control their children’s behavior. Parental locus of control refers to parents’ perception of their ability to control their children and their perception of whether their children’s behavior is controlled by fate. Those with an external locus of control feel unable to control their children’s behavior and have low self-efficacy with regard to parenting (Campis, Lyman, & Prentice-Dunn, 1986). Thus, mothers who have an external locus of control may feel incapable of preventing their children’s risky behavior and may engage in fewer injury prevention behaviors. Research on parental locus of control suggests that mothers of children with behavior problems, such as high rates of externalizing behaviors, have a more external locus of control than do mothers with nonexternalizing children (Morton, 1997). Thus, children who exhibit high rates of risky behavior may be at an increased risk for injury, both as a result of their own behavior and because their mothers do not attempt to correct their behavior.

In examining interactions between child and maternal characteristics, quality of the parent–child relationship has not been investigated as a factor in the etiology of injury; however, in keeping with Bell’s (1968, 1979) conceptualization of child development, it may be an important factor to consider when examining children’s risk for injury. Mothers’ feelings of closeness with their children may be reflected in their degree of investment in parenting, which is likely related to their injury prevention behaviors. For example, Brown and Davidson (1978) found that children were at an increased risk of injury only during periods of maternal depression, when mothers reported increased irritability and loss of interest in their children.

In summary, these findings highlight the contribution of both maternal and child characteristics in predicting injury rate and severity. As noted above, injury researchers have not yet fully investigated the complexity of injury etiology because they have not examined the effect of potential interactions between maternal and child characteristics on injury rate and severity. Thus, this study investigates maternal psychopathology, maternal stress, maternal locus of control, and mother–child relationship as moderators of the relationship between children’s risky behavior and children’s injury rate. (In preliminary analyses, the researchers also examined the effects of maternal control and risky maternal beliefs in the model; however, these composites were low in internal reliability and their inclusion in the model had no substantive effects on the outcome. Readers can contact the authors for further information about these analyses.) The study also examines the aforementioned maternal characteristics as moderators of the relationship between children’s risky behavior and their injury severity.

Study Hypotheses

The researchers hypothesized that each of the maternal risk variables would interact with child injury risk behavior (CIRS) such that the combination of high levels of maternal risk factors (i.e., psychopathology, stress, externalizing locus of control) and high CIRS would predict higher rates and severity of injury. Mothers who are high in risk factors, such as psychopathology, stress, and externalizing locus of control are likely to have less motivation and emotional resources to counteract the effects of their children’s risky behavior. In contrast, mothers who are relatively low in these risk factors may be more attuned to their children’s risky behavior and take active steps to prevent injury.

The researchers also hypothesized that mother–child relationship quality would interact with CIRS such that high-risk children with closer relationships to their mothers would have fewer and less severe injuries than those with poor relationships with their mothers. Mothers
who feel emotionally close to their children are likely to be more invested in their children’s well-being and might also find it easier to monitor their children (Schwebel et al., 2002). Research indicates that children with disruptive and highly active behavior tend to have disturbed relationships with their parents (Johnston & Mash, 2001), suggesting that high quality parent–child relationships may moderate the relation of child risky behavior and injury rate and severity.

**Method**

**Participants**

Mothers (n = 181) of children in two age groups were recruited. The first age group included children between the ages of 15 and 18 months, and the second group included children between the ages of 33 and 36 months. These age groups were selected based on epidemiological research suggesting that other than infants, toddlers are most at risk for injury (Baker et al., 1992) and that mothers may reduce their injury prevention behaviors when their children are between 18 and 33 months (Gralinski & Kopp, 1993). To reduce differences attributable to birth order and number of children in the home, mothers were excluded from the study if they had more than one child (unless they had an older child who was more than 10 years older than the target child). Mothers were also excluded if their children had been hospitalized overnight for an injury or had a developmental disability, because these factors might systematically alter mothers’ safety related behaviors. Last, mothers who were not proficient in English were excluded. The majority of recruited mothers completed all six months of the study (n = 161, 89%); however, 20 mothers dropped out of the study before completion. Ten of the remaining mothers did not complete one or more of the questionnaires included in this study; thus, our final sample size for this study was 151.

The children of the mothers in the study included approximately equal numbers of males (56%) and females (44%). With regard to ethnicity, the vast majority of mothers were Caucasian (91%), while the rest were African American (5%), Asian American or Hispanic (2% combined), or other (2%). The majority of mothers were married (83%), while 8% were never married, and 4% indicated that they were living with a partner. The rest were divorced, separated or widowed (5%). Mothers were predominantly of middle to upper class social strata, with a mean SES of 46.46 (SD = 10.95; range = 21–66) on the Hollingshead Four Factor Index (Hollingshead, 1975). Mean family gross annual income was between $35,000 and 40,000, while modal income was over $55,000 and ranged from less than $5,000 to over 55,000. The majority of mothers were college graduates (46%) or had attended some college (20%), and 18% had received some postcollege education. Slightly less than half of the mothers were employed 30 or more hours per week (42.4%), and mothers were largely in their mid-to-late 20s (M = 28.8, SD = 4.36; range 17–39).

Participants were recruited from the community using a patient list of telephone numbers from a local pediatric center, flyers in local businesses, letters to daycare centers and parent groups, and weekly advertising (in the community newspaper and a local advertisement newspaper). Mothers were paid $574.00 for participating. To reduce participant attrition, half of this amount was paid in monthly blocks ($45.60 per month), and the remaining half of the money was paid when the mothers completed the project.

**Procedures**

Mothers were trained to use the Participant Event Monitoring (PEM) procedure to record details about each injury sustained by their children (Peterson, DiLillo, Lewis, & Sher, 2002). Mothers’ reports of children’s injuries were obtained during biweekly, 2-hour interviews conducted over a 6-month period. Mothers also completed several measures assessing child injury-relevant behaviors and measures related to their own mental health, attitudes about parenting, and parenting practices. These measures were completed as “filler” and were administered to mothers after they completed their biweekly interviews to fill in the remaining 2-hour time block allotted for the interview. This procedure was used to discourage mothers from attempting to reduce the length of the interview by reporting fewer injuries. Thus, the questionnaires were administered at different points in time throughout the 6-month period.

**Measures**

In addition to SES and three single-scale construct measures (e.g., parental locus of control, mean injury rate, and maximum injury severity), several composite measures were created to measure each construct broadly while controlling for the likelihood of Type I error. Each composite score was computed as the average of the standardized (M = 0, SD = 1) constituent scores. Tables I and II summarize the descriptive statistics for each of the composite measures. Two criterion variables were examined, child injury rate and injury severity. Single scale measures as well as composites are described below, followed by a description of individual measures contained within each composite.
Child Variables

Child Injury Rate

This study investigated minor injuries. Thus, to study the mechanisms underlying the injury process, investigators have asserted that minor everyday injury events are an appropriate proxy for more serious injury. Furthermore, medically attended injuries are a low base-rate phenomenon. As Peterson et al. (2002) notes, it is unclear as to whether medically attended injuries are consistently more severe than nonmedically attended injuries because factors that contribute to a caregivers’ decision to seek medical attention extend beyond the actual severity of an injury (Peterson et al., 2002). Indeed, in an earlier article examining minor injury rates, Peterson et al. (2002) reported that 72% of child injuries were rated as having the potential to be more severe than they actually were.

Child injury rate was assessed in biweekly structured interviews conducted with mothers over a 6-month period (Peterson et al., 2002). Mothers were instructed to record information about every injury that their child sustained during the 6-month period. To screen out superficial injuries that fade quickly (e.g., red marks), injuries were defined as any specific outcome of an event that could be seen (e.g., a bruise, bump) or felt by the child (e.g., a sprained muscle), and that lasted for a minimum of 24 h. The mean number of injuries per child per 2-week period was 2.38 (SD = 1.34, range = 0.25–8.25). Injury events that were recorded included those that mothers witnessed or those that were reported by other caregivers, such as day care workers. Often, day care workers provided written injury reports for injuries that they witnessed.

<p>| Table I. Descriptive Statistics for Composite and Noncomposite Child Measures |
|-----------------------------------|-----|-----|-----|-----|</p>
<table>
<thead>
<tr>
<th>Composite scale</th>
<th>α</th>
<th>Measure</th>
</tr>
</thead>
<tbody>
<tr>
<td>Child risk behavior (CIRS)</td>
<td>.82</td>
<td>Child Behavior Checklist</td>
</tr>
<tr>
<td></td>
<td>.96</td>
<td>Injury Behavior Checklist</td>
</tr>
<tr>
<td></td>
<td>.85</td>
<td>Toddler Behavior Assessment Questionnaire—activity level</td>
</tr>
<tr>
<td></td>
<td>.73</td>
<td>Toddler Behavior Checklist—oppositional</td>
</tr>
<tr>
<td></td>
<td>.88</td>
<td>Toddler Behavior Checklist—aggression</td>
</tr>
<tr>
<td></td>
<td>.74</td>
<td>Toddler Behavior Checklist—immaturity</td>
</tr>
<tr>
<td>Mean injury rate</td>
<td></td>
<td>2.38</td>
</tr>
<tr>
<td>Maximum injury severity</td>
<td></td>
<td>2.86</td>
</tr>
</tbody>
</table>

‘Obtained from scale authors’ published data.

<p>| Table II. Descriptive Statistics for Composite and Noncomposite Child Measures |
|-----------------------------------|-----|-----|-----|-----|</p>
<table>
<thead>
<tr>
<th>Composite scale</th>
<th>α</th>
<th>Measure</th>
</tr>
</thead>
<tbody>
<tr>
<td>Maternal psychopathology (MPAT)</td>
<td>.81</td>
<td>Brief Symptom Inventory—Global Severity Index</td>
</tr>
<tr>
<td></td>
<td>.87</td>
<td>CES-Depression Inventory</td>
</tr>
<tr>
<td></td>
<td>.86</td>
<td>Multiple Affect Adjective Checklist</td>
</tr>
<tr>
<td></td>
<td>.87</td>
<td>(anxiety, depression, and hostility)</td>
</tr>
<tr>
<td>Maternal stress (MSTR)</td>
<td>.71</td>
<td>0.00</td>
</tr>
<tr>
<td></td>
<td>.93</td>
<td>Dyadic Adjustment Scale</td>
</tr>
<tr>
<td></td>
<td>.79</td>
<td>Parenting Daily Hassles—intensity</td>
</tr>
<tr>
<td></td>
<td>.79</td>
<td>Parenting Stress Inventory—child domain</td>
</tr>
<tr>
<td></td>
<td>.81</td>
<td>Parenting Stress Inventory—parent domain</td>
</tr>
<tr>
<td></td>
<td>NA</td>
<td>Parenting Stress Inventory—life domain</td>
</tr>
<tr>
<td></td>
<td>.72</td>
<td>Parental Opinion Questionnaire</td>
</tr>
<tr>
<td>Mother–child relationship (MCR)</td>
<td>.63</td>
<td>0.00</td>
</tr>
<tr>
<td></td>
<td>.72</td>
<td>Home observation for measurement of the</td>
</tr>
<tr>
<td></td>
<td>.67</td>
<td>environment—emotional and verbal responsivity</td>
</tr>
<tr>
<td></td>
<td>.69</td>
<td>HOME—acceptance of children’s behavior</td>
</tr>
<tr>
<td></td>
<td>.85</td>
<td>HOME—parental involvement with child</td>
</tr>
<tr>
<td>Parental locus of control</td>
<td></td>
<td>108.06</td>
</tr>
</tbody>
</table>

NA, scale alpha not available.

‘Obtained from scale authors’ published data.
Injuries that appeared on the child with an unknown origin (e.g., a small bruise on the child’s shin) were recorded and included in the injury rate statistic; however, the complete interview protocol was not followed for these injuries due to mothers’ lack of information about the circumstances surrounding the injury event.

Injury Severity
The second criterion variable of interest was maximum injury severity. During the interview, mothers were instructed to draw the exact size and shape of each injury and to indicate the location of the injury on the body, using a diagram of a child’s body. Interviewers then queried the mothers about other detailed aspects of the injury, such as the amount of blood loss or the color of a bruise. Injury severity was then coded using the Minor Injury Severity Scale (MISS; Peterson, Saldana, & Heiblum, 1996). Coders using the MISS rely on information about the injury, such as size, shape, and depth to code injury severity on a 7-point Likert scale, where “0 = no tissue damage lasting 24 h” and “6 = a disabling injury or death.” Injury severity was coded for each injury event; however, because each family had several injury events, for the present analyses, the maximum injury severity score for each family was used.

Child Risk Behavior
A composite measure was created to assess child behavior characteristics shown to be associated with higher rates of child injury, such as aggression, high activity level, behavior problems, and emotional reactivity. This composite, referred to as the Child Injury Risk Scale (CIRS), has high internal reliability (α = .82). CIRS scores were computed as the mean of standardized scores from the Child Behavior Checklist (CBCL; Achenbach, 1992), the Injury Behavior Checklist (IBC; Speltz et al. 1990), the activity scale from the Toddler Behavior Assessment Questionnaire (TBAQ; Goldsmith, 1996), and the oppositional, aggression, and immaturity subscales from the Toddler Behavior Checklist (TBC; Larzelere, Martin, & Amberson, 1989).

The Child Behavior Checklist (CBCL/2–3; Achenbach, 1992) is a 103-item questionnaire designed specifically to tap early child temperament. Six subscale scores can be computed from the parents’ responses; however, activity level was the only scale used for the current analyses. Published internal reliability for maternal reports are good, with subscale alphas ranging from .86 to .89 (Goldsmith, 1996). Further, evidence supports the construct validity and longitudinal reliability of the TBAQ (Goldsmith, 1996).

The TBC (Larzelere et al. 1989) is a 103-item questionnaire designed to assess children’s social and emotional characteristics. Five subscale scores can be computed; however, only four were included in this study (i.e., oppositional behavior, immaturity, emotional instability, and physical aggression). Internal reliability is high for most of the subscales and ranges from 0.67 to 0.91. Mean scores on each of the three subscales were similar to published norms, except that our sample mean for immaturity was lower than the published mean (Larzelere, Martin, & Amberson, 1989).

Maternal Variables
Parental Locus of Control
The Parental Locus of Control Scale (PLOC; Campis et al. 1986) is an instrument designed to assess whether caregivers have an internal or external locus of control with regard to parenting. The PLOC is a 47-item measure consisting of questions regarding parents’ beliefs, such as “What I do has little effect on my child’s behavior.” Parents respond using a 5-point Likert scale (1, “strongly disagree” to 5, “strongly agree”). This scale has high reliability (α = .92) and validity (Campis et al., 1986). Higher scores indicate an external locus of control while lower scores indicate an internal locus of control. A total scale score was used for these analyses.

Maternal Psychopathology
This composite measure, referred to as MPAT (α = .81), was computed using the mothers’ total scores from the Brief Symptom Inventory (BSI; Derogatis & Melisaratos, 1983) and the CES-D Depression Inventory (Radloff, 1977). An average of mothers’ scores from the anxiety, depression, and hostility subscales of the Multiple Affect Adjective Checklist Revised (MAACL-R; Lubin et al., 1986; Zuckerman & Lubin, 1985) were also used to compute MPAT scores.
The BSI (Derogatis & Melisaratos, 1983) is a 53-item scale designed to assess nine categories of psychological symptoms. Only the Global Severity Index score was used for the current analyses. A test–retest study of the global severity index yielded a stability coefficient of 0.90 (Derogatis & Melisaratos, 1983). As can be seen in Table I, the mean score for the current sample was 0.08 (SD = 0.06), which is below the normative scores for a nonpatient sample (Derogatis & Melisaratos, 1983).

The Center for Epidemiologic Studies Depression Scale (Radloff, 1977) was designed for assessment of depression in the general population. The CES-D exhibits good internal reliability (α >.80), and test–retest correlations ranging from .31 to .67 (Radloff, 1977). A total score from this measure was used for the current analyses. The mean score for our sample was similar to scores obtained by the measure’s author in a community sample (Radloff, 1977).

The MAACL-R (Lubin et al. 1986) is a 132-item list of adjectives that can be used to measure affective states or traits for adults. Responses can be aggregated into five subscales. For the current analyses we used an average of three subscales, including anxiety, depression, and hostility. Each scale exhibits reliability that is typically above 0.75 (Lubin et al., 1986), and subjects in the current sample scored similarly to a national sample of women assessed by Zuckerman & Lubin (1985).

Maternal Stress
A composite measure of stress (MTSR) (α = .71) was created from the mothers’ scores on the Dyadic Adjustment Scale (DAS; Spanier, 1976; Spanier & Thompson, 1982) and the intensity subscale of the Parenting Daily Hassles Scale (PDH; Crnic & Greenberg, 1990). Sub-scale scores from the three stress domains measured by the Parenting Stress Index (PSI; Loyd & Abidin, 1985) were also used to compute the composite MTSR scores.

The DAS (Spanier, 1976; Spanier & Thompson, 1982) is a 32-item measure designed to assess the quality of romantic relationships and partners’ relationship satisfaction. Research indicates that the DAS exhibits good internal reliability (α > .90) and construct validity (Spanier & Thompson, 1982). The reverse score of this measure was included in these analyses (indicating a low level of adjustment). The mean score for mothers in the current sample was above average for reported measures of marital satisfaction (Spanier, 1976).

The PDH (Crnic & Greenberg, 1990) is a 20-item measure that assesses parent’s day-to-day level of stress. When completing the PDH, parents use a 4-point scale to report the frequency of several day-to-day parent–child interactions as well as the extent to which they feel hassled by these interactions. Only the hassle-intensity sub-scale score was used in the current analyses (α = .90). Mothers’ ratings of hassle intensity in the current sample were close to that of a similar sample examined by Crnic & Greenberg (1990), such that the current mean is 42.58 (SD = 8.91), and the comparison mean was 41.8 (SD = 12.2).

The PSI (Loyd & Abidin, 1985) is a 120-item measure designed to assess relative psychological stress in parent–child relationships. Internal reliability for PSI responses is good (α = .95). The PSI contains several subscales that each represent different sources of parenting stress including parent characteristics, child characteristics, and life stress, all of which were used in the present analyses. Average mothers in the current sample scored within the 50th percentile for the parent domain, the 40th percentile for the child domain, and within the 10th percentile for the life stress scale; all of which are within normative levels (Abidin, 1995).

Mother–Child Relationship
Mothers’ scores on three subscales of the HOME Observation for Measurement of the Environment Scale (HOME; Caldwell & Bradley, 1984) were used to create a composite measure to reflect the quality of the mother–child relationship (MCR, α = .63), including the emotional and verbal responsivity subscale, the acceptance of child’s behavior subscale, and maternal involvement with child subscale. The HOME assesses several characteristics of a child’s home environment. Comprised of 45 items, the HOME is administered through interviews with caretakers in addition to home observations. The assessor responds to questionnaire items, either positively or negatively, to indicate whether the family has particular material objects available to the child (e.g., “family has a pet”) or engages in certain behaviors (e.g., “mother reads stories to child at least three times weekly”). Internal reliability of the HOME has been found to be high (α = .90), and the subscales are moderately correlated with classroom behavior and academic achievement (Bradley, Caldwell, Rock, & Hamrick, 1988). The average score of mothers in our sample was above published norms.

Results
Descriptive statistics for all measures are summarized in Tables I and II. Maternal and child variables fell within the range of nonclinical samples. The mean biweekly injury rate in this sample (M = 2.38, SD = 1.34) is lower than a similar study conducted with older children (M = 6.54, SD = 2.21) by Peterson, Moreno, and Harbeck-Weber (1993). Males had a significantly higher biweekly
injury rate ($M = 2.59$, $SD = 1.41$) than females ($M = 2.16$, $SD = 1.22$), $t(150) = 1.99$, $p = .05$; however, the number of children who sustained at least one medically attended injury did not differ significantly between males ($n = 92$) and females ($n = 78$), $X^2 = 0.14$, $p = .71$. The mean score for maximum severity was moderately severe, $M = 2.86$, $SD = 0.61$, median = 3.0 (0, no tissue damage lasting 24 h, 6, a disabling injury or death).

Bivariate correlations are presented in Table III. As can be seen, child gender was negatively related to injury rate ($r = 0.16$, $p = .05$) so that male gender was associated with more injuries. Child injury risk behavior was positively associated with injury rate ($r = 0.19$, $p = .02$), parental locus of control (PLOC; $r = 0.22$, $p = .007$), MPAT ($r = 0.34$, $p < .0001$), and MTSR ($r = 0.47$, $p < .0001$).

### Assessing Interactive Effects of Child Behavior and Maternal Characteristics

#### Child Injury Rate

One regression analysis was utilized to determine whether any of the composite scores moderated the relationship between child risk behavior and child injury rate. Scores on all predictor variables were centered to a mean of 0 prior to computation of cross-product terms. Five control variables were included in the model because these factors appear to be associated with injury rates: child age, sex, time of year (summer vs. winter—at time of study enrollment), maternal age, and socioeconomic status (Fingerhut & Kleinman, 1989; Peterson et al., 2002; Rivara et al., 1982). The model also included the CIRS composite in addition to all of the mother-related variables (MPAT, MTSR, maternal locus of control, and mother–child relationship) and all interactions between these variables and the CIRS. The model significantly predicted child injury rate [$F(14, 138) = 2.00$, $p = .02$, $R^2 = 0.17$].

Results for the individual predictors are summarized in Table IV. Similar to previous research, child injury risk behavior (CIRS) significantly predicted child injury rate ($\hat{\beta} = .27$, $p = .004$). Maternal stress also emerged as a significant predictor of child injury ($\hat{\beta} = -.32$, $p = .003$), so that increased MTSR predicted a decrease in child injury rates. Child injury risk behavior interacted significantly with maternal locus of control to predict child injury rate ($\hat{\beta} = .24$, $p = .001$), and the interaction between child injury risk and MTSR approached significance ($\hat{\beta} = -.19$, $p = .07$). Examination of the PLOC–CIRS interaction (Fig. 1; Aiken & West, 1991) indicates that children who exhibit high rates of risky behavior and who also have mothers with an external locus of control sustain relatively more injuries than high-risk children of mothers with an internal locus of control. High-risk children of mothers with an internal locus of control sustain approximately the same number of injuries as low-risk children of mothers with an internal locus of control.

#### Injury Severity

A second regression analysis was conducted to examine if any of the maternal variables moderated the relationship between child risk behavior and maximum injury severity. Scores on all predictor variables were centered to a mean of 0 prior to computation of cross-product terms. This model included all of the same control and predictor variables as the first model (Table IV). None of the main or interaction terms were significant predictors of maximum injury severity, and the overall model was not significant, $F(14, 138) = 1.23$, $p = .26$, $R^2 = 0.11$.

### Discussion

This study examined the potential impact of interactions between maternal and child characteristics on child injury...
rate and injury severity. Specifically, we investigated whether children’s risky behavior was moderated by maternal characteristics, including psychopathology, maternal locus of control, stress, and mother–child relationship quality. Our most salient finding involved an interaction between maternal locus of control and child injury risk behavior that showed a moderating effect of maternal locus of control on injury rate. We found that high-risk children of mothers with an external locus of control sustained more injuries than high-risk children of mothers with an internal locus of control. In addition, children of mothers with an internal locus of control sustained approximately

| Table IV. Summary of Regression Analyses for Maternal and Child Variables as Predictors of Child Injury Rate and Maximum Injury Severity |
|---------------------------------------------------------------|-------------------|-------------------|
| Child injury rate                                              | Maximum injury severity |
| **B** | **SE** | **β** | **B** | **SE** | **β** |
| Child age | −0.03 | 0.22 | −0.01 | −0.04 | 0.11 | −0.03 |
| Child gender | −0.36 | 0.22 | −0.14 | −0.11 | 0.10 | −0.09 |
| Time of year (season) | −0.22 | 0.22 | −0.08 | 0.01 | 0.10 | 0.01 |
| Maternal age | 0.00 | 0.03 | 0.00 | −0.01 | 0.01 | −0.05 |
| SES | 0.00 | 0.01 | 0.05 | −0.01 | 0.01 | −0.14 |
| Child Injury Risk Scale (CIRS) | 0.53 | 0.18 | 0.27** | −0.55 | 0.56 | −0.63 |
| Maternal variables |
| Maternal locus of control (PLOC) | 0.01 | 0.01 | 0.11 | −0.00 | 0.00 | −0.12 |
| Maternal psychopathology (MPAT) | 0.18 | 0.16 | 0.11 | 0.01 | 0.08 | 0.02 |
| Maternal stress (MTSR) | −0.66 | 0.22 | −0.32** | 0.06 | 0.10 | 0.06 |
| Mother–child relationship (MCR) | 0.13 | 0.15 | 0.07 | 0.11 | 0.07 | 0.14 |
| Two-way interactions |
| CIRSxLOC | 0.03 | 0.01 | 0.24** | 0.01 | 0.01 | 0.78 |
| CIRSxMPAT | 0.14 | 0.23 | 0.06 | −0.02 | 0.11 | −0.02 |
| CIRSxMTSR | −0.57 | 0.31 | −0.19*** | 0.04 | 0.15 | 0.03 |
| CIRSxMCR | −0.03 | 0.22 | −0.01 | 0.00 | 0.10 | 0.00 |

N = 151. *p < .05. **p < .01. ***p < .08.

Figure 1. Simple effects of maternal locus of control on child injury rate.
the same number of injuries, regardless of their risky behavior. Perhaps mothers with an external locus of control feel more helpless with regard to parenting and believe that their actions are ineffective. Thus, they may be less active in trying to control their children’s behavior or to take injury prevention steps. In contrast, high-risk children of mothers with an internal locus of control may not sustain more injuries than low-risk children because these mothers take a more active stance, believing that they are able to control their children’s behavior.

Alternatively, mothers may develop a more external locus of control because of their children’s increased injury rate or high-risk behavior, and they may develop an internal locus of control as a result of their children’s lower injury rates or low-risk behavior. Indeed, research on locus of control indicates that it may fluctuate with environmental events (Lefcourt, 1982; Roberts, Joe, & Rowe-Hallbert, 1992). Longitudinal research, examining changes in child risk behavior, maternal locus of control, and child injury rates may help to further explain the relationship between these variables.

Contrary to expectations, we found a main effect for MTSR so that injury rate increased when mothers were less stressed. One potential explanation may be that stressed mothers are actively engaged in behaviors to reduce injury to their children and therefore feel more stress, whereas other mothers may be less actively engaged with their children. The interaction between MTSR and child behavior was only marginally significant; yet, it may have reached significance with a larger sample size. Finally, we did not find any significant main or interaction effects for MPAT or mother–child relationship quality. Given that MPAT has been found to be related to injury rate in prior research (Bradbury et al., 1999; Brown & Davidson, 1978), it is somewhat surprising that this variable was not a significant predictor. However, as noted in the methods section, our sample fell within the average range on psychopathology and parent–child relationship measures. Thus, it is possible that we did not have sufficient variability on these measures to find hypothesized effects. We also did not find any significant effects when using maximum injury severity as an outcome variable. This may be due to the fact that there were few severe injuries; the majority of injuries in the sample were mild to moderate.

**Strengths and Limitations**

This study investigated a wide range of caregiver characteristics that may influence child injury rate and severity as well as interactions between caregiver and child characteristics. Little research has investigated how maternal characteristics moderate child variables to predict injury rate and severity. Thus, this study fills a large gap in the literature. Understanding what combinations of maternal and child characteristics might lead to increased injury can help in creating more focused interventions.

Another important strength of this study is its focus on nonmedically attended injuries. Most injury studies obtain data from medical records, whereas the current investigation employed a methodology in which data were obtained for all children’s injuries over a 6-month period, regardless of injury severity. Using everyday injuries afforded us a much higher base-rate of injuries and allowed us to collect a rich set of data. In addition, regardless of whether children receive medical attention for an injury, they may still experience significant amounts of physical and emotional discomfort because of the injury. Thus, although these data may serve as a proxy for more serious injuries, they also provide information that is relevant to families’ everyday lives (Peterson et al., 2002).

A limitation of the current investigation is the primarily Caucasian and upper to middle class demographic composition of the sample. Although these findings are important, they may not generalize to minority mothers or mothers of lower social strata. The limited variability in subject characteristics may also have prevented us from detecting effects of other variables that have been indicated in the past to relate to child injury rate (e.g., MPAT). This limited variability in the sample may also be responsible for our unexpected findings with regard to MTSR, given that this group of mothers possesses characteristics that are associated with lower stress levels. In addition, although this study deliberately focused on children most at risk for injury, the sample did represent a narrow age range. More research is needed to determine if these data can be generalized to older children.

Further research that would allow a clearer interpretation of these findings is also needed. For example, it is unclear whether mothers’ locus of control impacts their children’s risky behavior or vice versa. As noted above, longitudinal data may help to answer such questions. Because of the fact that mothers were reporters for their own characteristics and their children’s injury rate, it is possible that the dependent variables and independent variables were confounded. For example, mothers with a more externalizing locus of control or with a higher stress level may be more likely to report fewer injuries. There was an effort to account for injuries that were not reported by mothers, such that visible injuries
that were not reported were probed; however, these accounted for a very small percentage of total injuries. In addition, a bigger sample size may have enabled us to examine a larger number of more severe injuries, and we may have been able to better examine predictors of injury severity.

Last, despite our inclusion of several relevant variables in the models, much variance in our data remains to be explained. It is difficult to accurately model the complex personal, interpersonal, and environmental factors that precede individual injury events. The development of more precise prediction models remains a challenge for us and other injury prevention researchers.

**Prevention Implications**

Our findings suggest that maternal locus of control may moderate the effect of child risky behavior on child injury rates. Thus, this study illuminates the importance of investigating maternal locus of control as a potential mechanism in the etiology of child injury. Such information may provide us with a means for identifying parents whose children are at increased risk for injury occurrences so that future injuries may be prevented. For example, Roberts et al. (1992) found that they were able to decrease maternal locus of control scores for parents of oppositional children using parent training aimed at increasing child compliance. Thus, perhaps similar training can be used to lower child injury rates.

These findings also provide preliminary evidence that maternal characteristics may interact with child characteristics to influence injury rates. Thus, research on interactions between other maternal and child characteristics and their impact on child injury rates may yield valuable information about the etiology of child injuries. Such information can serve as the foundation for new approaches to child injury prevention efforts.

References


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