Interactions Between Child Behavior Patterns and Parenting: Implications for Children’s Unintentional Injury Risk

David C. Schwebel,¹ PhD, Carl M. Brezausek,² MS, Sharon L. Ramey,³ PhD, and Craig T. Ramey,³ PhD
¹Department of Psychology, University of Alabama at Birmingham, ²Center for Educational Accountability, University of Alabama at Birmingham, and ³Georgetown University Center on Health and Education, Georgetown University

Objectives  Two factors were considered as predictors of children's risk for unintentional injury: (a) children’s temperamentally difficult behavior patterns and (b) parenting. Along with hypotheses to replicate previous univariate effects, it was hypothesized that active, involved parents with sufficient time resources might reduce injury risk among temperamentally at-risk children. Methods  Study 1 used a retrospective design with a diverse sample of over 10,000 5-year-olds. Study 2 replicated Study 1 using a prospective design and behavioral data from a sample of over 1,000 children followed from 6 to 36 months of age. Results  In Study 1, male gender, child hyperactivity, and family poverty predicted injury in a univariate manner. In Study 2, male gender and lack of positive parenting predicted injury in a univariate manner. Interaction effects also emerged: in Study 1 the interaction between child hyperactivity and parental time resources protected children from injury, and in Study 2 the interaction between child's difficult temperament and positive parenting protected children from injury. Conclusions  Children at increased risk for injury, i.e., those with hyperactive and difficult behavior patterns, might be protected in the environment of positive parenting. Theoretically, results suggest that researchers should consider Temperament × Environment interactions along with univariate predictors of outcome behavior. From an applied perspective, results have implications for the design of injury prevention campaigns: Parents who spend positive time with temperamentally difficult children might protect them from injury.

Key words  injury; parenting; temperament; hyperactivity; safety.

Unintentional injuries are the leading cause of pediatric mortality, causing more deaths among children ages 1–18 years than any other cause (National Safety Council, 2001). Although the rate of injury among American children has declined slightly over the past three decades, the mortality rate from injuries continues to decline at a rate far inferior to the comparable decline in mortality from most congenital and contagious illnesses.

One risk factor that has consistently been reported as related to children's injury is a set of impulsive, undercontrolled, and hyperactive behavior patterns. First elaborated in a large-scale epidemiological study (Manheimer & Mellinger, 1967), this set of traits has been linked to injury in both retrospective (e.g., Bijur, Stewart-Brown, & Butler, 1986; Matheny, 1991; Plumert & Schwebel, 1997) and prospective (e.g., Bijur, Goldberg, & Haslum, 1988; Langley, McGee, Silva, & Williams,
longitudinal designs at a wide range of developmental stages through childhood and adolescence.

Recently, temperament theorists have emphasized the importance of considering behavior patterns within the context of the environment in which they are expressed (Wachs & Kohnstamm, 2001). Temperamentally impulsive children are known to be at increased risk for injury (Schwebel & Plumert, 1999), for example, but temperamental impulsivity only causes injury when expressed in an environmental context with hazards present. One aspect of the environmental context that might reduce injury risk among children with impulsive, hyperactive, and undercontrolled behavior patterns is parental supervision. Supervising parents take an active role in preventing hazardous engagement in the environment (Morrongiello & Dawber, 1998), and the extent of parental supervision appears to be related to children's risk for injury (Morrongiello, Midgett, & Shields, 2001; Schwebel & Bounds, 2003).

To date, little research has examined how parenting might influence injury in children considered to be at increased risk. A few studies have found independent contributions of parenting factors and child behavior within the same sample. Studying a British cohort of about 11,000 children, for example, Bijur and her colleagues (1986) found that parent report of children's aggressive and overactive behavior at age 5 predicted injuries requiring professional medical attention over the previous 5 years, as did the presence of young mothers and mothers with poor physical and mental health in the same sample. In a follow-up study with the same sample, injury between the ages of 5 and 10 years was predicted by traits measured during the age-5 assessment; both child aggression and youthful motherhood remained strong predictors of injury risk (Bijur et al., 1988). Bijur, Kurzon, Hamelsky, and Power (1991) achieved similar results with a different cohort of British adolescents, finding that adolescent antisocial and overactive behavior as well as parent/adolescent conflict were significant predictors of injury. Finally, one study with a clinical sample in the United States supports the possibility that children's behavior patterns and parenting factors independently predict injury risk: A case-control sample of 4-year-old children with behavior disorders and matched controls found that a diagnosis of oppositional defiant disorder and avoidant attachment patterns by the primary caregiver both predicted injuries requiring professional medical attention over the subsequent 2 years (Schwebel, Speltz, Jones, & Bardina, 2002).

Available data suggest, therefore, that children's impulsive, hyperactive behavior patterns are related to increased risk of injury and that inadequate parenting might also be independently related to increased injury risk in the same samples. To date, no empirical data speak to the possibility that active, positive parenting might reduce injury among children at risk for injury due to difficult behavior patterns. The present study was designed to test this possibility. Two archival datasets with large North American samples were used to examine this question. Study 1 used a retrospective design with questionnaire data available from a sample of over 10,000 children and their caregivers. Study 2 utilized a prospective design on data collected both through behavioral observation and caregiver report with a sample of over 1,000 children followed from birth until age 3.

Study 1

Method

Data for Study 1 came from the National Head Start/Public School Early Childhood Transition Demonstration Study, a multisite randomized longitudinal investigation designed to study the implementation of a comprehensive Head Start-like transition program (Head Start Bureau, 1996; Ramey & Ramey, 1992; Ramey et al., 2000). Data used in this analysis were collected from October 1992 through May 1994 from over 10,000 children as they transitioned into kindergarten from Head Start, home, or other preschool programs.

Data were collected by research assistants who were trained and supervised by local site evaluators at each of 30 sites. Site evaluators received training from the central research staff at the University of Alabama at Birmingham Civitan International Research Center to ensure standardization of data collection across sites. At each site, data were collected from four sources: standardized direct assessments of the children, interviews with the primary caregiver, ratings by the children's teachers, and systematic review of school records. After data collection, data were transmitted to the Civitan Center, where entry, preparation, and analysis took place. Extensive checks were conducted on all data to ensure accuracy.

Subjects

Children and their families were recruited from 30 Head Start transition programs in two cohorts. The first cohort
included 3,540 former Head Start children and their families, enrolled shortly before or after entry into kindergarten in the fall of 1992. The second included 3,975 former Head Start children and their families, enrolled as they entered kindergarten in the fall of 1993. Additionally, 22 of the 30 sites enrolled children and families who did not attend Head Start prior to entering kindergarten. This additional enrollment yielded 1,697 non-Head Start children and families in Cohort 1 and 1,617 non-Head Start children and families in Cohort 2.

Children in both cohorts were randomly assigned by school to one of two conditions—one group received an intervention, and the other served as a comparison control group. Because parents in both cohorts reported children's injury history only during the initial interview, data from only the first measurement period of the longitudinal study are reported in the present study. Further, because the present report used data from only the first assessment, before the intervention, group assignment was not considered.

With cohorts and conditions merged, data from a total of 10,829 children are included in the present report. This sample is racially and geographically diverse, includes children in rural and urban settings, and samples primarily low-income families. Mean age for the sample at the initial measurement time was 5.76 years ($SD = 0.38$). When English proficiency was limited, interviews were conducted in the native language of the family; 17 sites administered interviews in Spanish, 2 sites in Vietnamese, 2 sites in Hmong, 2 sites in Cambodian, and 1 site in Navajo.

To ensure that cohort and group effects did not bias the data, reported analyses were replicated with cohort and group controlled, and results were similar. Previous reports have also compared the groups on a number of key variables and found no significant differences (Ramey et al., 2000). Among the variables tested for group and cohort effects were (1) characteristics of the child, including gender, presence of a health condition that interfered with school attendance, receptive language ability on the Peabody Picture Vocabulary Test, and social skills on the Social Skills Rating System; (2) characteristics of the primary caregiver, including ethnicity, immigrant status, employment status, education level, chronic health condition that interfered with raising the child, and a depression screening; and (3) characteristics of the family, including presence of mother in the home, presence of father or father figure in the home, family mobility within the past year, receipt of money under Aid for Families with Dependent Children, receipt of Social Security payments, household income, and use of a language other than English in the home.

**Measures**

All measures used in this analysis were collected from reports by the primary caregiver. Specifics of measures are outlined below and descriptive data are presented in Tables I and II.

**Unintentional Injury**

Caregivers reported the number of injuries children had experienced in the previous year that required professional medical attention.

**Child Characteristics**

Caregiver report yielded children's gender, ethnicity, and history of diagnosis or treatment for problems with hyperactivity.

**Family Characteristics**

To assess family size, caregivers reported the total number of adults and children in the household (range = 2–24). To assess family poverty, the family's annual income was divided by a computed poverty level based on standardized tables published by the U.S. Department of Health and Human Services (DHHS, 2003). These tables take geographic location, cost of living, and size of family into consideration.

**Parenting Characteristics**

Three measures of parenting were assessed: the extent to which the family maintained regular routines, the family's time resources, and the parenting approaches and beliefs of the primary caregiver.

**Family Routines**

To assess family routines, a modified version of the Family Routines Questionnaire (Boyle, Jensen, James, & Peacock, 1983) was administered to caregivers. Frequency of routine activities such as eating dinner together as a family, children going to sleep at a regular time, and working parents coming home at a regular time was scored on a 4-point scale from *every day* to *almost never*. The scale included 32 items; total score was a sum of scores on all items, with items reversed as appropriate (range = 16.00 to 93.00). This measure has been related to the success of former Head Start children in elementary school (Keltner, 1990) and is considered...
to reflect family values and organization (i.e., higher scores reflect less chaotic routines and more positive family cohesion). Internal consistency in the present sample was acceptable (Cronbach’s α = 0.71).

Family Time Resources
To assess time resources in the family, the Family Resource Scale (FRS) (Dunst & Leet, 1987) was administered. Because the FRS was originally developed and validated on a sample of less than 100 children (Dunst & Leet, 1987), revalidation was conducted using the National Transition Demonstration Study data (Ramey et al., 2000). An exploratory principal-components factor analysis was conducted with the first cohort, followed by a confirmatory factor analysis with the second cohort of the study. This analysis yielded a three-factor structure that encompassed three highly intuitive sets of resources in the family: basic needs, money, and time. Subscales were created to represent these three factors and had adequate internal reliability (Cronbach’s α ranged from 0.72 to 0.87). Of particular interest for the purposes of the study were the temporal resources in the family: How much time was available to parents for desired activities, including time to be with children? The scale included seven items that were averaged to create a total score (range 1.00 to 5.00). Other items on the scale assessed time for sleep/rest and time to be by oneself.

Parenting Approaches and Beliefs
To assess parenting approaches and beliefs, the 26-item Short Form of the Parenting Dimensions Inventory (PDI) (Slater & Power, 1987) was given to caregivers to assess parenting approaches and beliefs. The PDI includes four scales: nurturance, responsiveness to child input, nonrestrictive attitude, and consistency. Nurturance is defined as a warm, supportive, and affectionate relationship between parent and child. Responsiveness to child suggests that the parent is open to the feelings and desires of the child and indicates some degree of parental flexibility. Nonrestrictive attitude suggests that the parent gives the child freedom for expression, experimentation, and exploration. Consistency indicates stability and predictability in the parenting approach. Each of the four scales has five to eight items that are rated on a 5-point Likert scale; total score on each scale is the sum.
of all items. The full range was used for most scales (for nurturance, range = 7.00–36.00; for nonrestrictive attitude, range = 7.00–42.00; for responsiveness to child, range = 7.00–30.00; for consistency, range = 8.00–48.00). In the present sample, the scales for nurturance (Cronbach’s \( \alpha = .81 \)) and nonrestrictive attitude (Cronbach’s \( \alpha = .70 \)) had adequate internal validity. The scales for responsiveness to child (Cronbach’s \( \alpha = .61 \)) and consistency (Cronbach’s \( \alpha = .55 \)) had moderate internal validity. Work with other samples indicates good convergent validity with related constructs (Slater & Power, 1987).

**Results**

The data analysis plan involved two steps. First, descriptive analyses were conducted among the variables, including a comparison of predictor variables among the injured and noninjured groups. Second, a logistic regression equation was constructed to predict injury.

**Step 1: Descriptive Analysis**

The first step of data analysis examined the prevalence of injuries among the sample. Because it was rare for children to have more than one injury requiring professional medical attention over the previous year, injury status was collapsed into presence of injury versus lack of injury. Of those who responded, 76.7% reported no injuries in the previous year that required professional medical attention, and 23.3% reported at least one injury that required professional medical attention.

Table I lists descriptive data for categorical variables of interest, both for the overall sample and for the injured and noninjured groups separately. The injured and noninjured groups differed on several variables. Injured children were significantly more likely to be male and white (non-Hispanic) and to have hyperactivity problems. Injured children were also significantly more likely to have a mother with an education level of at least a high school diploma. Table II lists descriptive data for continuous variables of interest, both for the overall sample and for the injured and noninjured groups separately. The injured and noninjured groups differed on two variables; the injured sample was more likely to have parents with a nonrestrictive attitude and to come from a family with fewer time resources.

**Step 2: Logistic Regression Analysis**

The primary analysis was a logistic regression equation used to predict presence or absence of injury requiring medical attention over the previous year. The model fit was assessed using the Hosmer and Lemeshow goodness-of-fit statistic, and the null hypothesis that the model fit the data was retained, \( \chi^2(8) = 9.40, p > .05 \). As shown in Table III, the strongest univariate predictor of injury in the model was child hyperactivity (OR = 28.39). Nonrestrictive parenting was also a modestly significant predictor of injury (OR = 1.02). Two univariate variables were significantly protective from injury: female gender (OR = 0.69) and family poverty level (OR = 0.87).

Interactions between hyperactivity and parenting variables were also entered into the logistic regression model. One interaction, Family Time Resources \( \times \) Child Hyperactivity, emerged as a significant protective factor (OR = 0.62), suggesting that parents who had more adequate temporal resources protected their hyperactive children from injury.

**Discussion**

Understanding the individual and family factors that may lead to increased risk for unintentional injury is a crucial aspect of injury prevention. Results from Study 1 confirm that univariate predictors such as child hyperactivity and child gender predict injuries. Children whose parents had at least a high school diploma were more likely to be injured, perhaps because educated parents were more likely to seek professional medical treatment for their injured children.

Children’s hyperactivity was a particularly strong predictor of injury (OR = 28.39). However, injuries invariably occur due to a complex set of risk factors, and therefore interactions between children’s behavior patterns and the environment they act within are also important to identify. The present results suggest that parents who have ample temporal resources might actually protect hyperactive children from injury. In other words, although children with hyperactive disorders had much higher rates of injury than other children in the sample, those children with hyperactive disorders whose parents reported adequate temporal resources had fewer injuries than the other children in the sample. One possible explanation for this finding is that parents who have ample temporal resources are able to spend more time with their children, thus supervising their children more carefully and therefore moderating the injury-prone tendencies of their hyperactive children.
Theoretically, this possibility is supported. The positive effect of supervision on reducing childhood injury is documented (Gaërling & Gaërling, 1995; Morrongiello et al., 2001; Peterson, Ewigman, & Kivlahan, 1993). Recent evidence also suggests that the effect of parental supervision might cause temperamentally difficult children to engage more cautiously in potentially dangerous environments (Schwebel & Bounds, 2003). Thus, it is consistent with other findings that hyperactive children, though generally at increased risk for injury, might be protected from injury by skilled parents who have sufficient time to supervise and engage with them.

Study 1 used a large and diverse sample size to retrospectively predict injuries over the previous year using parental report data. Study 1 had limitations, however. Most crucially, it relied on parent report in a retrospective design. Study 2 was developed to rectify limitations of Study 1 and further investigate the possible interaction between children’s behavior patterns and parental supervision as a protective factor from childhood unintentional injury. Like Study 1, data came from a large, nationally representative sample. To test the robustness of the finding, data examining younger children were selected for Study 2. A prospective design was used, assessing child and family characteristics when the child was 6 months of age, which predicted injuries over the subsequent 30 months. Finally, both behavioral and observational measures of the child’s temperament and the caregiver’s parenting skills were available.

Study 2

Method and Participants

Data for Study 2 came from the longitudinal Study of Early Child Care by the National Institute of Child Health and Human Development (NICHD Early Child Care Research Network, 1994, 1998, 2001). Children were recruited from 10 geographically diverse hospitals. In total, 1,364 children were recruited and entered into the study at 1 month of age. At the 36-month assessment, 1,041 of the original 1,364 families provided data. The sample was 80% white, 13% African American, and 7% other ethnicities. Mothers had an average of 14.31 years of education. Details of the recruitment procedures and demographic details about the sample are available elsewhere (e.g., NICHD, 1994).

Data reported in the present study were collected through questionnaires at 1 month, phone calls or face-to-face interviews at 3-month intervals from 9 through 36 months, and face-to-face contact with families at 6 months. Details on data collection at these and other times are reported elsewhere (e.g., NICHD, 1994).

Measures

Data in the NICHD Study of Early Child Care were collected through a variety of questionnaire and behavioral techniques. Information concerning relevant variables is presented below.

Demographic Information

Parents reported child gender and mother’s education level (range = 7–21 years) during an interview at the 1-month initial assessment period. Parents reported the number of individuals in the household (range = 2–15) and total household income (range = $2,500 to $315,000) during an interview at the 6-month assessment.
Child Temperament

This parameter was measured at age 6 months through mother report using the My Baby–6 questionnaire, which was developed for use in the NICHD Study of Early Child Care. Due to difficulties with parents omitting large numbers of items that did not apply to their baby, all 55 items were averaged into a single scale (Appelbaum, Batten, & Wendell, 1994). Each item was answered on a 6-point Likert scale (range of scores = 2.06 to 4.44). Data from this sample indicate good internal reliability (Cronbach’s $\alpha = .81$). High scores on the scale represent more difficult temperament (i.e., a child who is higher in approach, activity, intensity, and mood and lower in adaptability).

Child Activity Level

At 6 months, all participants were videotaped during an 8-minute interaction with the caregiver. Caregivers were provided with a mat to lie on and several toys. Videotapes were reviewed by trained coders, and children were rated on a set of variables. Most relevant to the present study was a rating of child activity level, which was scored on a 4-point scale from not at all active to highly active (range = 1–4).

Parent Social Interaction

When children were 7 months, parents were interviewed to determine the way they spent time with their children during the previous day. Detailed telephone interviews were conducted to elicit every event the caregiver participated in, even if for brief periods of time (e.g., washing dishes for 5 minutes, showering for 10 minutes, etc.). Of particular interest for the present study was the caregivers' report of time spent in social interaction with the child participating in the study. As recommended by the NICHD Early Child Care Group (Coleman, Batten, Appelbaum, & Wendell, 1995), this measure was computed by summing times parents reported they spent with children, interacting with the child, helping or teaching the child, or going on organized outings with the child. Both the primary activity of the caregiver and a secondary activity, such as “watching TV and playing a board game with the child,” were included in the score (range = 0–545 minutes). Because some caregivers reported on single-day versus two-day bases, workdays versus nonworkdays, or weekdays versus weekends, the last reporting day available for each parent was chosen for analysis.

Positive Parenting

The Infant/Toddler HOME (Home Observation for Measurement of the Environment) Inventory (Bradley & Caldwell, 1988) was conducted when children were 6 months of age to evaluate the home environment. Observers visited the home and interviewed parents. Binary decisions were made about various aspects of the home environment as observed during the visit. For example, raters scored whether parents read to the child or shouted at/were hostile to the child. Factor analyses were conducted on the 45-item inventory and indicated that several of the measures were not directly relevant to the home environment of 6-month-old children (e.g., “family has a pet,” “push or pull toy present”). Those items were dropped and a principal components analysis was conducted with the remaining 25 items. That analysis yielded a single factor with an eigenvalue greater than 2, which was labeled positive parenting and included 9 items with factor loadings greater than or equal to .4 (e.g., “parent spontaneously vocalizes to child at least twice,” “parent structures child’s play periods”; Little, Appelbaum, Batten, & Wendell, 1994). Responses to those 9 items were summed to create the full measure (range = 0–9).

Injury History

Caregivers reported their children’s history of injuries requiring professional medical attention on a quarterly basis, through either telephone interviews or interviews during scheduled visits by research staff. For the purposes of this study, all injuries reported by parents from the 9-month phone assessment until the 36-month visit were summed to create a single measure of injuries experienced from 6 to 36 months. This permitted a prospective analysis to predict injuries from age 6 to 36 months based on the measures collected at the 6- and 7-month evaluation periods.

Results

Table IV lists the descriptive statistics for all variables. Caregivers reported that children had a mean of 0.35 injuries over the 30-month period ($SD = 0.64$, range = 0–4 injuries). A backward elimination linear regression analysis was conducted. Each variable listed in Table IV served as a predictor variable, with the exception of the number of injuries, which was the dependent variable. Four interactions were also computed and entered: child’s activity level by positive parenting, child’s activity...
level by parent’s social interaction with child, child’s temperament by positive parenting, and child’s temperament by parent’s social interaction with child. Table V illustrates the results. Using a criterion of $p < .10$ to drop variables out of the model, six univariate predictors and two interactional predictors were retained in the final model. Three of the variables retained were significant at the $p < .05$ level: child sex, positive parenting, and the interaction between temperament and positive parenting.

**Discussion**

Like Study 1, the univariate predictors that emerged from the model in Study 2 were consistent with previous findings: Boys had significantly more injuries than girls, and children with parents who showed positive parenting were protected from injury. Of particular interest was the replication of an interactional effect. In Study 2, the interaction between children’s temperament and positive parenting was related to reduced injury risk, such that high-quality interactive parenting for children who have difficult temperaments served to protect the children from injury. In other words, children with difficult temperaments whose parents were observed to use positive parenting techniques had fewer injuries than other children in the sample.

In Study 1, 5-year-old children who were seen by a professional for hyperactive behavior and whose parents reported having adequate time resources were better protected from injury over the previous year than those whose parents did not report adequate time resources. In Study 2, 6-month-old infants rated by their parents as temperamentally active, intense, and moody were protected from injury over the subsequent 30 months if the parents were observed to have good parenting skills during an observational and interview assessment when the infant was 6 months old. Taken together, results from both studies suggest that an environment with active, positive parents who have sufficient time to spend with children might reduce injury risk among children typically thought to be at increased risk for injury—children with difficult and hyperactive behavior patterns. Stated in the opposite direction, children without difficult behavior patterns, children typically viewed as protected from injury, were at increased risk for injury when in the care of inactive or poor parents without sufficient temporal resources. This trend was identified in both studies, even though Study 1 used a retrospective design and Study 2 a prospective one, the parenting and child behavior constructs were defined and measured differently in the two studies, the children in the two studies were of different ages and developmental stages, and the sample demographics differed greatly.

These findings have theoretical and applied implications. Theoretically, both temperament and psychopathology theorists have emphasized the role of environmental context in affecting children’s behavior, a notion that this research supports empirically. Temperament researchers, building on the early notion by Thomas and Chess (1977) of “goodness of fit,” recognize that temperament is expressed in reaction to the context of the environment (Wachs & Kohnstamm, 2001).

---

### Table IV. Characteristics of Study 2 Sample

<table>
<thead>
<tr>
<th>Variable</th>
<th>M (SD)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Family characteristics</td>
<td></td>
</tr>
<tr>
<td>Household size (number of people)</td>
<td>4.04 (1.27)</td>
</tr>
<tr>
<td>Household income ($/year)</td>
<td>48,720 (39,968)</td>
</tr>
<tr>
<td>Child characteristics (% male = 52%)</td>
<td></td>
</tr>
<tr>
<td>Activity level</td>
<td>2.45 (.57)</td>
</tr>
<tr>
<td>Temperament</td>
<td>3.18 (.40)</td>
</tr>
<tr>
<td>Number of injuries</td>
<td>0.35 (0.64)</td>
</tr>
<tr>
<td>Parent characteristics</td>
<td></td>
</tr>
<tr>
<td>Mothers’ years of education</td>
<td>14.23 (2.51)</td>
</tr>
<tr>
<td>Positive parenting</td>
<td>7.08 (1.77)</td>
</tr>
<tr>
<td>Social interaction with child</td>
<td>124.05 (98.93)</td>
</tr>
</tbody>
</table>

### Table V. Study 2 Backward Elimination Linear Regression Predicting Injuries, Ages 6–36 Months

<table>
<thead>
<tr>
<th>Predictor (6–7 months)</th>
<th>$F$</th>
</tr>
</thead>
<tbody>
<tr>
<td>Univariate predictors</td>
<td></td>
</tr>
<tr>
<td>Household size</td>
<td>3.43*</td>
</tr>
<tr>
<td>Household income</td>
<td>3.49*</td>
</tr>
<tr>
<td>Mother education</td>
<td>3.30*</td>
</tr>
<tr>
<td>Child sex</td>
<td>4.78**</td>
</tr>
<tr>
<td>Parent’s social interaction with child</td>
<td>2.83*</td>
</tr>
<tr>
<td>Positive parenting</td>
<td>6.67***</td>
</tr>
<tr>
<td>Interactional predictors</td>
<td></td>
</tr>
<tr>
<td>Child temperament by parent’s social interaction</td>
<td>2.98*</td>
</tr>
<tr>
<td>Child temperament by positive parenting</td>
<td>4.08**</td>
</tr>
</tbody>
</table>

The following variables were entered but dropped out of the model because the probability of the $F$ statistic was $p < .10$ in the following order: child temperament, child activity level by parent’s social interaction with child, child activity level, child activity level by positive parenting. On final step, $R^2 = 0.02; F(8, 1052) = 2.67, p < .01.$

* $p < .10,$ ** $p < .05,$ *** $p < .01.$
Children’s temperament drives behavior, but that behavior is expressed only in response to particular environments. Thus, hyperactive children might injure themselves when unsupervised, but those same children, when supervised by capable parents, might be protected from injury (Morrongiello & Dawber, 2000; Schwebel & Bounds, 2003). Psychopathology researchers reach a similar conclusion when they consider the role of the family environment in promoting or preventing hyperactivity and conduct disorders. For example, Bates, Pettit, Dodge, and Ridge (1998) found that the interaction between resistant temperament and parental restrictive control during infancy and toddlerhood predicted increased externalizing behavior in middle childhood.

The role of the environment in affecting children’s behavioral tendencies is not a new concept (Bronfenbrenner, 1988; Scarr & McCartney, 1983; Thomas & Chess, 1977). However, the present results suggest its importance in yet another domain of children’s functioning: behavior in potentially dangerous environments. From an applied perspective, the results suggest that injuries might be prevented by prohibiting at-risk children from engaging unsupervised in dangerous environments. In Study 1, the OR for hyperactivity predicting injury was 28.39, suggesting that such children were over 2,800% more likely to experience an injury than their nonhyperactive counterparts. Any mechanism that might reduce this tremendous risk is worthy of applied scientific exploration. A relatively straightforward environmental manipulation might help prevent injury: the presence of parents who spend time with at-risk children.

Interventions targeted toward at-risk populations have achieved moderate success in other domains of injury prevention. Roberts, Alexander, and Knapp (1990), for example, determined that large numbers of children on school buses were not wearing safety belts. Through a behavioral reward system, the researchers were able to successfully increase the rate of safety-belt usage among the children. Peterson (1984) taught environmentally relevant safety lessons to “latchkey” children, i.e., those who were left home unattended after school for periods of time. Empirical tests of interventions focusing on supervision of children are limited, but epidemiological data suggest that decreased student-to-staff ratios on school playgrounds result in fewer playground injuries (Boyce, Sobolewski, Sprunger, & Schaefer, 1984).

Implementation of an intervention that would increase parental supervision for temperamentally difficult and hyperactive children is a challenging objective. Parents are typically resistant to change, particularly when the change involves their behavior in their own home. Initial initiatives might target more public places with nonparental supervisors. Installing crossing guards outside of schools, for instance, might reduce pedestrian injuries. Increasing adult presence on school playgrounds might reduce falls from playground equipment. Preliminary evidence from our laboratory suggests that an intervention designed to increase the attentiveness of playground monitors at a preschool reduced injury risk among the children (Schwebel, Summerlin, Bounds, & Morrongiello, 2004).

**Unexpected Results**

Although the primary goal of this study was to examine interactions between child behavior patterns and parenting strategies, two unexpected univariate findings also warrant discussion. In Study 1, parenting factors were not strong univariate predictors of injury. In Study 2, child temperament was not a significant predictor of injury.

A sizable body of research has developed that indicates parental supervision reduces risk for childhood injury (e.g., Morrongiello et al., 2001; Peterson, Ewigman, et al., 1993). This body of research is supported by findings from Study 2. In Study 1, however, none of the four scales of the PDI were strong predictors of injury risk (high levels of nonrestrictive parenting were marginally predictive of injury risk, OR = 1.02). Methodological, sampling, and theoretical explanations for the nonsignificant results emerge. Methodologically, most previous work, including Study 2, linked behavioral measures of parenting to injury risk rather than parent self-report measures like that used in Study 1. It may be that self-report biases influenced the results. From the perspective of sampling, most previous work has studied primarily white, financially comfortable samples in North America and Europe. Study 1 sampled low-income families from diverse backgrounds across North America. Finally, theoretical explanations are also plausible. The PDI assesses somewhat different constructs than those measured in previous work. Previous work has emphasized parental attentiveness and time with the child rather than factors such as parenting approaches and beliefs.

A second unexpected finding was the failure of temperament to predict injury risk in Study 2. Again, a large body of literature, including Study 1, supports a link between children's temperamental behavior
patterns and risk for injury (e.g., Bijur et al., 1986, 1988; Matheny, 1991; Plumert & Schwebel, 1997; Schwebel & Plumert, 1999). Methodologically, due to a large quantity of missing data, the NICHD team summed scores from a number of temperament scales to create a single estimate of children’s temperament (Appelbaum et al., 1994). That aggregated scale might have lacked the specificity of temperamental traits used previously. Developmentally, most previous work on behavior and injury risk has been conducted with older children. Developmental change in temperamental expression or injury etiology may explain the nonfinding.

Limitations

In closing, two limitations should be mentioned. Most prominently, both studies relied on caregiver report of injuries requiring professional medical attention as the criterion variable. Although this is a standard measure in the injury literature, it has limitations. Some parents seek medical treatment when others might not because of differences in finances, medical insurance, emotions, experience with injury, and judgment. Further, such measures are influenced by recall bias. Study 1 relied on caregiver memory for the previous year; Study 2 used 3-month interview intervals. Relatively short time periods of assessment are preferable (Harel et al., 1994; Peterson, Harbeck, & Moreno, 1993), but even with short intervals parents may still intentionally or unintentionally omit injury reports. A second limitation is that the studies were opportunistic secondary analyses of existing datasets, and therefore were limited to analysis of available measures. More comprehensive measures of parenting should be used, for example, in replication attempts.

Acknowledgments

Study 1 was supported by funds from the Administration on Children, Youth, and Families and the Civitan International Foundation. Study 2 was conducted by the NICHD Early Child Care Research Network supported by NICHD through a cooperative agreement that calls for scientific collaboration between the grantees and the NICHD staff. We thank the NICHD team for sharing their data. Secondary analysis of both studies was supported by funds from the Department of Psychology, the School of Social and Behavioral Sciences, by funds from the Department of Psychology and School of Social and Behavioral Sciences, University of Alabama at Birmingham, and from the Lloyd J. Rockhold Center for Child Development.

Received November 12, 2002; revisions received March 14, 2003 and May 13, 2003; accepted May 15, 2003

References


Youth, and Families and the University of Alabama, Birmingham.


