# Interactions Between Child Behavior Patterns and Parent Supervision: Implications for Children's Risk of Unintentional Injury

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Abstract

Unintentional injuries are the leading cause of death for children. Prior research has implicated both child behavioral attributes and parent supervisory patterns as risk factors. The present study assessed interactions between these two risk factors and determined whether supervision moderates the relation between child attributes and injury. Mothers completed questionnaire measures of child attributes and supervisory patterns and also recorded how they supervised their young child (2 - 5 years) at home on each of 10 randomly selected days within a 3-week period. Results provide support for the moderating effect of supervision: supervision interacted with some child attributes to elevate children's risk of medically-attended injury and with other attributes to decrease injury risk. Implications for preventing childhood injuries are discussed.

Key words: unintentional injury, children, behavioral attributes, parent supervision, moderation

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## *Overview & Theoretical Formulation*

Unintentional injuries are the leading cause of pediatric mortality, causing more deaths for children 1 – 18 years than any other cause (Canadian Institute of Child Health, 2000; National Safety Council, 2001). Approximately one of four children experience a medically-attended injury each year in the United States (Scheidt et al., 1995) and experts estimate that at least 90% of these injuries are preventable (Rimsza, Schackner, Bowen, & Marshall, 2002). For children under 6 years of age the greatest risk of injury is in their homes (Rivara, 1995; Shanon, Bashaw, Lewis, & Feldman, 1992), which is surprising given children at these young ages are typically expected to be supervised. Recent research findings confirm that risk factors for injury to young children include not only child behavioral attributes but also caregiver supervisory patterns. Building on these findings, the aim of the present study was to explore the notion that injury risk arises from an *interaction* of child attributes and parent supervision. Hence, depending on a child's behavioral tendencies, supervision may or may not moderate the child's risk of injury.

This unique conceptualization of childhood injury risk breaks with the traditional main-effect models that permeate the injury epidemiology literature (see Schwebel & Barton, 2005 for further discussion), and garners support from theories and research on a variety of aspects of child development. Vygotsky's theory, for example, emphasizes the social-relational underpinnings of cognitive development, highlighting how interactions between aspects of the social-environmental context and the child's state of cognitive functioning serve to promote advancements in development (Langford, 2005). Similarly, interactions between child temperament and parenting have been shown to play an instrumental role in social-emotional development. Research by Kochanska and her

colleagues, for example, demonstrates that children's internalization of values and development of conscience arises not simply from parent socialization practices but from how these practices interact with the child's temperament (Kochanska, 1993; Koachanska, Aksan, & Joy, 2007; Kochanska, Tjebkes, & Forman, 1998). Thus, parenting practices that may appear to be well suited to a socialization goal, may actually fail to achieve this goal because of how these practices interact with a child's temperament.

When one considers how caregiver supervision may relate to childhood injury, this conceptualization suggests that efforts to develop 'standards' for supervision (Peterson, Ewigman, & Kivlahan, 1993) or to define what constitutes 'adequate' supervision (Coohey, 2003) are probably destined to fail because injury risk is a multi-determined outcome and caregiver supervision is only one of a number of determinants (see Morrongiello, 2005 for further discussion). The fact is that some children experience injuries even when caregivers are nearby and capable of supervising and other children do not experience injuries even though supervisors are not present and only supervise intermittently (Morrongiello, Ondejko, & Littlejohn, 2004a, b). We propose, therefore, that there are meaningful interactions between child attributes and caregiver supervision that contribute to explain differential risk for injury. In the present study, we specifically tested whether supervision moderates the relation between child attributes and injury outcomes.

*Child Behavioral Attributes and Injury Risk*

Child characteristics that have been associated with injury include certain child clinical disorders (e.g., Attention Deficit Hyperactivity Disorder, Oppositional Defiant Disorder), temperament traits (i.e., individual difference traits reflected in stable behavioral tendencies, e.g., sensation seeking) and aspects of cognitive functioning, such as attention and appraisal of risk (Bijur, Golding, Haslum, & Kurzon, 1988; Byrnes, Bawden, Beattie, & DeWolfe, 2003; Davidson, 1987;

Hillier & Morrongiello, 1998; Horwitz, Morgensten, DiPietro, & Morrison, 1988; Manheimer & Mellinger, 1967; Morrongiello & Lasenby, 2006; Schwebel & Plumert, 1999). Within preschool populations, because of the difficulty in diagnosing psychopathology at very young ages and the challenge of assessing cognitions about injury risk in those with limited verbal abilities, the research has focused primarily on identifying temperament-based behavioral traits that elevate young children's risk of injury.

Previous research findings indicate that preschool children who score higher in activity level, behavioral intensity (e.g., preference for boisterous activities), and sensation seeking (i.e., preference for seeking out risk-taking activities for affect arousal) are more likely to experience unintentional injuries (Bijur et al., 1988; Dal Santo, Goodman, Glik, & Jackson, 2004; Matheny, Jr., 1986; Morrongiello & Lasenby-Lessard, 2007; Schwebel & Plumert, 1999). In contrast, children scoring high in inhibitory control (e.g., ability to follow safety rules and inhibit dangerous behaviors) experience fewer injuries (Morrongiello, Corbett, McCourt, & Johnston, 2006b; Schwebel & Bounds, 2003; Schwebel & Plumert, 1999). Thus, children whose behavioral characteristics might lead them to have more frequent contact with environmental hazards are more likely to experience unintentional injury, whereas children whose self-controlled and inhibited behavioral characteristics might lead them to have fewer opportunities for interacting with hazards are less likely to experience injury. Interestingly, boys are more likely than girls to experience unintentional injury at all ages (Canadian Institute of Child Health, 2000; National Safety Council, 2001), relating perhaps to boys' greater likelihood of being identified as active, higher in sensation seeking, and less compliant with rules (Morrongiello & Dawber, 1998; Morrongiello & Lasenby-Lessard, 2007).

*Caregiver Supervision and Injury Risk*

Although there is a long history of speculation about the relation between caregiver supervision

and young children's risk of injury (Garbarino, 1988; Peterson, Farmer, & Mori, 1987; Peterson & Stern, 1997; Saldana & Peterson, 1998; Stratton, 1985), and many studies of children's injuries mention lapses in supervision as a potential contributing factor (Alwash & McCarthy, 1987; Brayden, MacLean, Jr., Bonfiglio, & Altemeier, 1993; Landen, Bauer, & Kohn, 2003), only recently have studies been completed that confirm direct relations between supervision and children's risk of injury (see Morrongiello, 2005 for a review of earlier literature). In a prospective study of children's home injuries over a 12-week period, examining the patterns of supervision provided to 2-3 year-olds at the time of injury revealed five levels of supervision, and as supervision level decreased there was an increase in the frequency of children's injuries (Morrongiello et al., 2004a, b). Similarly, research relating reports of supervision on a standardized measure (Parent Supervision Attributes Profile Questionnaire, PSAPQ: Morrongiello & Corbett, 2006; Morrongiello & House, 2004) to children's injuries reveals that mothers who more strongly endorse statements indicative of supervision (e.g., "I keep a close watch on my child") have children with fewer injuries.

Recently, investigators also have considered how often children routinely experience different types of supervisory patterns when at home. Results indicate that lower supervision levels (e.g., child out of view of supervisor) occur for about 8% of young children's awake time when at home with a parent (Morrongiello, Corbett, McCourt & Johnston, 2006a). The fact that not all children experience injuries under reduced supervision conditions, however, raises questions about why reduced supervision poses greater risk of injury for some children but not others. One possibility is that child behavioral attributes *interact* with supervision, elevating risk of injury more for some children than others. Schwebel and his colleagues, for example, report that when parents spend positive time with temperamentally difficult children this reduces the child's risk of injury, although how this occurs was not determined (Schwebel, Brezausek, Ramey, & Ramey, 2004). Similarly, Morrongiello found that

parents modify their supervisory practices based on children's behavioral attributes, supervising some children more closely than others (Morrongiello et al., 2006b). However, whether such differential supervision actually influences children's risk of injury was not considered.

*Present Study*

Building on the success of the participant event-monitoring methodology (Morrongiello, 1997; Morrongiello et al., 2004a; Peterson, DiLillo, Lewis, & Sher, 2002), mothers were trained to complete diary sheets to provide continuous records of supervision during the entire time the child was awake for each of 10 days, including weekday and weekend days; prior research reveals the importance of sampling both weekday and weekend days when one wants to obtain accurate estimates of *typical* levels of time-use activities (Juster & Stafford, 1985). The diary records provided information about time the child was left unsupervised versus supervised, who was the primary supervisor, and level of supervision provided under different circumstances (e.g., child in view versus out of view of supervisor). In addition, mothers completed standardized questionnaire measures that assessed supervision (PSAPQ), child attributes that have been linked to injury risk in previous research (activity level, behavioral inhibition, sensation seeking, behavioral intensity, and risk taking), and children's history of medically-attended injury. Analyses focused on assessing whether supervision moderates the relation between child attributes and injury-history scores.

Boys and girls in two age groups were included (2 and 5 years). Although few studies have direct measures of supervisory behaviors per se, parents report they believe that they less closely supervise older than younger children (Garling & Garling, 1993; Pollack-Nelson & Drago, 2002). There also is some indirect evidence to suggest that boys are less closely supervised than girls (Fagot, 1974; Fagot, 1978; Newson & Newson, 1976; Saegert & Hart, 1976), however, recent direct comparisons of home supervision revealed only one sex difference that supported this notion

(Morrongiello, Corbett, McCourt, & Johnston, 2006b). Thus, variation in supervision as a function of children's age seems a more robust finding than evidence of sex differences. These factors were considered in the present study.

## *Method*

### *Participants*

The sample included 124 mothers of children aged 2.5 years ($N$ = 62; 30 males, 32 females; $M$ = 2.62 years, $SD$ = .51) and 5 years ($N$ = 62; 32 males, 30 females; $M$ = 4.97 years, $SD$ = .41). Mothers were randomly selected from a database of over 12,000 families recruited from the community who were interested in participating in research relating to child development; Guelph is a suburban setting 1 hour from Toronto and the population includes a broad range of income and education levels, with some ethnic diversity. In this randomly-selected sample from the database, mothers were predominantly Caucasian, English speaking and generally well-educated, with 76 % having completed at least one university or college degree, 14% having completed some university or college courses, 7% having completed high school and 3% having some high school credits. Family income fell within the mid- to high-socioeconomic status range, with 35% earning $ 80,000 and above, 25% earning between $60,000 and $80,000, 24% earning between $40,000 and $60,000 and 13% earning under $40,000 per year; the remainder did not provide income data.

### *Measures*

Mothers were trained to complete: (a) diary recording sheets indicating how their time was spent while at home with their child on specified days; (b) measures assessing their own characteristics and demographic information; and (c) measures assessing their child's characteristics and injury history.

*Diary recording sheets.* Three types of sheets were completed by mothers as a given

recording day unfolded: (1) Time Use Sheet recorded how the mother and child spent time at home, with the major focus on supervision. Starting from the moment the child and mother were both awake and continuing until the child's bedtime, the mother recorded the clock time whenever a child's activity or room was changed, supervisor or type of supervision changed, or if the parent or child left the house. The mother also indicated who was supervising at the time of the entry (Mom, Dad, No One, Other) and whether or not the child was in view of the supervisor. (2) In-View Recording Sheet was used to code level of supervision (see Data Reduction below) and was completed every time a 'child in view of supervisor' entry was made on the Time Use Sheet. (3) Out of View Recording Sheet was completed to indicate the level of supervision (see Data Reduction below) when the child was out of view of the supervisor, as indicated on the Time Use Sheet.

*Parent and Child Attribute Measures.* Mothers completed the: (1) *Demographic Information Sheet t*o provide information about the mother's education and family income; (2) *Parent Supervision Attributes Profile Questionnaire* (PSAPQ; Morrongiello & Corbett, 2006; Morrongiello & House, 2004), which is a questionnaire that has proven valid and reliable as an index of maternal supervision that relates to child-injury risk. In addition to the total score ($\alpha = .76$), for each subscale, higher scores indicate closer supervision: general vigilance ($\alpha = .72$), supervision during child self-care tasks ($\alpha = .78$) and supervision during play ($\alpha = .78$); (3) *Injury History Questionnaire* provides an index of the frequency with which the child has sustained medically-attended injuries (physician or dentist treated) since birth; prior research confirms that mothers are accurate reporters about medically-attended injuries (Pless & Pless, 1995); (4) *Sensation Seeking Scale for Young Children* is based on a measure of sensation seeking recently validated for elementary-school age children (SSSC; Morrongiello & Lasenby, 2006); wording changes to some items were made to make them more applicable to young children. This provides a measure ($\alpha = .70$) of the personality attribute of sensation seeking (i.e.,

seeking of novel, daring, and emotionally arousing risk taking experiences); (5) *Injury Behavior Checklist* (IBC; Speltz, Gonzales, Sulzbacher, & Quan, 1990) provides a measure (α = .89) of a child's typical level of risk taking (e.g., "Jumps off furniture or other structures"); and (6) *Early Childhood Behavior Questionnaire* (ECBQ; Putnam, Gartstein, Rothbart, & Jones, 2006) measures a child's inhibitory control (α = .89), activity level (α = .73), and intensity of behavior (α = .81).

*Procedure*

Mothers were told that the researcher's aim was to determine how parents and children spend their time at home and how parents balance promoting independence with monitoring their child. At the first of two home visits, mothers completed the following measures in randomized order: *Demographic Information Sheet, Injury History Questionnaire*, and *Parent Supervision Attributes Profile Questionnaire*. During this approximately hour and a half visit, mothers also were given a binder with diary recording sheets and were trained in their proper completion. They were given a calendar with 10 'recording days' marked over the span of three weeks (including 6 weekdays, 2 Saturdays and 2 Sundays). It was emphasized that diary sheets should be completed continuously as events were unfolding on each recording day and mothers were given a clipboard to carry with them in the home to facilitate recording.

After three weeks, a second home visit was scheduled. In addition to collecting recording sheets, mothers also completed the remaining questionnaire measures in randomized order. Each mother was then thanked for participating and given $25 and a flowering plant.

*Data reduction*

Calculations relating to time spent in various supervision situations were based on clock times recorded on Time Use Sheets; all supervision measures included only situations in which the mother indicated that she was the primary supervisor, which occurred the majority of the time. Two such

supervision variables were calculated: (1) the proportion of time a mother spent with her child *in view* while she was the child's primary supervisor and (2) the proportion of time a mother indicated that she was *not supervising* (i.e., not watching the child at all or listening in on them for at least 5 minutes, cf. Morrongiello et al., 2004a) while she was the child's primary supervisor.

An *overall supervision* index was calculated based on ratings of supervision recorded on both In View and Out of View Recording Sheets. Ratings of supervision ranged from 1 (not watching or listening in while child *out of view*) to 9 (engaging in activity with child while *in view* of child).

All three supervision behavior measures were calculated based on averaging entries across 10 recording days. Entries were not included in the computation of supervision measures and the analyses if mothers recorded: (a) that their child was sleeping ($M$ = 7.75 % of the time) or (b) that they "didn't know" who was supervising but it was not them (0.4 % of all entries).

## *Results*

### *Child Attributes and Parent Supervision*

An Analysis of Variance (ANOVA) with age (2) and sex (2) as between-participant factors was conducted for each of five child attribute measures (high-intensity, activity level, inhibitory control, risk taking, sensation seeking). A main effect of sex was significant for each child attribute measure ($p < .05$). Average scores for these measures are therefore reported separately for each sex (see Table 1). Mean scores were higher for males on attributes indicative of more energetic and intense behavior, whereas mean scores for females were higher on an attribute indicative of self-control.

An ANOVA with age (2) and sex (2) as between-participant factors was also conducted for each of measure of supervision. Results revealed a significant effect of age for: time in view, $F(1, 120) = 17.46$, $p < .01$; time not supervising, $F(1, 120) = 46.94$, $p < .01$; overall supervision level, $F(1,120) = 6.86$, $p < .01$; PSAPQ supervision during children's play, $F(1, 120) = 12.73$, $p < .01$; and PSAPQ

supervision during children's self-care activities, $F(1, 120) = 75.61$, $p < .01$. As can be seen in Table 2, for each of these various indices of supervision younger children were more closely supervised than older ones. The only sex difference that emerged was for proportion of time not supervising, $F(1, 120) = 4.43$, $p < .05$, with boys being unsupervised more often than girls ($M = .41$ and .30, $SD =$ .44 and .44, respectively).

Correlations between child attributes and measures of supervision are presented in Table 3; note that as one would expect, scores on the PSAPQ correlated with behavioral measures of supervision: *vigilance* correlated with *proportion of time not supervising* ($p < .05$), *self-care activities* and *play activities* both correlated with all supervision measures ($p < .01$) and PSAPQ *total* correlated with both *in view supervision* and *overall supervision* ($p < .05$). Overall, correlation patterns suggest that child attribute measures were more highly correlated with behavioral measures of supervision than questionnaire indices of supervision; hence, in testing for moderation we focused on behavioral indices of actual supervision, rather than questionnaire indices (PSAPQ scores). Children higher in self-control were left unsupervised more often and were less closely supervised (overall score) by their mothers. In contrast, children higher in activity level were left unsupervised less often and were more closely supervised overall. Thus, the pattern of these findings suggests that mothers are aware of their child's behavioral attributes and alter their supervision patterns accordingly.

*Child attributes and Supervision measures that Relate to Injury*

An Age (2) x Sex (2) ANOVA was conducted on medically-attended injury scores. Results did not reveal any significant variation due to age or sex. All children had experienced approximately 1 medically-attended injury since birth ($M = 0.85$, $SD = 1.12$). Correlations relating child attributes and measures of supervision to injury are reported in Table 4. In general, correlation patterns suggest that children behaving in more intense, vigorous ways sustain more medically-attended injuries, whereas

children who behave in ways indicative of self-control have fewer such injuries. In general, mothers who reported providing more supervision had children who had sustained fewer injuries.

*Does Supervision Moderate the Impact of Child Attributes on Medically-attended Injury?*

Hierarchical regression analyses predicting medically-attended injuries were conducted in order to assess for child attribute × supervision effects. A separate regression was conducted for each of the three behavioral supervision measures (proportion of time in view, proportion of time not supervising, overall supervision level); we elected not to aggregate these scores because these represent conceptually distinct constructs and are not highly correlated with one another, therefore, we felt it was important to assess how each of these supervision indices differentially interact with child characteristics. In each regression, child age and sex were entered in Step 1 to control for these factors. Step 2 included five centered child attribute measures (high-intensity, activity level, inhibitory control, risk taking, and sensation seeking), as well as the single centered supervision measure of interest. Step 3 included five product terms, which were created by multiplying the five centered child attribute measures with the supervision measure being examined in the model. If Step 3 of the regression model indicated a significant amount of unique variance in predicting medically-attended injury, then the interaction was further investigated using simple slopes analyses (cf. Aiken & West, 1991) to test for moderation and determine if the child attribute was a significant predictor of injury risk at each of three levels of supervision (low = 1 SD below mean; mid = mean; high = 1 SD above mean).

Hierarchical regression analyses revealed six significant interaction effects in predicting medically-attended injury (see Table 5 for summary of statistics for Step 3 of each model). In Model 1, a Child Attribute × Proportion of Time Not Supervising interaction was indicated and two significant interactions were identified: High-intensity Behavior × proportion of time Not Supervising and Sensation Seeking × proportion of time Not Supervising. Model 2 revealed a Child Attribute × Overall

Supervision Level effect, involving four significant interactions: High-intensity Behavior × Overall Supervision level; Activity Level × Overall Supervision level; Inhibitory Control × Overall Supervision level; and Sensation Seeking × Overall Supervision level. No other significant interaction effects resulted for the other measures of supervision.

Further probing of interaction effects was accomplished by testing for simple slopes effects (see Table 6 for summary of statistics). High scores for High-intensity Behavior predicted more medically-attended injuries when mothers were Not Supervising to a moderate and high degree, but was not a significant predictor at low levels of this supervision measure (see Figure 1). In contrast, high scores on Sensation Seeking predicted more medically-attended injuries when mothers were Not Supervising at low and moderate levels, but was not predictive when mothers were not supervising at high levels (see Figure 2, and the Discussion for an explanation for this seemingly anti-intuitive result).

Higher scores for High-intensity Behavior significantly predicted greater medically-attended injury at low and mid levels for Overall Supervision, but did not predict at high Overall Supervision levels (see Figure 3). Surprisingly, Activity Level did not significantly predict injury risk at any of the three levels of Overall Supervision. High Inhibitory Control predicted fewer medically-attended injuries at low levels of Overall Supervision, but was not a significant predictor at mid or high supervision levels (see Figure 4). In comparison, higher Sensation Seeking predicted greater risk of medically-attended injuries at both mid and high levels of Overall Supervision, but was not a significant predictor for low Overall Supervision (see Figure 5). Thus, several of these results provide evidence for supervision's role as a moderator of the relationship between child characteristics and child-injury risk.

## *Discussion*

Unintentional injuries pose a significant health threat to children at all ages. Results of the present study highlight important complexities and provide a number of insights into factors that are relevant to injury for toddlers and preschoolers. Sex differences in child attributes indicate that males score higher on attributes indicative of more energetic and intense behavior, whereas females score higher on behavioral inhibition or self-control. Such temperament differences in behavioral attributes may contribute to explain why boys show more risk taking and typically experience more frequent injuries than girls (Canadian Institute of Child Health, 2000; National Safety Council, 2001). Age differences in supervision also were evident. As one might expect, parents showed closer supervision of younger than older children and this was true for most indices of supervision. In past interview research, parents reported an expectation that they would more closely supervise younger than older children (Garling & Garling, 1993; Pollack-Nelson & Drago, 2002). The present findings, however, confirm this speculation.

Interestingly, there were no sex differences in number of injuries in this sample. This finding probably reflects the fact that we limited our focus to the more severe injuries that required treatment by a doctor, and these occur less frequently than more minor or moderately severe injuries that are treated at home. Hence, the younger the children in the sample the fewer severe injuries that are likely to have occurred; indeed, the average number of medically-attended injuries in this sample was one. Previous studies of children at these young ages also failed to find sex differences in medically-attended injuries, although sex differences for the more frequent less severe injuries were evident (Morrongiello et al., 2004 a, b). Surprisingly, sex differences emerged for only one measure of supervision for which parents reported closer supervision of girls than boys. Previous studies of children at these young ages have also yielded inconsistent results regarding sex differences in

supervision (e.g., Morrongiello et al., 2006a). Possibly, at these young ages, parents' recognition of their child's immature developmental level and need for close supervision results in them showing limited variation in supervision of boys and girls. With children's increasing age, however, one may be better able to capture differences in how parents supervise boys and girls. For example, robust sex differences have been noted when parents of 8-year-olds were asked to supervise boys' and girls' playground play (Morrongiello & Dawber, 2000).

Although there is increasing recognition of the need to consider how risk factors *interact* to influence children's risk of unintentional injury (Morrongiello, 2005; Schwebel & Barton, 2005), few studies have applied this conceptual approach. The results of the present study confirm that child behavioral attributes interact with parent supervision practices to influence children's risk of injury. Although prior research indicates that mothers are well aware of their child's behavioral attributes and alter their supervision accordingly (Morrongiello et al., 2004b; Morrongiello et al., 2006b), to our knowledge this is the first study to demonstrate that supervision moderates the relation between children's behavioral attributes and injury outcomes. Although longitudinal studies are needed to confirm causative linkages, the present study provides tantalizing evidence that such relations may exist.

Children who scored high in behavioral intensity experienced more medically-attended injuries under conditions of reduced supervision but not when closely supervised. Consistent with this, (Schwebel et al., 2004) finding that parents high in positive parenting of temperamentally difficult children have children who experience fewer injuries may reflect the parents' closer supervision of these temperamentally difficult children. These findings highlight the importance of closely supervising children, particularly those who are temperamentally difficult. On the other hand, the child attribute of inhibitory control served a protective function and predicted fewer medically-attended

injuries even under conditions of reduced supervision. Thus, whether reduced supervision elevates child-injury risk depends on the child's behavioral attributes.

When mothers closely supervise, attributes of their children are not predictive of risk of unintentional injury, with one exception - children high in sensation seeking. Surprisingly, for children high in sensation seeking there was elevated risk of medically-attended injury regardless of the level of supervision, whereas for children low in sensation seeking, overall supervision level influenced risk and less supervision was associated with more injuries. It may be that children high in sensation seeking are so driven to seek risk-taking experiences (cf. Zuckerman, 1994) that even the presence of a supervisor does not deter them. Previous findings of children being injured as pedestrians when in close proximity to a supervisor are consistent with the notion that supervision may not suffice to prevent injury for children with certain behavioral attributes (Wills et al., 1997). Thus, the pattern of these findings suggests that high levels of supervision can counteract the potential negative effect on injury risk of some child attributes, thereby serving a protective or risk-reducing function for children, but there may be other attributes (sensation seeking) for which this is not likely to occur.

Surprisingly, activity level did not predict medically-attended injury under any level of supervision in this study. Past research examining the relation between activity level and injury has yielded inconsistent results (Byrnes et al., 2003; DiScala, Lescohier, Barthel, & Li, 1998; Schwebel, Brezausek, & Belsky, 2006), suggesting that if and when activity level predicts injury risk is not well understood. One possible explanation for the lack of consistent findings relates to age differences in child participants across studies. Because activity level generally tends to be high among preschoolers, it may be that the children participating in the current study did not differ sufficiently on this trait for it to be reliably predictive of injury risk. In addition, research with children high in activity level suggests this attribute may lead to more frequent *minor* than medically-attended injuries (Byrnes et al.,

2003), which also would suggest it would have limited capacity to predict medically-attended injuries in the present study. Suffice it to say, the conditions under which activity level predicts injury risk are not well understood and merit further study.

*Practical Implications*

One implication of the present findings is that parents must be *in tune* with their child's behavioral propensities in order to decide what method of parenting will be effective for their particular child. This corresponds with Kochanska's view (e.g., Kochanska, 1993) that child temperament is an important factor when considering socialization of desired behaviors (i.e., moral development) in young children, as no one form of caregiver behavior is invariably effective. Indeed, results of recent longitudinal research by Kochanska et al. (2007) demonstrated that child temperament moderates the relation between parenting and development of conscience in early childhood. The same kind of parenting (e.g., high power assertion), practiced toward children of different temperaments (e.g., low versus high fearfulness), resulted in different developmental outcomes for the children (e.g., high versus low level of moral development). Extending this theory to the topic of unintentional childhood injury, it appears that the level of supervision necessary to ensure a given child's safety should be based on the child's characteristics. Past epidemiological research, for example, has shown that young children are at increased risk of injury at developmental transition points when new milestones in motor and physical development occur (Agran et al., 2003). For example, injuries related to airway obstruction peak around 9 to 11 months, which is when children typically become mobile and have acquired the dexterity to explore objects by placing them in their mouth. Similarly, falling from furniture peaks at 15 to 17 months when children become adept walkers and capable of climbing. Thus, a parent's ability to anticipate how their child will behave is an essential determinant of children's risk of injury, particularly during the preschool years when there

are rapid changes in motor and physical development and children can behave somewhat unpredictably (Morrongiello et al., in press). Increasing parental awareness of the injury-risk implications of young children's emerging advancements in motor skills is essential to aid their making of appropriate decisions about children's supervisory needs. Also of potential relevance to understanding unintentional injury in toddlers, children's development of noncompliance strategies (i.e., ways of resisting parental control) is thought to occur in response to interactions among parenting behavior (e.g., responsiveness), parent-child relationship (e.g., attachment), and child temperament (Kochanska, Aksan, & Carlson, 2005). Thus, whether or not children comply with their parents' requests to behave in safe ways is likely a complex interaction among these variables, which are interdependent.

A related implication of the present findings has to do with how to define 'adequate' supervision for purposes of denoting when low levels of supervision constitute *neglectful* parenting because children are at risk of injury (Budd, 2001; Coohey, 2003). Previous research reveals little agreement among parents, medical personnel, and Child Protection Service workers regarding how long children can reasonably be left unsupervised (Peterson et al., 1993). In fact, the only reliable trend in responses by different professionals was that the time children could be safely left unsupervised generally was believed to increase with child age. The present findings further complicate the issue of distinguishing *adequate* from *neglectful* supervision because the consequences of lower levels of supervision were not uniform for all children but depended on child attributes. For some children (e.g., high sensation seekers) even close supervision was not adequate to prevent injury. For other children (e.g., high in behavioral control) even not supervising did not elevate risk of injury. Thus, defining adequate supervision may require consideration of factors other than just caregiver behaviors. Extending the focus to consider individual child attributes and even extent of environmental

hazards may help in the elaboration of what a minimal or adequate level of supervision needs to be to ensure an individual child's safety. In this context, then, aspiring to the development of universal standards that define adequate supervisory behavior by caregivers may not be a realistic goal for professionals concerned with child safety.

*Limitations and Directions for Future Research*

There are several limitations of this study that merit consideration in the design of future studies. First, one must be cautious about the generalizability of the results. Generalizability is constrained by virtue of the demographic characteristics of the sample, which was limited to primarily Caucasian, educated, and middle class families. Second, because of the use of diary recordings (i.e., self reports), there is no way to confirm that these data accurately reflect the supervision provided to young children. The fact that mothers report leaving their child unsupervised and out of view, suggests that mothers were being honest and accurate in their reporting. Moreover, past research comparing naturalistic observations with parental reports about supervision suggest that parents are accurate reporters about supervision (Morrongiello & House, 2004). Nonetheless, in future research it would be useful to incorporate an observational component so that one can directly compare diary-based with observation-based supervision data.

Finally, in future research on risk factors it would be useful to extend this conceptual approach to also consider interactions of child, parent, and environmental characteristics. It may be, for example, that supervision moderates child attributes better in some environmental contexts than others. For example, results of a recent study suggest that child behavior interacts with environmental characteristics to influence injury risk. Specifically, a retrospective analysis of pediatric farm injuries revealed that toddler and preschool children are more likely than older children to behave in unpredictable ways, therefore, they are more likely to experience injury in high-hazard situations in

which they are close to tools, animals, or machinery (Morrongiello et al., in press). In such situations, supervision may not be sufficient to reduce the child's risk of injury. Thus, a thorough appreciation of the role that supervision plays in children's risk of injury necessitates broadening our approach to also consider not only child attributes but also environmental characteristics. For effective intervention planning, therefore, we need research that assesses the real-world complexity of injury-outcome processes (i.e., interactions among child, parent, and environmental characteristics) in studying children's risk of injury. The present study confirms that supervision interacts with child attributes to differentially influence injury outcomes. Future research can now extend this approach to also assess how characteristics of the environment interact with child and caregiver attributes to influence children's risk of unintentional injury.

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## Author Notes

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Table 1

*Mean scores (sd) for boys and girls on child attribute measures*

| Measure [score range] | Boys | | Girls | | Overall | |
|---|---|---|---|---|---|---|
| **Child Attribute:** | | | | | | |
| High-Intensity Behavior [0-7] | 4.62 | (.91) | 4.01 | (1.01) | 4.32 | (1.01) |
| Activity Level [0-7] | 4.68 | (.85) | 4.37 | (.91) | 4.53 | (.89) |
| Inhibitory Control [0-7] | 4.45 | (.91) | 4.82 | (.98) | 4.63 | (.96) |
| Risk taking [0-96] | 31.16 | (13.34) | 23.98 | (11.13) | 24.57 | (12.76) |
| Sensation Seeking [0-12] | 9.59 | (2.53) | 7.80 | (3.31) | 8.71 | (3.07) |

Table 2

*Mean scores (sd) for young and old age groups for mothers' supervision measures*

| Measure [score range] | Young | | Old | | Overall | |
|---|---|---|---|---|---|---|
| **Supervision Measure:** | | | | | | |
| % time In View [0-100] | 86.94 | (9.08) | 78.84 | (11.04) | 82.39 | (10.68) |
| % time Not Supervising [0-100] | 0.86 | (1.95) | 6.05 | (8.41) | 3.35 | (6.61) |
| Overall Supervision [1-9] | 6.92 | (.99) | 6.53 | (.85) | 6.72 | (.94) |
| PSAPQ: | | | | | | |
| Total [1-5] | 3.18 | (.31) | 3.16 | (.42) | 3.17 | (.37) |
| Vigilance [1-5] | 4.19 | (.64) | 4.03 | (.78) | 4.11 | (.72) |
| Self-Care [1-5] | 4.39 | (.50) | 3.42 | (.76) | 3.90 | (.81) |
| Play [1-5] | 3.48 | (.57) | 3.06 | (.71) | 3.27 | (.67) |

*Note.* PSAPQ = Parent Supervision Attributes Profile Questionnaire

Table 3

*Correlations between child attributes and indices of supervision*

| Attribute | Supervision Measure | | | | | | |
|---|---|---|---|---|---|---|---|
| | IV (*n*) | NS (*n*) | OS (*n*) | PSAPQ Total (*n*) | PSAPQ V (*n*) | PSAPQ S-C (*n*) | PSAPQ P (*n*) |
| High- Intensity | -.19* (115) | -.12 (115) | .01 (115) | -.01 (114) | .05 (114) | .10 (114) | -.04 (115) |
| Activity Level | .04 (120) | -.17* (120) | .27** (119) | .03 (119) | -.03 (119) | .11 (119) | .15* (120) |
| Inhibitory Control | -.06 (123) | .17* (123) | -.26** (122) | -.04 (122) | .03 (122) | -.16* (121) | -.03 (122) |
| Risk Taking | .04 (124) | -.17* (124) | .11 (123) | .07 (123) | .01 (123) | .07 (121) | -.09 (122) |
| Sensation Seeking | -.16* (123) | -.09 (123) | .06 (122) | -.06 (122) | .07 (122) | -.04 (120) | -.01 (121) |

* $p < .05$, ** $p < .01$

*Note.* IV = proportion of time mother has her child in view
NS = proportion of time mother is main supervisor but is not supervising her child
OS = overall supervision level
PSAPQ = Parent Supervision Attributes Profile Questionnaire
Total = total score
V = score on Vigilance subscale
S-C = score on Self-Care Situation subscale
P = score on Play Situation subscale

Table 4
*Correlations between child attributes, indices of supervision and medically-attended injuries*

| Measure | Medically-Attended Injury |
|---|---|
| **Child Attribute:** | (*n*) |
| High-Intensity | .22** (114) |
| Activity Level | .10 (119) |
| Inhibitory Control | -.10 (122) |
| Risk Taking | .14 (123) |
| Sensation Seeking | .33** (122) |
| **Supervision Measure:** | |
| In View Supervision: | -.29** (123) |
| Not Supervising | .06 (123) |
| Overall Supervision | -.13 (122) |
| PSAPQ: | |
| Total | .09 (122) |
| Vigilance | .03 (122) |
| Self-Care | -.22** (120) |
| Play | -.18* (121) |

* $p < .05$, ** $p < .01$

Table 5

*Multiple regression analyses predicting medically-attended injury*

| Variable | *B* | *SE* |
|---|---|---|
| Step 3 ($n$ = 111) | | |
| High- intensity Behavior × Proportion of Time Not Supervising | .33** | .11 |
| Activity Level × Proportion of Time Not Supervising | -.03 | .14 |
| Inhibitory Control × Proportion of Time Not Supervising | -.09 | .12 |
| Risk Taking × Proportion of Time Not Supervising | -.32 | .21 |
| Sensation Seeking × Proportion of Time Not Supervising | -1.35* | .62 |
| Step 3 ($n$ = 110) | | |
| High-intensity Behavior × Overall Supervision Level | -.14** | .05 |
| Activity Level × Overall Supervision Level | .13** | .05 |
| Inhibitory Control × Overall Supervision Level | .09* | .04 |
| Risk Taking × Overall Supervision Level | -.05 | .07 |
| Sensation Seeking × Overall Supervision Level | .60** | .23 |

* $p < .05$, ** $p < .01$

*Note*. Model 1 $\Delta R^2 = .10$ for Step 3 ($p < .05$); Model 2 $\Delta R^2 = .13$ for Step 3 ($p < .01$)

Table 6

*Results of simple slopes analyses testing child attribute x supervision measures predicting medically-attended injury. A significant result indicates the level of supervision at which the child attribute indicated predicts medically-attended injury*.

| | *B* | *SE* |
|---|---|---|
| **NOT SUPERVISING (NS)** | | |
| (*n* = 111) | | |
| Step 3 | | |
| High-intensity × NS – LOW | .03 | .04 |
| High-intensity × NS – MID | .07* | .03 |
| High-intensity × NS – HIGH | .11** | .04 |
| Step 3 | | |
| Sensation Seeking × NS – LOW | .76** | .21 |
| Sensation Seeking × NS – MID | .58** | .16 |
| Sensation Seeking × NS – HIGH | .40 | .23 |
| | | |
| **OVERALL SUPERVISION (OS)** | | |
| (*n* =110) | | |
| Step 3 | | |
| High-intensity × OS – LOW | .12** | .04 |
| High-intensity × OS – MID | .07* | .03 |
| High-intensity × OS – HIGH | .02 | .05 |
| Step 3 | | |
| Activity Level × OS – LOW | .04 | .05 |
| Activity Level × OS – MID | .05 | .04 |
| Activity Level × OS – HIGH | .07 | .05 |
| Step 3 | | |
| Inhibitory Control × OS – LOW | -.13** | .05 |
| Inhibitory Control × OS – MID | -.05 | .03 |
| Inhibitory Control × OS – HIGH | .02 | .04 |
| Step 3 | | |
| Sensation Seeking × OS – LOW | .42 | .25 |
| Sensation Seeking × OS – MID | .58** | .16 |
| Sensation Seeking × OS – HIGH | .73** | .20 |

* $p < .05$, ** $p < .01$

Figure Caption

*Figure 1*. Proportion of Time Not Supervising x High-intensity Behavior interaction predicting medically-attended injury.

*Figure 2*. Proportion of Time Not Supervising x Sensation Seeking interaction predicting medically-attended injury.

*Figure 3.* Overall Supervision Level x High-intensity Behavior interaction predicting medically-attended injury.

*Figure 4*. Overall Supervision Level x Inhibitory Control interaction predicting medically-attended injury.

*Figure 5.* Overall Supervision Level x Sensation Seeking interaction predicting medically-attended injury.

Figure 1.

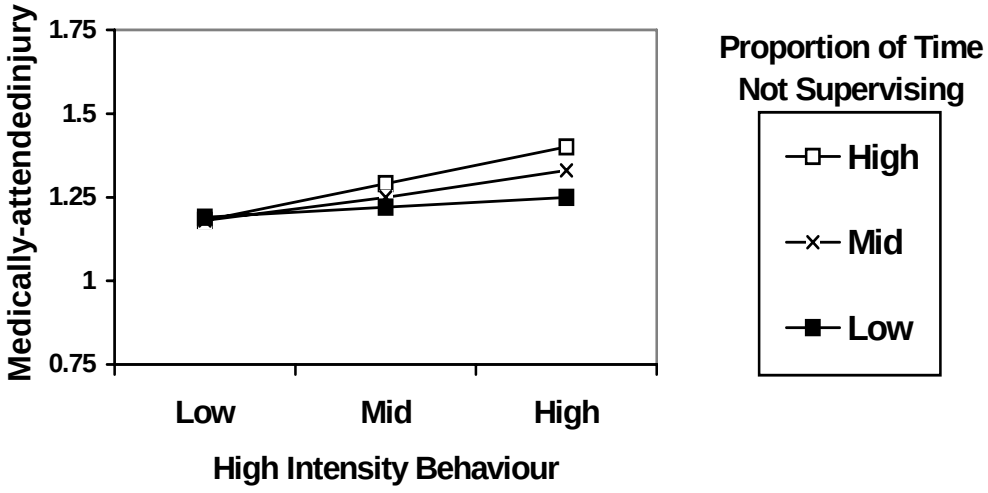



Figure 2

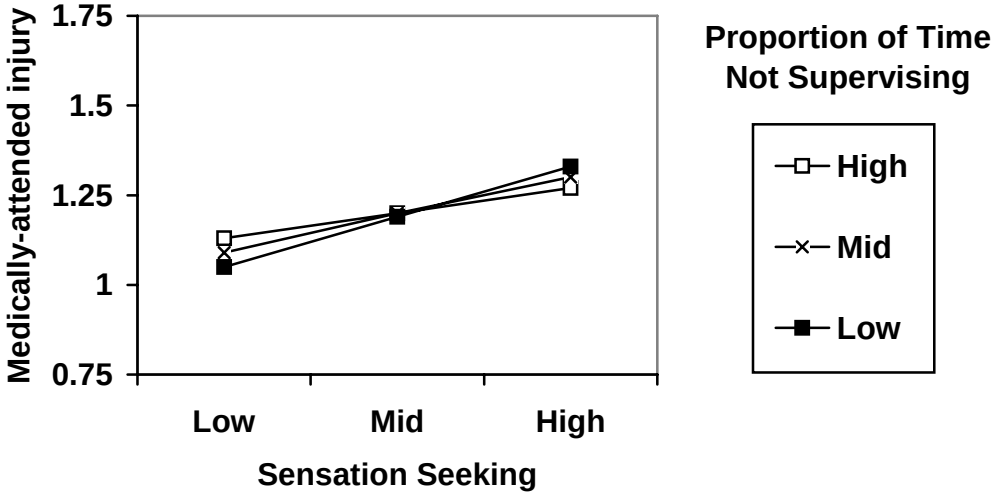


Figure 3

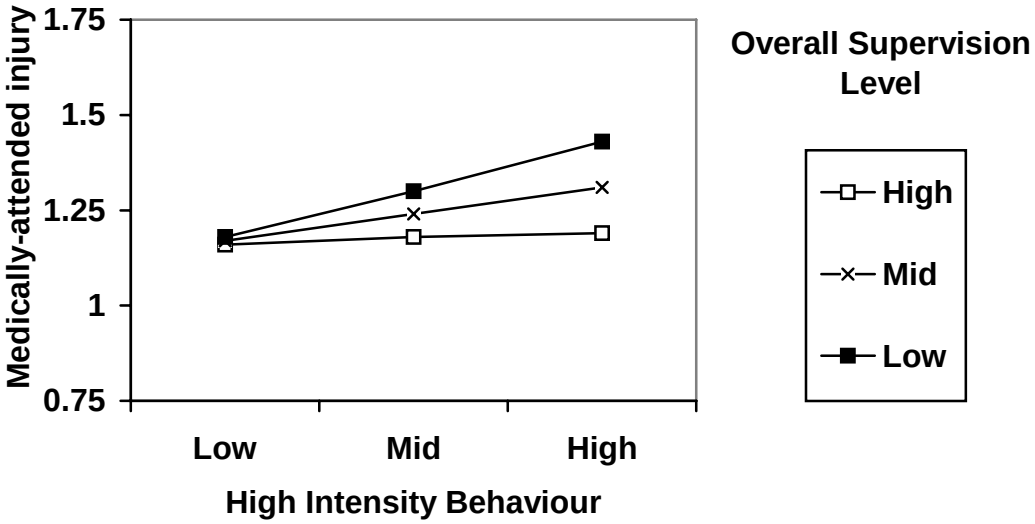

Medically-attended injury
1.75
1.5
1.25
1
0.75
Low
Mid
High
High Intensity Behaviour
Overall Supervision Level
High
Mid
Low

Figure 4

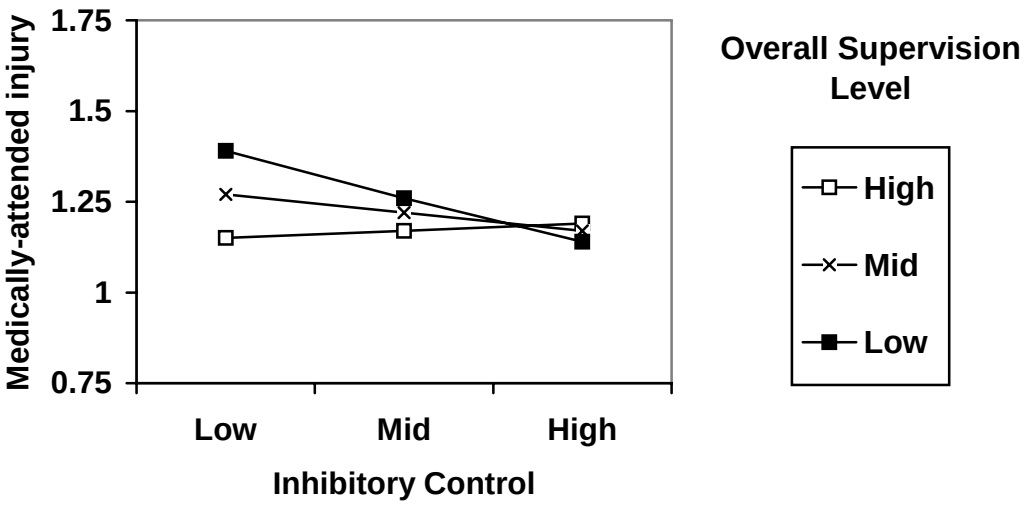
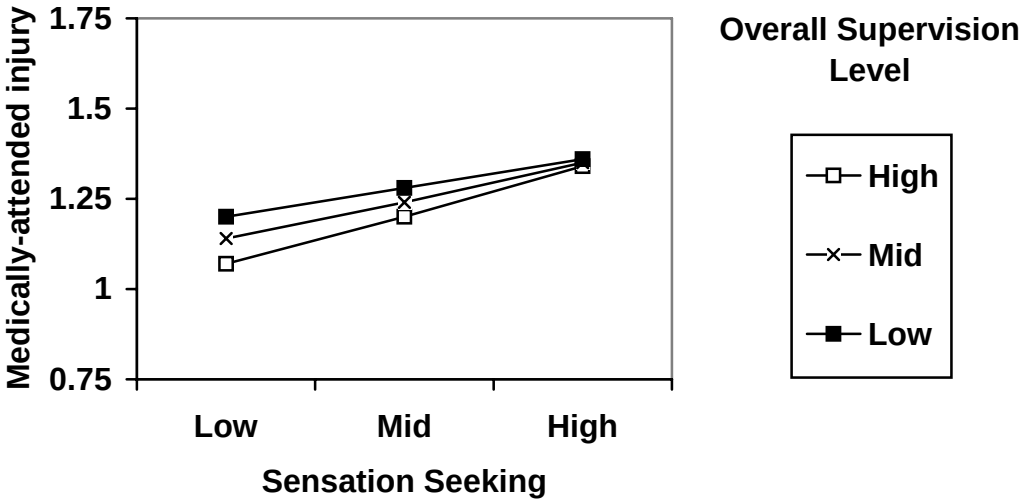

Medically-attended injury
1.75
1.5
1.25
1
0.75
Low
Mid
High
Inhibitory Control
Overall Supervision Level
High
Mid
Low

Figure 5


Medically-attended injury
1.75
1.5
1.25
1
0.75
Low
Mid
High
Sensation Seeking
Overall Supervision Level
High
Mid
Low