

Understanding Unintentional Injury Risk in Young Children II. The Contribution of Caregiver Supervision, Child Attributes, and Parent Attributes

Barbara A. Morrongiello, PhD, Michael Corbett, MM, Meghan McCourt, MM, and Natalie Johnston, BA
Psychology Department, University of Guelph

Objective To identify child and parent attributes that relate to caregiver supervision and examine how these factors influence child-injury risk. **Methods** Mothers completed diary records about supervision of their young child (2–5 years) when at home. Standardized questionnaires provided information about child attributes, maternal attributes, and children's history of injuries. **Results** Correlations revealed that child attributes and parent attributes related both to actual maternal supervision and child-injury scores. Regression analyses to predict injury scores revealed child-temperament factors alone predicted all levels of severity (minor, moderately severe, and medically attended), but parent supervision also contributed to predict medically attended injuries. **Conclusions** Both child and parent factors influenced caregiver's supervision of young children at home and related to child-injury risk. For medically attended injuries, child attributes and parent supervision both predicted risk, whereas for less serious injuries, child factors alone determined risk.

Key words child temperament; children; determinants; supervision; unintentional injury.

Unintentional injuries rank as the number one cause of death and a leading cause of hospitalization for children beyond 1 year of age (Baker, O'Neill, & Ginsburg, 1992). In the United States, child-injury deaths exceed the next nine causes combined (Centers for Disease Control and Prevention, National Center for Injury Prevention and Control, 2000). The scope of this problem has led to calls for research to identify factors that influence children's risk of injury (Miller, Romano, & Spicer, 2000). This report examines how child and parent attributes relate to the supervision provided in the home and considers how child attributes, parent attributes, and supervision each influence child-injury risk.¹

¹A related report focuses on the nature and scope of the supervision young children receive, with an emphasis on examining how supervision varies as a function of a child's sex and age (Morrongiello, Corbett, McCourt, & Johnston, in press).

Child Attributes and Injury Risk

Aspects of temperament (i.e., individual difference traits reflected in stable behavioral tendencies) have received considerable attention as possible behavioral markers of injury risk. Children who are impulsive, highly active, and/or sensation seeking are likely to experience injuries (Jaquess & Finney, 1994; Morrongiello & Sedore, 2005; Plumert & Schwebel, 1997), and those with attention-deficit/hyperactivity disorder, who are high on both impulsivity and activity level, show significantly higher rates of injury than children without this disorder (Byrne, Bawden, Beattie, & DeWolfe, 2003).

The temperament characteristics of behavioral intensity (i.e., high intensity activity and reactions to new situations and events) and inhibitory control (i.e., capacity to inhibit inappropriate behavior, such as approaching dangerous hazards) also contribute to injury (Schwebel & Bounds, 2003; Schwebel & Plumert,

All correspondence concerning this article should be addressed to Barbara A. Morrongiello, Psychology Department, University of Guelph, Guelph, Ontario, Canada N1G 2W1. E-mail: bmorrong@uoguelph.ca.

Journal of Pediatric Psychology 31(6) pp. 540–551, 2006

doi:10.1093/jpepsy/jsj073

Advance Access publication August 31, 2005

Journal of Pediatric Psychology vol. 31 no. 6 © The Author 2005. Published by Oxford University Press on behalf of the Society of Pediatric Psychology. All rights reserved. For permissions, please e-mail: journals.permissions@oupjournals.org

1999). For example, children rated low on inhibitory control have more injuries than peers without this trait. Drawing on these diverse findings, this study incorporated measures of sensation seeking, temperament (activity level, impulsivity, behavioral intensity, and inhibitory control), and the frequency with which children routinely engage in injury-risk behaviors.

Parent Attributes and Injury Risk

Although demographic characteristics of mothers (e.g., single parenthood, substance abuse) have been shown to influence children's risk of injury, few studies have considered parent personality attributes. One study reported that mothers high in neuroticism (i.e., anxious, impulsive, vulnerable to stress) had children who experienced more injuries (Davidson, Hughes, & Richards, 1987). A recent study found that mothers high in conscientiousness (i.e., dutiful, planful, organized, determined) had children who experienced fewer injuries (Morrongiello & House, 2004). In this study, we related these personality attributes not only to children's injury histories but also to parental supervision in an effort to determine if this may be one means by which parent personality traits influence injury risk.

Maternal beliefs about locus of control regarding their child's health also has been shown to influence children's risk of injury and maternal supervision. Mothers who believed that fate was mostly responsible for their child's health status showed less supervision when unobtrusively observed at a park *and* had children with a history of more injuries (Morrongiello & House, 2004). In this study, maternal beliefs about control over their child's health were assessed to examine how these influenced the extent of supervision provided at home and related to children's injury-history scores.

Finally, recent studies suggest that underlying attributes and beliefs relevant to how parents supervise children can be measured and also have implications for child-injury risk. Morrongiello and House (2004) developed the Parent Supervision Attributes Profile Questionnaire (PSAPQ) to tap attributes relevant to supervision and found that these attributes related to children's injury-history scores *and* to aspects of supervision parents provided their children at a park: mothers high on protectiveness, vigilance, confidence in supervising, and worry had children who had a history of fewer injuries, and those high in vigilance showed closer supervision when unobtrusively observed at a park. Similarly, maternal reports on a Beliefs About Supervision Questionnaire (BAS) revealed that the younger the age at which mothers

believe they can leave their child alone without constant supervision, the greater the frequency of injuries experienced by the children (Morrongiello, Ondejko, & Littlejohn, 2004a), and the less frequently mothers believe they have to check on their child when not providing constant supervision, the greater the frequency of injuries to the child (Morrongiello & Hogg, 2004). In this study, maternal attributes and beliefs about supervision were both measured to examine how these relate to actual supervision in the home and to various indices of child-injury risk.

Supervision and Injury Risk

Many injuries to toddlers occur in their homes when they presumably are being monitored by a caregiver (Shannon, Brashaw, Lewis, & Feldman, 1992). Lapses in caregiver supervision have been implicated in many types of injuries that commonly occur to young children, such as drowning, poisoning, and falls (for review, see Morrongiello, 2005). Few studies, however, have directly related supervision to child-injury risk. Some studies have simply measured parent supervision and drawn inferences about the implications for childhood injury risk (Harrell, 2003; Pollack-Nelson & Drago, 2002). These studies note that young children are routinely left unattended and that decreased supervision is associated with increased risk behaviors by children (Harrell, 2003; Morrongiello & House, 2004), which are circumstances that could lead to greater childhood injury.

Other studies have sought to link supervision to injury risk by examining whether children who have a history of more injuries are more poorly supervised when in a "contrived-hazards" laboratory situation with their parents. Children with a history of injuries showed frequent risk behaviors; however, parent supervision has not been found to vary for high-injury compared with low-injury children (Cataldo et al., 1992; Morrongiello & Dawber, 1998). Although these findings suggest that parents do not moderate supervision to reduce risk of injury depending on children's behavioral characteristics, there is no way of knowing how typical the behaviors shown by the children were in these hazardous settings (i.e., to what extent parents should have anticipated and expected such behaviors of high-risk children and therefore supervised more closely). Nor is there any way to confirm that how parents supervised in these unique settings typifies how they usually behave. In this study, these issues were addressed by focusing on parent supervision of young children in their *homes*, which is a setting equally familiar to both children and parents. In

addition, standardized measures of numerous child attributes were completed to determine whether parents adjust supervision level depending on their beliefs about children's behavioral attributes.

Direct support for a link between supervision and children's injuries has only recently been obtained in a prospective study in which mothers provided detailed reports about young children's home injuries and caregiver supervision at the time of injury over the course of 12 weeks (Morrongiello, Ondejko, & Littlejohn, 2004b). These data were then used to develop a taxonomy of supervision. Relating these different types of supervision to frequency of injuries revealed that children who routinely engaged in greater risk taking required constant supervision to limit injuries, whereas children who usually showed less risk taking were at decreased risk of injury even when checked on only intermittently. Thus, depending on child-behavioral attributes, different levels of supervision were needed to moderate injury risk. In this study, children's behavioral attributes also were related to maternal supervision, but we sampled these attributes more extensively than in previous research.

This Study

This study sought to identify child and parent attributes that relate to actual home supervision and to examine how these factors influence child-injury risk. A participant event-monitoring method (cf., Morrongiello, 1997; Morrongiello et al., 2004a, 2004b; Peterson, DiLillo, Lewis, & Sher, 2002) was used in which participants were taught to be careful observers of their own behaviors and to record these, yielding reports of supervision provided to children at home. Child and parent attributes were then related to these diary indices of supervision. Also, to advance our understanding of measuring supervision, at the end of each day, mothers retrospectively completed questions estimating the supervision they provided, for comparison with diary supervision data.

Finally, three indices of child-injury risk were used: *minor* parent-attended injuries, *moderate* injuries, and *medically attended* injuries. For young children, medically attended injuries might be too infrequent (cf., Morrongiello et al., 2004a, 2004b), which would limit our ability to determine how child and parent attributes and supervision related to injury risk. Hence, measures of minor and moderately severe injuries were included. Previous research demonstrates that mothers are accurate reporters of injuries (Pless & Pless, 1995) and readily report on routine behaviors (e.g., not supervising

or taking precautions) in which they engage that may elevate their children's risk of injury (Morrongiello & Dayler, 1996; Morrongiello & Kiriakou, 2004). Thus, several lines of evidence indicated that mothers would be reliable reporters of supervision and their children's injury histories.

Method

Participants

The sample consisted of two ages: the *young* group included 40 mothers of first-born female ($N = 18$) and male ($N = 22$) toddlers 2-and-a-half years of age ($M = 31.34$ months, $SD = 4.58$ months), and the *older* group consisted of 28 mothers of first-born females ($N = 15$) and males ($N = 13$) 5 years of age ($M = 57.40$ months, $SD = 4.95$ months). An additional 15 participants began the study but then dropped out.² Participants were randomly selected from an existing database of families who had indicated a wish to participate in research on child development. Annual family-income distribution for the sample was as follows: 12% earned less than \$40,000, 32% earned between \$40,000 and \$59,999, 28% earned between \$60,000 and \$79,999, and 21% earned over \$80,000. Five mothers did not wish to disclose family-income information. For maternal education, 10% had completed high school, 74% had some or had completed university, and the remainder had graduate training and/or post-university education. Nearly all mothers were Caucasian.

Measures

Psychometric information about all questionnaire measures is summarized in Table I.

Parent Attribute Measures

Questionnaires measuring parent attributes included the following: (a) *Demographic Information Questionnaire* to assess the mother's education and family income. (b) *The Big Five Inventory* (BFI; John, Donahue, & Kentle, 1991) provided information about the personality attributes of conscientiousness and neuroticism. (c) Two subscales of the *Parent Health Locus of Control Questionnaire* (PHLOC, cf., DeVellis et al., 1993) measured the extent to which parents attributed control over the status of their child's health to fate and parent control, and we also included the overall score.

²A comparison of demographics (age, income) and scores on every child and parent questionnaire measure listed in Table I revealed no significant differences between those who dropped out and those who completed the study ($p > .05$).

Table I. Information About Questionnaires Completed by Mothers, Including the α Obtained in this Sample, Possible Range of Scores, and the Mean and Standard Deviation (SD) of Scores

Questionnaire	Number of items	Subscales selected	α	Possible range	<i>M</i> (<i>SD</i>)
Parent measures					
Big Five Inventory	8	Neuroticism	.81	1–5	2.67 (0.73)
	9	Conscientiousness	.80	1–5	4.11 (0.57)
Parent Health Locus of Control	5	Fate	.82	1–6	2.50 (1.05)
	7	Parental influence	.70	1–6	5.39 (0.49)
		Overall	.73	1–6	3.48 (0.42)
Parenting Dimensions Inventory	8	Consistency	.62	1–6	4.43 (0.55)
	6	Nurturance	.8	1–6	5.25 (0.65)
	5	Responsiveness	.38	1–6	5.07 (0.53)
	7	Permissive attitude	.49	1–6	4.88 (0.60)
Parent Supervision Attributes Profile		Overall	.71	1–6	4.85 (0.40)
	10	Protectiveness	.76	1–5	3.94 (0.48)
	3	Vigilance	.68	1–5	4.01 (0.69)
	4	Ambivalence	.66	1–5	2.51 (0.63)
	21	Supervision	.75	1–5	3.54 (0.69)
Beliefs About Supervision		Overall	.80	1–5	3.13 (0.39)
	12	Youngest age	.77	0–18 year	4.17 (0.90)
	12	Checking interval	.78	2–12 min	4.91 (1.63)
Child measures					
Sensation Seeking Scale for Children	17	Overall	.69	0–17	8.78 (3.01)
Injury Behavior Checklist	24	Overall	.89	0–96	28.81 (13.30)
Early Childhood Behavior	12	Intensity	.84	1–7	4.39 (1.02)
	10	Impulsivity	.68	1–7	4.77 (0.76)
	12	Activity level	.80	1–7	4.65 (0.96)
	12	Inhibitory control	.83	1–7	4.48 (0.81)

(d) *Parenting Dimensions Inventory for 2–5 Year Olds-Short Form* (Slater & Power, 1987) provided information on parenting (nurturance, consistency, responsiveness to child input, and nonrestrictive attitude). (e) PSAPQ (Morrongiello & Corbett, in press) was an extended version of a questionnaire that has proven valid and reliable as an index of maternal supervision that relates to child-injury risk (Morrongiello & House, 2004). In part I, using a 5-point Likert scale (1, “strongly disagree”; 5, “strongly agree”) mothers indicate the extent of agreement with various statements to yield subscale scores tapping vigilance, protectiveness, and ambivalence about the extent of supervision needed. In part II, a 5-point Likert scale (1, “I’m typically in another room and I go to my child when he/she calls for me”; 5, “I’m typically in the same room and within arm’s reach of my child”) is used to indicate typical level of supervision provided when the child is engaged in eight common self-help/chore activities (e.g., washing hands in bathroom sink), 10 common play activities at home (e.g., watching television or videos), and three common home-situated risk activities (e.g., getting in/out of bathtub). This subscale provided an index of “typical supervision”, with higher scores indicating closer supervision. (f) Beliefs

About Supervision (BAS) (Morrongiello & Hogg, 2004) provided a measure of parental beliefs regarding the youngest age a child can be left without constant supervision in 12 common situations. The parent was then asked how often they would check on the child (in minutes). The younger the age of the child listed and the less frequent the checking on the child, the more lax the supervision by the parent.

Child Attribute Measures

Questionnaires yielded information about several child attributes, including: (a) *Sensation Seeking Scale for Children* (SSSC; Morrongiello & Lasenby, manuscript submitted for publication) provided a measure of the personality attribute of sensation seeking. For each of 22 items, parents were asked to choose between one of two options, one indicating a daring/arousing behavior (e.g., riding very fast on a rocking horse) and the other a more subdued/nonarousing behavior (e.g., rock gently in a rocking chair). (b) *Injury Behavior Checklist* (IBC; Speltz, Gonzales, Sulzbacher, & Quan, 1990) provided a measure of the child’s typical level of risk taking in the past 6 months. (c) *Early Childhood Behavior Questionnaire* (ECBQ; Putnam, Gartstein, & Rothbart, manuscript submitted

for publication) provided a measure of impulsivity, inhibitory control, activity level, and intensity of behavior.

Injury Measures

An *Injury History Questionnaire* (IHQ) provided an index of the frequency with which the child had sustained minor injuries (parent treated), 17 different types of moderate injuries (e.g., crushing fingers in a door), and medically attended injuries (physician or dentist).

Supervision Measures

Mothers completed many diary-recording sheets, including: (a) *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 whether the parent or child left the house. The mother also indicated who was supervising at the time of the entry (mom, dad, no one, and other), whether or not the child was in view of the supervisor, and whether the supervisor and child were doing something together. (b) *In-View Recording Sheet* was completed every time a "child in view of supervisor" entry was made on the *Time Use Sheet*. Parents indicated the room the child was in, who was supervising, whether or not the supervisor was doing something with the child, and rated level of supervision (see *Data Reduction*). (c) *Out-of-View Recording Sheet* was completed to indicate the level of supervision (see *Data Reduction*) when the child was out of view of the supervisor for an entry on the *Time Use Sheet*.

Procedure

During an initial 1-and-a-half-h home visit, mothers completed a random selection of half the questionnaires, were given calendar pages showing their recording days to place on the refrigerator, and were given a binder, containing diary-recording sheets and training in how to complete these and a clipboard with a pen attached to use for carrying around the house to aid completing their sheets. It was emphasized that diary-recording sheets were to be completed as the day was unfolding and that every time there was an entry on the *Time Use Sheet* the mother was then to complete either the *In-View* or *Out-of-View Recording Sheet*. Participants completed 10 days of recording (6 weekdays, 2 Saturdays, and 2 Sundays) across a 3-week period, with days randomly selected by the research assistant. At study conclusion, an interviewer returned to the home to complete the remaining questionnaires, to pick up the recording binder, and to give the mother a flowering plant and \$25.

Data Reduction

The *Time Use Recording Sheets* indicated the amount of time in different supervision situations (child in view versus out of view) and with different supervisors. The *In-View Recording Sheets* indicated how much of the time a child and supervisor were in the same room and "doing something" versus "not doing something" together. Supervision when not doing something together was coded as 1, "not watching or listening for child at all" (e.g., mom was washing dishes and talking on the phone while the child played with toys out of view of the mother but somewhere in the kitchen); 2, "not watching but listening intermittently"; 3, "watching him/her intermittently and/or listening constantly"; 4, "have him/her within constant view"; and 0, "don't know" (e.g., mom is not the supervisor and she does not know the nature of the supervision being provided, but she knows the child and supervisor are in the same room). Supervision when doing something together was coded as maximum supervision (i.e., 4). The *Out-of-View Recording Sheets* were used to determine the nature of the activities of the child and supervisor, and the level of supervision provided when constant supervision was not possible, because the child and supervisor were in different locations in the home. Supervision levels were coded as follows: 1, "not supervising" (i.e., not checking or listening in at all); 2, "only going to check on the child when he/she hears something that indicates the child needs to be checked"; 3, "checking every 10 min or longer"; 4, "checking every 8–9 min"; ... 9, "listening in constantly and supervisor knows what child is doing at all times."

Supervision scores were calculated by averaging the 10 days after excluding time when the child was napping ($M = 10\%$ of the time) or mom coded "don't know" for supervision (0.3% of all entries).³

Results

Child Attributes that Relate to Supervision

As can be seen in Table I, mothers and their children were awake⁴ and home together approximately 6.50 h per day.

³Extensive reports about age and sex differences in supervision, along with confirmation of the reliability of diary reports about supervision and information about measuring supervision in future research, are presented elsewhere (Morrongiello, Corbett, McCourt, & Johnston, in press).

⁴We limit the focus to awake periods only because younger children spent significantly, $F(1, 64) = 36.70, p < .01$, more time napping than older children ($M = 1.10$ versus $.26$ h, $SD = .63$ and $.44$, respectively), and the level of supervision was less when children were asleep than awake ($p < .05$). Hence, including supervision during nap times differentially distorted and underestimated actual supervision for younger versus older children.

Table II. Average Number of Hours, and Percentage of Time, that Children Experienced Different Supervision Circumstances when they and the Mother were Awake and at Home

Circumstance	Number of hours [M (SD)]	Percentage of time
Awake and at home	6.51 (1.56)	100
Unsupervised	0.26 (0.57)	4
Supervised	6.25 (1.59)	96
Supervisor		
Mom	4.85 (1.55)	78
Dad	1.04 (0.89)	16
Other	0.36 (0.53)	6

The majority of the time children were supervised, typically by the mother. An analysis of variance (ANOVA), with age and sex as factors, was conducted separately on each child measure (IBC, SSSC, ECBQ-intensity, ECBQ-activity level, and ECBQ-inhibitory control) and did not reveal any significant effects. Hence, the average scores for these measures is summarized in Table II. Correlations were conducted relating child attributes to five aspects of supervision provided by the mother⁵: the proportion of time mothers had the child in view ($M = 0.80$, $SD = 0.12$), the proportion of time the child was completely unsupervised ($M = 0.04$, $SD = 0.07$), and supervision scores (max = 9) when the child was in view ($M = 7.73$, $SD = 0.62$) and out of view ($M = 5.15$, $SD = 1.75$), as well as overall supervision score collapsing across these circumstances ($M = 6.80$, $SD = 0.92$). As can be seen in Table III, maternal supervision related to many child attributes; a Bonferroni correction was applied to constrain alpha to .05 for each attribute (row) separately. Specifically, attributes likely to lead to greater injury-risk behaviors (IBC, SSSC, and ECBQ-impulsivity) were associated with greater supervision, whereas attributes indicating greater self-control by the child (ECBQ-inhibitory control) were associated with less supervision.

Maternal Attributes that Relate to Supervision

The scores earned for parent measures are summarized in Table I. For the purposes of relating questionnaire indices that mothers completed about herself to actual supervision, we limited our focus to those supervision data in which the mother was the primary supervisor and the child was awake (see footnotes 5 and 4, respectively).

⁵Because the mother was the primary supervisor (Table I) and she had completed the child questionnaires about child attributes (i.e., we had only *her* view of the child characteristics), supervision scores were limited to the mother supervising, though it should be noted that the *same* pattern of results was obtained when the data from *all* supervisors were averaged and analyzed.

Correlations were conducted and revealed that several parent attributes related to supervision; a Bonferroni correction was applied to constrain alpha to .05 for each attribute (row) separately. As can be seen in Table III, the PSAPQ emerged as the most significant indicator of maternal supervision. High scores on these subscales negatively related to time the child was not supervised and positively related to time in view of the mother. High scores on the supervision subscale were also positively related to overall level of child supervision and to the level of supervision provided when the child was out of view.

For personality measures, scoring high in conscientiousness was associated with keeping the child in view more of the time, whereas neuroticism was associated with not having the child in view and also not closely supervising when the child was out of view. On the BAS, maternal beliefs about how much time could elapse before they needed to check on their child, when not providing constant supervision, negatively related to the time the child was in view of the mother. Thus, mothers who believed that they should more frequently check on a child kept children in view. Amount of time unsupervised marginally related to this checking interval, $r(67) = .23$, $p = .06$, with mothers who believed in frequent checking on a child leaving their child completely unsupervised less of the time (Table III). Surprisingly, measures of parenting behaviors and indices of control over their child's health did not significantly relate to any measure of supervision.

Factors Affecting Child-Injury Risk

Three indices of child-injury risk were considered: parent-attended minor injuries since birth (minor), moderate injuries the child had experienced since birth (moderate), and medically attended injuries experienced since birth (medical). ANOVAs with age (2) \times sex (2) as factors were conducted on each measure separately and revealed that older children experienced more injuries than younger ones for all severity of injury: minor ($M = 17.06$ and 11.23 , $SD = 8.09$ and 5.89 , respectively), $F(1, 60) = 11.27$, $p < .01$, $d = .82$; moderate ($M = 5.07$ and 3.94 , $SD = 1.01$ and 1.75 , respectively), $F(1, 64) = 10.23$, $p < .01$, $d = .79$; and medically attended ($M = 2.12$ and 1.74 , $SD = 0.91$ and 1.05 , respectively), $F(1, 63) = 3.81$, $p = .05$, $d = .39$.

Relations of child and parent attributes to these injury history scores are summarized in Table IV; a Bonferroni correction was applied to constrain alpha to .05 for each attribute (row) separately. As can be seen, children high on behavioral intensity experienced more minor,

Table III. Correlations Showing the Relation of Parent Attributes and Child Attributes to Indices of Maternal Home Supervision

Attribute	Supervision measure				
	IV	S-IV	S-OV	OS	NS
Parent attribute					
Big Five Inventory					
Conscientiousness	.32**	-.10	.12	.10	-.15
Neuroticism	-.22*	.04	-.21*	-.20	.13
Parent Health Locus of Control Scale					
Fate	-.12	.03	-.20	-.16	.16
Parent influence	.09	.01	.07	.09	-.18
Overall score	-.12	.01	-.16	-.11	.13
Parenting Dimensions Inventory					
Consistency	.04	-.05	-.02	-.02	.02
Nurturance	.01	.07	.03	.06	.05
Overall score	.17	-.10	.05	.05	.01
Parent Supervision Attributes Profile Questionnaire—home version					
Protectiveness	.36**	.14	.18	.22*	-.52**
Vigilance	.21*	.06	.14	.13	-.39**
Ambivalence	.16	.00	.10	.07	-.31**
Supervision	.42**	.08	.34**	.38**	-.45**
Overall score	.30**	.14	.14	.16	-.47**
Beliefs About Supervision					
Youngest age	-.05	.03	-.05	-.04	-.21
Checking interval	-.41**	-.05	-.07	-.07	.23
Child attribute					
Sensation Seeking Scale for Children					
Injury Behavior Checklist	-.16	.17	.20*	.16	-.12
Early Childhood Behavior					
Behavioral intensity	-.31**	.14	.03	.02	-.08
Activity level	-.17	.17	.19	.14	-.03
Inhibitory control	-.06	-.23*	-.22*	-.21*	.24*
Impulsivity	.17	.11	.25*	.19	-.35**

IV, proportion of time when the mother has the child in view; NS, proportion of time when mom is responsible for the child but is not supervising at all; OS, overall supervision score; S-IV, supervision score when child is in view of the mother; S-OV, supervision score when child is out of view of the mother.

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

moderate, and medically attended injuries. Children high in sensation seeking and risk taking experienced more moderately severe injuries. Elevated activity level was associated with more minor injuries. Children high in inhibitory control experienced fewer medically attended injuries. Thus, a variety of behavioral attributes of the child related to injury risk, some serving as risk factors and associated with more frequent injuries (i.e., sensation seeking, risk taking, and behavioral intensity) and others serving as protective factors and associated with fewer injuries (i.e., inhibitory control).

Parent attributes also related to child-injury risk, with some serving as a protective factor and others as a risk factor. Conscientiousness was associated with fewer moderate injuries, whereas mothers high in neuroticism had children who experienced more minor and moderate injuries. Maternal beliefs about locus of control over their child's health status did not relate to child-injury

risk. Similarly, parenting indices also did not relate to child-injury risk. Questionnaire indices of supervision, however, related to several aspects of child-injury history. On the PSAPQ, high scores on the supervision subscale were associated with low scores on all measures of child-injury risk. Similarly, mothers' beliefs about supervision were strongly associated with medically attended injuries: mothers who frequently checked on their child when the child was not receiving constant supervision had children with fewer medically attended injuries.

Finally, to identify those child and parent attributes that best predicted child-injury risk, a hierarchical regression was conducted separately on each injury-history measure (minor, moderate, and medically attended injuries). For each regression, only those child and parent attributes summarized in Table IV that significantly related to the outcome measure were included. For each regression, in step 1 the child's age (in months) and sex

Table IV. Correlations Showing the Relation of Parent Attributes, Child Attributes, and Maternal Supervision to Child-Injury Risk

Measure	Injury-risk measure from the Injury History Questionnaire		
	Minor	Moderate	Medical
Parent attribute			
Big Five Inventory			
Conscientiousness	.00	-.26*	-.06
Neuroticism	.21*	.26*	.12
Parent Health Locus of Control Scale			
Fate	-.03	.07	.01
Parent influence	.19	-.03	.03
Overall score	.02	.07	.08
Parenting Dimensions Inventory			
Consistency	.17	-.03	.10
Nurturance	.00	-.14	.11
Overall score	-.05	-.07	-.05
Parent Supervision Attributes Profile Questionnaire			
Protectiveness	-.09	-.19	.07
Vigilance	-.13	-.03	-.05
Ambivalence	-.19	.09	-.03
Supervision	-.35**	-.26*	-.32**
Overall score	-.08	-.18	.07
Beliefs About Supervision Questionnaire			
Youngest age	-.14	-.22	.07
Checking interval	-.08	.03	.35**
Child attribute			
Sensation Seeking Scale for Children	.15	.32**	.14
Injury Behavior Checklist	.12	.21*	.19
Early Childhood Behavior Questionnaire			
Behavioral Intensity	.23*	.46**	.27*
Activity level	.32**	.17	.11
Inhibitory control	-.01	-.18	-.26*
Impulsivity	.08	-.16	.05
Maternal supervision			
IV	-.25*	-.40**	-.24*
S-IV	-.06	-.12	-.26*
S-OV	-.19*	-.04	-.15
OS	-.25*	-.07	-.12
NS	.27*	.21*	.03

IV, proportion of time when the mother has the child in view; medical, injuries since birth that were treated by a doctor or dentist; minor, minor injuries since birth that mom has treated; moderate, moderately severe injuries since birth; NS, proportion of time when mom is responsible for the child but is not supervising at all; OS, overall supervision score (collapsed over all entries); S-IV, supervision score when child is in view of the mother; S-OV, supervision score when child is out of view of the mother. * $p < .05$. ** $p < .01$

were entered to control for these variables. In step 2, child attributes that were correlated with the criterion variable (Table IV) were entered. In step 3, questionnaire-based parent attributes that correlated with the criterion variable (Table IV) were entered. We entered child attributes before parent ones, because we were most interested in determining whether parent attributes predict child-injury risk *after* controlling for any impact of child attributes on risk. However, it should be noted that entering parent variables before child ones (i.e., reversing steps 2 and 3) yielded the exact same conclusions as reported below.

For minor parent-attended injuries, a significant step 1, $F(2, 62) = 6.95, p < .01$, and step 2, $F(2, 60) = 5.43, p < .01$, indicated that child attributes were the only significant predictors of injury risk. In particular, age, $t = 3.53, p < .05, r^2 = .18, B = 0.04, SE = 0.01$, and activity level, $t = 2.95, p < .05, r^2 \text{ change} = .13, B = 0.61, SE = 0.21$, were the key predictors, accounting for 31% of the variance.

For moderately severe injuries, a significant step 1, $F(2, 58) = 6.87, p < .01$, and step 2, $F(3, 55) = 5.47, p < .01$, also revealed that child attributes were the only significant predictors. Specifically, age, $t = 3.35, p < .05, r^2 = .19$,

$B = 0.21$, $SE = 0.06$, and behavioral intensity, $t = 2.14$, $p < .05$, r^2 change = .19, $B = 1.94$, $SE = 0.97$, predicted moderately severe injuries and accounted for 38% of the variance.

For medically attended injuries, however, child attributes and parent attributes both predicted injury risk as indicated by a significant step 2, $F(3, 59) = 2.92$, $p < .05$, and step 3, $F(1, 58) = 6.18$, $p < .05$. Specifically, inhibitory control, $t = -1.97$, $p < .05$, $r^2 = .18$, $B = -0.21$, $SE = 0.11$, and scores on the supervision subscale of the PSAPQ significantly predicted children's medically attended injuries, $t = -2.23$, $p < .05$, r^2 change = .06, $B = -0.38$, $SE = 0.17$, accounting for 32% of the total variance.

In summary, child attributes predicted all levels of injury risk, but for medically attended injuries supervision also significantly contributed to predict injury risk.

Discussion

These findings reveal child and parent attributes that relate to caregiver supervision and provide insight into how these factors influence child-injury risk.

Child Attributes

In general, child attributes that were likely to result in increased frequency of injury-risk behaviors (risk taking, sensation seeking, and impulsivity) were associated with greater supervision, whereas attributes likely to reflect good self-control and compliance with rules by the child (inhibitory control) were associated with less supervision. These findings contrast with those obtained in laboratory-based studies of maternal supervision which did not find evidence that parents moderate supervision for children as a function of the child's behavior (Cataldo et al., 1992; Morrongiello & Dawber, 1998). This discrepancy in results highlights the importance of selecting settings for the study of supervision that are familiar to parents and their children, thereby increasing the likelihood of observing *typical* behaviors and important relations between child behavior and parent supervision.

The only attribute that did not relate to supervision as expected was behavioral intensity, which related to greater risk of moderately severe injuries but was associated with less time in view of the mother. Previous research has shown that mothers of children who routinely engage in increased risk taking report that they can have little impact on changing such behaviors (Morrongiello & Dayler, 1996; Morrongiello & Hogg, 2004). Extending this logic to these findings, children high in behavioral intensity may behave in ways that make it

difficult for parents to provide close supervision regardless of how they intend to supervise, thereby increasing children's risk of injury. To date, the attribute of behavioral intensity has received little attention in child-injury research. These findings, however, suggest further research to explore how this attribute influences injury risk is warranted.

Child attributes also related to children's history of injuries. Sensation seeking, risk taking, and several aspects of temperament (activity level, behavioral intensity, and inhibitory control) differentially related to various indices of injury risk. These results add to the growing evidence that temperament characteristics are important to understanding child-injury risk. The results extend these findings, however, by demonstrating that particular aspects of temperament may predispose children to *different* levels of injury risk. In this study, behavioral intensity related to minor, moderate, and medically attended injuries, whereas activity level related only to minor injuries and inhibitory control related only to medically attended injuries. Recent research with children having attention deficit hyperactivity disorder (ADHD) also suggests that the behavioral attributes of activity level and impulsivity may lead to more frequent minor than medically attended injuries (Byrne et al., 2003). These findings call attention to the need for greater specificity in studying behavioral attributes and their relation to injury risk in children. It is increasingly common for studies to utilize a temperament composite, which precludes examining relations between specific attributes and injury risk. However, it may prove more useful to fully examine how *different* temperament attributes uniquely relate to injury risk and whether certain attributes play a more critical role than others in predicting risk for different levels of injury severity.

Parent Attributes

Surprisingly, few studies have examined the relation between caregiver personality attributes and child-injury risk. Morrongiello and House (2004) found that mothers high in conscientiousness had children who had experienced fewer injuries, though the mechanism by which this effect was realized was not evaluated. These findings suggest that closer supervision may be one way that conscientious mothers achieve this result. Although not all measures of supervision related to conscientiousness, mothers high in this attribute kept children in view more often than those low in conscientiousness, and having children in view has been shown to result in closer supervision (Morrongiello, Corbett, McCourt, & Johnston, in press).

There is also a suggestion in the literature that neuroticism may relate to injury risk (Davidson et al., 1987), though the basis for this relation remains to be determined. In this study, mothers high in neuroticism had their children with them less of the time when at home together, which could increase child-injury risk. Neuroticism was also associated with lower overall supervision. Obviously, further research is needed to more fully examine how parent personality attributes influence young children's risk of home injury. Suffice it to say that these results suggest there is merit in examining links between caregiver personality attributes and young children's risk of home injuries and that these relations might be effected via caregiver supervision behaviors.

Previous research reported that mothers who believe fate mostly is responsible for their child's health had children who experienced more injuries (Morrongiello & House, 2004; Morrongiello et al., 2004a). The results of this study suggest that this effect may be realized via supervision. Specifically, a belief that fate mostly determines their child's health status was marginally associated with lower supervision of children when the child was out of view of the mother (Table III). Fate beliefs, however, did not relate directly to the frequency of childhood injuries in this study, which is surprising. Further research exploring caregivers' beliefs that fate is primarily responsible for their child's health status is needed to more fully understand the implication of these beliefs for children's risk of injury. It may be, for example, that beliefs about the extent of control they can have over their child's health status change over time as a function of parents' experiences in attempting to socialize their children to avoid risk and engage in more safety practices. Mothers of school-age children who are risk takers and have a long history of experiencing injuries, for example, report that they can have little impact to change their children's behavior, and they have tried all that can be done, leading to a greater belief in fate than parent control over their child's health (Morrongiello & Hogg, 2004). Thus, repeated difficulties encountered when parents attempt to socialize their children for safety may lead to a shift from a belief in parents' control over their child's health to a belief in fate, resulting in more lax supervision and, eventually, increased injuries. Possibly, in this study, a belief in fate controlling their child's health was starting to influence supervision but was not yet producing noteworthy effects on the frequency of children's injuries.

Surprisingly, measures of parenting attributes did not relate to supervision behaviors. Possibly, the dimensions of parenting that were sampled (consistency, nonrestrictive

attitude, nurturance, and responsiveness to child input) are responsible for the lack of findings. Measures that tap more traditional characterizations of parenting (permissiveness, authoritative, and authoritarian) may prove more fruitful for understanding child-injury risk. For example, a recent study found that permissive parenting was associated with teaching children about safety in ways they elevated their risk of medically attended injury (Morrongiello, Corbett, Lasenby, Johnston, & McCourt, in press). Thus, dimensions of parenting that were not measured herein seem to be important determinants of children's risk of injury.

Supervision and Child-Injury Risk

Speculation of links between caregiver supervision and childhood injuries is long-standing in the child-injury literature. Only recently, however, have professionals begun to address this issue empirically. A recent study yielded a taxonomy of supervision and demonstrated that this relates to child-injury risk (Morrongiello et al., 2004a, 2004b), providing the first *direct* evidence that closer supervision plays a protective role and is associated with fewer child injuries. These findings extend our understanding of caregiver supervision and how this relates to childhood injury risk. Not only did mothers moderate level of supervision to provide closer supervision of children possessing attributes likely to increase injury risk but supervision predicted children's history of injuries. Specifically, in addition to child attributes, supervision independently contributed to predict medically attended injuries. To our knowledge, these are the first data demonstrating that caregiver supervision predicts children's risk of experiencing medically attended injuries.

Methodological Advancements

It can be extremely difficult to study caregiver supervision in ways that do not distort or misrepresent this phenomenon and that have relevance for understanding child-injury risk (Morrongiello, 2005). The results of this study reveal two questionnaire indices of supervision that related to actual supervision and child-injury risk. For the PSAPQ, many subscales related supervision indices and injury risk. A previous study on the validity of the PSAPQ confirmed that responses on the PSAPQ correlate with unobtrusively observed supervision of children on playgrounds (Morrongiello & House, 2004). This study extends these findings by demonstrating that the PSAPQ is a good proxy for supervision in the home environment. Earlier research on the BAS found that parents who reported infrequent checking on their child had children with a history of more frequent

injuries (Morrongiello & Hogg, 2004). The same results were obtained herein for medically attended injuries. Possibly, this relation occurs via supervision. Mothers who would allow longer time to pass before going to check on their unsupervised child had their child with them less of the time when at home, which could elevate children's risk of injury. In sum, these two new questionnaire measures of supervision are proving useful for research that seeks to relate caregiver supervision to child-injury risk.

Limitations and Directions for Future Research

There are limitations that must be noted and considered in future research. First, parents were fully aware that we were interested in supervision, and this may have distorted their behavior. Though we emphasized that no child was ever supervised all the time and that we were especially interested in understanding the basis for not supervising, the very fact of their need to report on supervision may have made them more self-aware of this and effected changes in these behaviors. Of course, the fact that parents *still* reported unsupervised periods, and poorly supervised periods certainly suggests that the data are valid. Moreover, positive reporting biases would mean only that the results provide conservative *underestimations* of how poorly caregivers actually routinely supervise. Nonetheless, this is a consideration in interpreting the results and designing future studies on this topic.

Second, the parents were required to track supervision using paper and pencil recording devices. Use of hand-held computerized devices might have made this process easier, as well as prevented parents the opportunity to review earlier entries and reports that might have biased later entries or their behavior. Finally, the generalizability of the findings must be cautiously considered. The study demands for participation were substantial, and 15 of the original families dropped out. Although statistical comparisons revealed no differences between those who continued and those who dropped out (see footnote 2), one cannot be certain that this was not somehow a select sample.

Conclusion

The results of this study reveal many child and parent attributes that influence the nature of the supervision children receive at home. Specifically, child temperament and parent personality characteristics both related to maternal supervision practices. Moreover, child and parent factors also related to injury risk. For medically attended injuries, child attributes and parent supervision

both predicted risk, whereas for less serious injuries child factors alone determined risk. These findings add to the growing evidence linking supervision to child-injury risk, and they highlight the importance of examining both child *and* parent characteristics, including supervision, in studies on the determinants of children's injuries.

Acknowledgments

This research was supported by a grant from the Social Sciences and Humanities Research Council. The authors extend their thanks to the parents for their enthusiastic participation.

Received November 15, 2004; revisions received April 4, 2005, June 17, 2005 and July 28, 2005; accepted August 5, 2005

References

- Baker, S. P., O'Neil, B., & Ginsburg, M. (1992). *The injury fact book*. New York: Oxford University Press.
- Byrne, J., Bawden, H., Beattie, T., & DeWolfe, N. (2003). Risk for injury in preschoolers: Relationship to attention deficit hyperactivity disorder. *Child Neuropsychology*, 9, 142–151.
- Cataldo, M., Finney, J., Richman, G., Riley, A., Hook, R., Brophy, C., et al. (1992). Behavior of injured and uninjured children in and their parents in a simulated hazardous setting. *Journal of Pediatric Psychology*, 17, 73–80.
- Centers for Disease Control and Prevention, National Center for Injury Prevention and Control. (2000). *Ten leading causes of death by age group: 1996*. Retrieved September 20, 2000, from <http://www.cdc.gov/ncipc/osp/states/101c96.html>
- Davidson, L., Hughes, S., & Richards, M. (1987). Maternal personality and injury in children. *Personality and Individual Differences*, 8, 961–963.
- DeVellis, R., DeVellis, B., Blanchard, L., Klotz, M., Luchok, K., & Voce, C. (1993). Development and validation of the parent health locus of control scale. *Health Education Quarterly*, 20, 211–225.
- Harrell, W. A. (2003). Dangerous activities by children in grocery carts: Is adult supervision important? *Psychological Reports*, 92, 957–962.
- Jaquess, D., & Finney, J. (1994). Previous injuries and behavior problems predict children's injuries. *Journal of Pediatric Psychology*, 19, 79–89.
- John, O., Donahue, E., & Kentle, R. (1991). *The "Big Five" Inventory*. Berkeley, CA: Berkeley Institute of Personality and Social Research, University of California.

- Miller, T., Romano, E., & Spicer, R. (2000). The cost of childhood unintentional injury and the value of prevention. *Future of Children, 10*, 137–163.
- Morrongiello, B. A. (1997). Children's perspectives on injury and close call experiences: Sex differences in injury-outcome processes. *Journal of Pediatric Psychology, 22*, 499–512.
- Morrongiello, B. A. (2005). The role of supervision in child-injury risk: Assumptions, issues, findings, and future directions. *Journal of Pediatric Psychology*. doi:10.1093/jpepsy/jsj041.
- Morrongiello, B. A., & Corbett, M. (in press). The Parent Supervision Attributes Profile Questionnaire (PSAPQ): A measure of parent supervision that is relevant for understanding children's risk of unintentional injury. *Injury Prevention*.
- Morrongiello, B. A., Corbett, M., Lasenby, J., Johnston, N., & McCourt, M. Factors influencing young children's risk of unintentional injury: Parenting style and strategies for teaching about home safety. Manuscript submitted for publication.
- Morrongiello, B. A., Corbett, M., McCourt, M., & Johnston, N. (2005). Unintentional injuries in young children: I. A contextual analysis of caregiver supervision of children at home. *Journal of Pediatric Psychology*. doi:10.1093/jpepsy/jsj045.
- Morrongiello, B. A., & Dawber, T. (1998). Toddlers' and mothers' behaviors in an injury-risk situation: Implications for sex differences in childhood injuries. *Journal of Applied Developmental Psychology, 19*, 625–639.
- Morrongiello, B. A., & Dayler, L. (1996). A community-based study of parents' knowledge, attitudes, and beliefs related to childhood injuries. *Canadian Journal of Public Health, 87*, 383–388.
- Morrongiello, B. A., & Hogg, K. (2004). Mothers' reactions to children misbehaving in ways that can lead to injury: Implications for gender differences in children's risk taking and injuries. *Sex Roles, 50*, 103–118.
- Morrongiello, B. A., & House, K. (2004). Measuring parent attributes and supervision relevant to child-injury risk: Examining the usefulness of questionnaire measures. *Injury Prevention, 10*, 114–118.
- Morrongiello, B. A., & Kiriakou, S. (2004). Mothers' home-safety practices for preventing six types of childhood injuries: What do they do, and why? *Journal of Pediatric Psychology, 29*, 285–297.
- Morrongiello, B. A., & Lasenby, J. *Development and validation of a Sensation Seeking Scale for Children (SSSC)*. Manuscript submitted for publication.
- Morrongiello, B. A., Ondejko, L., & Littlejohn, A. (2004a). Understanding toddlers' in-home injuries. I. Context, correlates, and determinants. *Journal of Pediatric Psychology, 29*, 415–431.
- Morrongiello, B. A., Ondejko, L., & Littlejohn, A. (2004b). Understanding toddlers' in-home injuries. II. Examining parental strategies, and their efficacy, for managing child injury risk. *Journal of Pediatric Psychology, 29*, 433–446.
- Morrongiello, B. A., & Sedore, L. (2005). The influence of child attributes and social-situational context on school-age children's risk-taking behaviors that can lead to injury. *Journal of Applied Developmental Psychology, 26*, 347–361.
- Peterson, L., DiLillo, D., Lewis, T., & Sher, K. (2002). Improvement in quality and quantity of prevention measurement of toddler injuries and parental interventions. *Behavior Therapy, 33*, 271–297.
- Pless, C., & Pless, B. (1995). How well they remember: The accuracy of parent reports. *Archives of Pediatric and Adolescent Medicine, 149*, 533–558.
- Plumert, J., & Schwebel, D. (1997). Social and temperamental influences on children's overestimation of their physical abilities: Links to accidental injuries. *Journal of Experimental Child Psychology, 67*, 317–337.
- Pollack-Nelson, C., & Drago, D. (2002). Supervision of children aged two through six years. *Injury Control and Safety Promotion, 9*, 121–126.
- Putnam, S. P., Gartstein, M. A., & Rothbart, M. K. *Fine-grained assessment of toddler temperament*. Manuscript submitted for publication.
- Schwebel, D. C., & Bounds, M. L. (2003). The role of parents and temperament on children's estimation of physical ability: Links to unintentional injury prevention. *Journal of Pediatric Psychology, 28*, 505–516.
- Schwebel, D. C., & Plumert, J. M. (1999). Longitudinal and concurrent relations among temperament, ability estimation, and injury proneness. *Child Development, 70*, 222–230.
- Shannon, A., Brashaw, B., Lewis, J., & Feldman, W. (1992). Nonfatal childhood injuries: A survey at the Children's Hospital of Eastern Ontario. *Canadian Medical Association Journal, 146*, 361–365.
- Slater, M. A., & Power, T. G. (1987). Multidimensional assessment of parenting in single-parent families. *Advances in Family Intervention, Assessment, and Theory, 4*, 197–228.
- Speltz, M. L., Gonzales, N., Sulzbacher, S., & Quan, L. (1990). Assessment of injury risk in young children: A preliminary study of the injury behavior checklist. *Journal of Pediatric Psychology, 15*, 373–383.