A Study of Infants’ Injury-Risk Behaviours at Various Stages of Motor Development: A Longitudinal Study

by

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ABSTRACT

A STUDY OF INFANTS’ INJURY-RISK BEHAVIOURS AT VARIOUS STAGES OF MOTOR DEVELOPMENT: A LONGITUDINAL STUDY

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In Canada, unintentional injury represents the leading cause of death among young children. Infants remain particularly vulnerable as they are gaining access to hazards through increased mobility, yet unable to properly assess and avoid risk. The current study examined the rate and type of injury-risk behaviours, how these relate to injury-risk, and parent supervision patterns, with the focus on three stages of motor-development (sitting, crawling, and walking). Eighty-five parent-infant dyads were followed over the course of an average 6 months. Results found stability in infant risk-taking over development, with these rates predicting infant injury-risk across development. The majority of injury-risk behaviours occurred while infants’ were within view of supervisors but with infants out of reach about 55% of this time. The significance of these results for understanding infant injury-risk is discussed.

Key words: infants, unintentional injury-risk, injury prevention, parent supervision, mobility
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Unintentional Injury

Unintentional injury represents the leading cause of death and disability, and a major contributor to hospitalization, among young children aged 1 through 18 years of age in Canada, the United States and most other industrialized countries (Gill & Kelly, 2017a; Hollwarth, 2013; Morrongiello, Macisaac, & Klemencic, 2007; Morrongiello, Ondejko, & Littlejohn, 2004a; Parachute, 2015; Statistics Canada, 2015; Wells, Morrongiello, & Kane, 2012). Worldwide, unintentional injury accounts for the deaths of approximately 830,000 children each year, a staggering 2300 every day (He et al., 2014; Hollwarth, 2013; Salam et al., 2016; World Health Organization [WHO], 2012). In Canada alone, approximately 400 children die each year as a result of unintentional injury (Government of Canada, 2013). In addition to the death toll, every year millions of injured children require long-term hospitalization and care, often being left permanently disabled (WHO, 2008). Along with the undisputable health threat, unintentional injuries produce both direct and indirect economic costs. Indeed, the financial burden is estimated to be around $6 billion a year in Canada (Parachute, 2015). It is astounding to note too that nearly half of these childhood deaths could have been prevented had the appropriate prevention strategies been implemented (WHO, 2012). Regrettably, despite the unquestionable health threat unintentional injury poses to young children and adolescents, this global issue lacks appropriate awareness and attention from the research community, the public, and political policies (Salam et al., 2016).

One developmental stage during which children experience particularly high rates of injury, is infancy. As infants (younger than 1 year) demonstrate distinct patterns of mortality, they are often excluded from statistical reports of the leading causes of death among children (Public Health Agency of Canada, 2009). However, as representing the 5th leading cause of death
in the United States (Centers for Disease Control and Prevention [CDC], 2014) and 9th in Canada (Statistics Canada, 2016), unintentional injury among infants are of particular concern. The Center for Disease Control and Prevention recently released data for the year 2013, revealing distinct differences in the unintentional injury death rate by age. Infants under 1 year of age were reported to have the highest death rate (29.3/100,000), significantly greater than what was reported for children aged 1 to 4 (8.3/100,000), 5 to 14 (3.7/100,000) and 15 to 24 (26.4/100,000) years (Xu, Murphy, Kochanek, & Bastian, 2016). Moreover, in the United States, it has been projected that every one and a half minutes, an infant is taken to an emergency department for treatment following an unintentional injury (Mack, Gilchrist, & Ballesteros, 2007; Ramdzan, Liew, & Ming Khoo, 2014). For infants age 0-12 months, it is estimated that approximately 328,500 cases of unintentional injury are treated within emergency departments each year (Mack et al., 2007). In fact, in response to this pediatric health threat, in the United States, many influential agencies have come together to release recommendations regarding injury prevention counselling, urging that this be incorporated as part of the well-child exam given by pediatricians (Gardner, 2007; Gill & Kelly, 2017a). Due to the nature and extent of this public health threat, many studies have sought to identify factors that elevate risk for injury (Hollwarth, 2013; Schwebel & Gaines, 2007).

Factors Related to Injury-Risk

Child Factors

Previous research has identified a number of child factors that influence risk of injury (Wells et al., 2012). These factors include: (a) child sex (Greenes, Wigotsky, & Schutzman, 2001; Kronsberg, Schmaling, & Fagot, 1985; Morrongiello & Dawber 1998; Morrongiello, McArthur, & Spence, 2016; Schwebel et al., 2017; Wells et al., 2012); (b) behavioural
difficulties, which include over-activity, aggressiveness, and challenging temperaments (Morrongiello & Dawber 1998; Schwebel et al., 2017; Wells et al., 2012); (c) propensity toward sensation seeking and risk-taking (i.e., motivated toward novel and sensory-stimulating activities; Morrongiello & Dawber 1998; Morrongiello et al., 2016; Morrongiello et al., 2004a; Wells et al., 2012); (d) lower adherence to parental commands and safety rules (Morrongiello et al., 2016; Morrongiello et al., 2004a; Wells et al., 2012); (e) an overestimation of physical capabilities (Wells et al., 2012); (f) having experienced past injuries (Wells et al., 2012); and (g) children’s developmental level or age (Gill & Kelly, 2017a; Hollwarth, 2013; Mack et al., 2007; Morrongiello & Kiriakou, 2004; Morrongiello et al., 2004a; Schwebel et al., 2017).

Research has consistently found males to sustain more frequent and severe injuries in comparison to females (Karazsia, Guilfoyle, & Wildman, 2011; Morrongiello & Dawber 1998; Morrongiello et al., 2016; Morrongiello et al., 2004a). More generally, children who score higher in sensation seeking, impulsivity, and activity level are more likely to engage in injury-risk behaviours, as well as experience more frequent injuries (Morrongiello & Dawber, 1998; Morrongiello et al., 2004a; Wells et al., 2012).

Children’s developmental level affects both the causes and locations of injuries (Gill & Kelly, 2017a; Hollwarth, 2013; Mack et al., 2007; Morrongiello et al., 2007; Morrongiello et al., 2004a). For children aged 6 years and older, it is more common for injuries to occur outside of the home, often resulting from fall- or pedestrian- related incidents. Whereas, infants, toddlers and preschool children are more likely to experience injuries in the home, most commonly as a result from falls, burns and unintentional poisonings (Gill & Kelly, 2017a; Hollwarth, 2013; Morrongiello & Kiriakou, 2004; Morrongiello et al., 2007; Morrongiello et al., 2004a; Nouhjah, Niakan Kalhori, & Saki, 2017). In addition, research investigating injury patterns have shown the
rate of injury during infancy increases as children become more mobile and physically capable of engaging in injury-risk behaviours (Morrongiello, Sandomierski, & Valla, 2010; Schwebel et al., 2017).

Indeed, examination of epidemiology data reveal heightened rates of infant injury that directly coincided with newly achieved developmental milestones that allow for increased mobility, exploratory behaviour and hand-to-mouth gestures (Agran et al., 2003). For example, the rate of injuries related to the ingestion of foreign objects peaked at around 9 to 11 months, a time when infants often demonstrate hand-to-mouth movements and have acquired independent mobility (Agran et al., 2003). Similarly, fall-related injuries increased at around 15 to 17 months, a time in which infants typically demonstrate the ability to climb (Agran et al., 2003), but have not yet become adept and skillful climbers. Thus, with newly acquired developmental milestones comes increased independent mobility, where infants are now able to explore their environment and access hazards that were previously inaccessible due to a lack of mobility (Agran et al., 2003; Flavin, Dostaler, Simpson, Brison, & Pickett, 2006; Hammig & Ogletree, 2006).

Moreover, these newly mobile infants are at further risk of injury because they are underdeveloped in the ability to assess the danger and risk associated with various environmental hazards and to effectively avoid them (Agran et al., 2003; Gill & Kelly, 2017a, 2017b; Longobardi, Quaglia, & Settanni, 2016; Schwebel & Gaines, 2007). In addition, until around 2 years of age, infants are ineffective in their ability to accurately perceive the size of their bodies in relation to their environment (e.g., attempting to walk under a table that is too low for their height), or unaware that their bodies may present as an obstacle when moving around (e.g., trying to pick up a blanket, which they are standing on, from off the floor; Longobardi et al.,
Thus, it is up to parents to implement safety precautions to prevent injuries during infancy.

**Parent Factors**

Many parents lack adequate knowledge about hazards that pose an injury-threat to their young (Nansel et al., 2002). Additionally, an investigation into the homes of young children revealed an alarming absence of preventative safety precautions. For example, nearly half of the homes contained bathwater with temperatures high enough to burn young children, and even more homes kept chemicals in unlocked, accessible locations (Gaines & Schwebel, 2009). Unfortunately, caregivers are generally unaware of the common threats of injury that their children are at an increased risk for at various ages (Hollwarth, 2013; Morrongiello & Dayler, 1996). While parents may not adequately remove the presence of risk in their home, this is not occurring as a sole consequence of a parents’ inability to detect the actual safety threat posed (Gaines & Schwebel, 2009). Indeed, relevant literature has shown that even if caregivers possess a significant amount of knowledge on household safety hazards, they often nevertheless fail to take adequate preventative measures to safeguard their children (Morrongiello & Dayler, 1996). Unfortunately, the decision to actively eliminate hazardous environments is often compromised by parental perceptions regarding the causes they assign to the injuries of their young, and consequential beliefs regarding the preventability of such injuries (Gaines & Schwebel, 2009).

It is a commonly held belief among many caregivers that injuries sustained in young childhood are simply unfortunate consequences, typical of childhood behaviour, and as such, perceived as unavoidable or a natural part of childhood (Gaines & Schwebel, 2009; Morrongiello & Schwebel, 2008). In contrast, however, research has found that the *majority* of childhood injuries (50 to 90%) are in fact preventable (Gill & Kelly, 2017a; Hollwarth, 2013; Morrongiello,
Corbett, McCourt, & Johnston, 2006). Unfortunately, caregivers who perceive injuries sustained in childhood as accidental feel less personal responsibility in taking action to prevent against them (Gaines & Schwebel, 2009). Thus, critical to the health and wellbeing of children, it is imperative that caregivers’ believe that these injuries can be prevented, and more importantly, provided knowledge about the steps they can take to help prevent against them. Indeed, there is evidence to support the development of interventions that target educating parents on improving in-home safety, as this has been found to successfully reduce the occurrence of unintentional injuries requiring medical attention (Gill & Kelly, 2017a).

**Supervision and In-Home Injury**

Previous research reveals the following three strategies are most often used by caregivers to protect against child injuries in the home: (1) Modifications to the environment to prevent hazard accessibility (Ablewhite et al., 2015; Morrongiello et al., 2004b; Morrongiello, Widdifield, Munroe, & Zdzieborski, 2014); (2) teaching strategies and other child-directed approaches designed to alter child behaviour (Ablewhite et al., 2015; Morrongiello et al., 2004b; Morrongiello et al., 2014); and (3) supervision, that is watching and proximity (Ablewhite et al., 2015; Morrongiello et al., 2004b; Morrongiello et al., 2014). For infants beginning to gain access to hazards in the environment, strategies that involve making changes to the environment to prevent access to these hazards becomes critical. Examples of environmental modifications include: installation of safety devices (i.e., stair gates, plugs for electrical outlets, etc.), and the storage of hazardous chemicals in out-of-reach and securely fastened areas (Ablewhite et al., 2015).

In terms of teaching and child-directed strategies, examples include providing knowledge to children about safety hazards, setting rules for children to obey, and providing a system of
reward and/or punishment; all used in order to prevent and discourage children from engaging with hazards and in injury-risk behaviours (Ablewhite et al., 2015). Although a common method implemented by parents, the use of strategies such as teaching varies largely depending on child age. Specifically, the use of teaching strategies to inform children about home safety has been found to begin with children two years of age (Morrongiello et al., 2014). Moreover, while parents often use a combination of these preventative measures (Ablewhite et al., 2015; Morrongiello et al., 2004b), supervision has been repeatedly cited as one of the most important behavioural factors related to child injury-risk, particularly among the very young (Morrongiello et al., 2007; Morrongiello et al., 2006; Morrongiello et al., 2004b; Schwebel & Gaines, 2007).

For supervision, three components define the quality and level of supervision being provided. Specifically, supervision has been defined based on the following: attention (both auditory and visual), proximity (measured by degree of physical closeness between supervisor and child), and level of continuity of these behaviours across time (Morrongiello, 2005; Schnitzer, Dowd, Kruse, & Morrongiello, 2015). Applying this conceptual approach, Morrongiello and colleagues provided direct evidence for the influence of supervision on children’s injury-risk. For example, examining maternal reports of supervision level provided during times when children aged 2 to 3 years sustained injury, demonstrated that as supervision level decreased, the risk of injury increased (Morrongiello et al., 2004b). Notwithstanding the direct association between caregiver supervision and infant injury-risk, there has been scarcely any research conducted on the supervision levels of children under 2 years of age. In fact, there appears to be no research that has investigated how supervision levels change as a function of infant motor development. Thus, the current study’s investigation of infant injury-risk will
incorporate an exploration of caregiver supervision levels during times their infants are demonstrating behaviours likely to result in injury (i.e., injury-risk behaviours).

The Current Study

Due to the paucity of research examining infant injury-risk behaviours, the current study is mainly exploratory in nature. The aims of the current study are: (1) to investigate the rate and types of injury-risk behaviours infants engage in as they increase in motor-development level (sitting, crawling, walking), and if infants show stability in their frequency of risk behaviours across motor development stages; (2) to identify the supervision levels that are in place when infants engage in these risk behaviours; (3) and to examine how risk behaviours and supervision relate to in-home injuries sustained. This study will also investigate parental perceptions and beliefs regarding their infants’ threat of injury, and determine how these relate to parent supervision practices as well as infant risk behaviours.

Method

Participants

Participants included a total of 85 parent-infant dyads (47 boys, 38 girls). The average age of infant’s at the start of the study was 7 months old ($M_{age} = 6.96$ months, $SD = 1.10$, age range: 4-9.5 months). Participants were recruited from a database developed and maintained by the Child Development Research Unit (CDRU) at the University of Guelph. The database contains the contact information of over 13,000 families that are interested in participating in research on child development. The contact information stored on the database was collected at various recruitment locations in Guelph and the surrounding areas (e.g. Mom’s town events, Guelph General Hospital, local recreation centres, Early Years daycare centres, etc.). Parents were eligible to participate if their infants were able to sit up independently but were not yet able
to move around independently (i.e. not yet able to crawl) and were developing normally, as reported by the parent and observed during home visits.

The majority of the sample consisted of maternal caregivers who were married (95%), Caucasian (92%), earned an annual family income of at least $80,000 (75%), and had attended post-secondary education (100%). The majority of caregivers (88%) were not currently working outside of the home on a regular basis.

**Measures**

Through the use of the measures described below, the current study collected information regarding infant motor-development, the nature and rate of injury-risk behaviours and level of parental supervision provided, as well as infant injury rates. A complete list of all materials are presented in the Appendices.

**Motor Development Checklist**

Infant motor-development was determined and tracked throughout the study’s duration by using the criteria outlined on the Motor Development Checklist (MDC), a hierarchical rating system based on the integration of three popular measures of infant development: the Bayley Scales of Infant Development (Bayley, 2006), Ages & Stages Questionnaire (Squires & Bricker, 2009), and the Denver Developmental Screening Test (Frankenburg & Dodds, 1967). The MDC includes 6 levels of motor ability, with higher levels indicative of increasing mobility status (e.g. level 1 = sitting up without back support, level 6 = running without support; see Appendix A). For the purposes of this study, we focused on sitting, crawling and walking, which represents the most common sequence of motor development levels.
Injury-Risk Behaviour Diary Sheet

Primary caregivers completed an ‘Injury-risk Behaviour Diary Sheet’ each time their infant engaged in a behaviour that was likely to result in injury (see Appendix B). These forms have been implemented and validated in previous research investigating injury-risk behaviours over time (Morrongiello et al., 2004a, 2004b). Prior to completing the diary forms, caregivers were provided with an extensive discussion about the nature and type of behaviors of interest. Specifically, injury-risk behaviours were defined to parents as any behaviour that almost, or was likely to result in injury to the infant. Parents were asked to answer a number of questions pertaining to the incident such as: (1) a description of the infant’s behaviour that was considered dangerous (see Data Reduction below for details on coding for type of injury-risk behaviour), and (2) whether the infant had ever done the behaviour in the past and had ever gotten hurt. In order to obtain a measure of supervision level at the time of the injury-risk behaviour, parents were asked to report the following: (1) whether the infant was in view of supervisor or out of view, (2) within reach of supervisor or beyond reach, and (3) how many minutes had passed since the supervisor last laid eyes on the infant (see Data Reduction below for details on coding of supervision levels). Finally, using a likert-scale (1 = not at all, to 5 = very), parents were asked to respond to a variety of questions that targeted parental perceptions regarding the incident (e.g. “How much can parents prevent these types of behaviours?”; “How much do you agree that closer supervision would have prevented him/her from doing this?”).

Injury Diary Form

Parents were asked to complete a ‘My Infant Got Hurt Diary Form’ (see Appendix C) to track minor in-home injuries to their infants. This method of parent recording has been successfully implemented in previous research tracking child injury events (e.g., Morrongiello et
al., 2004a, 2004b; Peterson, Brown, Bartelstone, & Kern, 1996). As in past research (Morrongiello et al., 2004a, 2004b; Peterson et al., 1996), caregivers were asked to complete a form each time the target infant sustained an in-home injury, with injury defined for them as requiring a physical indication of damage (e.g. bump, bruise, scratch, burn mark) lasting longer than 5 minutes, or an indication of internal tissue damage that may not be visible (i.e., vomiting as a result of ingesting poisonous substances). In order to obtain information regarding the nature and frequency of infant injury, parents were asked to describe the type of injury sustained (i.e., burns, cuts/scrapes/punctures, bumps/bruise/crushing/red mark). Additional information regarding infant injury events was obtained, however, is not presented or discussed in this thesis.

**Procedure**

At the start of their time in the study, each participant was provided a home visit, where a research assistant would meet individually with primary caregivers to provide a detailed and thorough explanation of all study materials. Participants were provided with their own personal binder, which contained the following materials: (1) Instructions on how to complete binder sheets, (2) ‘Infant Injury-Risk Behaviour Diary Sheet’, (3) ‘My Infant Got Hurt Diary Form’, and (4) sample entries for each form. In order to ensure that each participant was being provided with the same information in a standardized manner, research assistants read through a script with each participant, which detailed all instructions. To ensure proper understanding and completion of all forms, participants were given a detailed explanation of how and when to complete each form, and provided with a number of sample entries that the research assistant completed with the participant. Research assistants provided participants with their contact information, and were encouraged to call if they had any questions or concerns regarding the forms. The home visit was concluded once the research assistant was confident in the
participant’s understanding of all binder materials. Bi-weekly check-in calls, and reminder emails were also provided throughout the study’s duration, with many opportunities provided to ask questions.

As part of a larger study, which will not be described here, participants were provided with a second home visit a week following their first. During this visit, research assistants were provided an opportunity to address participant questions/concerns in person and review any completed forms for accuracy. At each home visit, research assistants worked in collaboration with the parents to assess infant motor-development using the MDC.

Following the two home visits, primary caregivers were contacted every two weeks, by either phone or email, and asked to complete a short interview regarding their infant’s current motor ability, to track infant motor-development and assess if any new milestones had been met. Using the MDC, participants were read a series of motor abilities, and asked to indicate whether their infant was capable of demonstrating each item indicated. In an effort to prevent participants from over-estimating their infants true motor capabilities, participants were specifically asked if the target infant was able to demonstrate each milestone *consistently* (e.g., target infant had demonstrated the motor milestone 80% of the time over at least a two week period). The dates of each motor development check-in were recorded and later matched with the corresponding dates for each form completed by the participant. This was done in order to match infant injury-risk behaviours and infant injuries to the corresponding level of mobility attained at the time of the incident.

Primary caregivers tracked infant injury-risk behaviours and injuries across infant motor-development, starting from when infants were pre-mobile (i.e., able to sit independently, without back support, but not yet able to move from one location to another), to becoming mobile (i.e.,
able to crawl), through to increasing independent mobility (i.e., able to take at least 3 steps unsupported). Once infants were able to consistently demonstrate independent mobility for at least two weeks, two final home visits were scheduled with the participants (as part of the larger study), with each visit approximately one week apart, and participants encouraged to continue completing forms as necessary until the date of their final home visit. This was done in order to capture infants at each stage of motor development, specifically, to ensure an adequate amount of time for infants to become successful in the independently mobile stage of development. At the final home visit, research assistants collected the completed binders, provided participants with a Certificate of Completion and thank you letter from the lab director, as well as a $20.00 gift card as compensation for their hard work.

Data Coding

Coding Infant Injury-Risk Behaviour

Participants’ responses to the open-ended question, “describe exactly what the child did that was dangerous”, was recorded verbatim and then coded using a manual that was constructed based on commonly reported behaviours obtained during pilot testing. Each time a unique response was given that did not fit with the current coding manual, two research assistants would discuss whether it could be coded under a pre-existing code, or if a new code should instead be created. For each additional code added to the manual, the director of the lab was first consulted, and then all previously entered data was re-checked to ensure it was still accurate under the instructions of the updated manual. In order to assess inter-rater reliability, 20% of the data was independently coded by a primary coder and another research assistant, each blind to the others’ codes, and agreement exceeded 88%; the data of the primary coder were analyzed. The complete
coding manual is presented in Appendix D, with a reduced coding scheme shown in Appendix E which contains the final codes used for analysis.

**Coding Infant Injury**

In order to code participants’ responses to the open-ended question, which asked parents to describe the type of injury sustained, the same procedure described above was used to develop and implement a coding manual.

**Coding Supervision Level**

Based on previous conceptualizations of supervision level (Morrongiello et al., 2006; Schwebel & Gaines, 2007), participants were asked to indicate the degree of proximity to the infant (i.e., within or beyond reach of infant), and level of visual attention (i.e., in view or out of view of infant), as well as the continuity of their supervision (i.e., minutes since they last laid eyes on infant). Based on participant responding, 4 separate levels of supervision were identified: (1) within reach and in view of infant, (2) within reach and out of view of infant, (3) beyond reach and in view of infant, and (4) beyond reach and out of view of infant. In respect to participants’ responses regarding when they last laid eyes on their infant, smaller time durations reflect higher levels of supervision in comparison to longer durations.

**Analytic Approach**

The data were analyzed based on three motor-development phases, which occurred sequentially: sitting, crawling, walking/running. For the Analysis of Variance (ANOVA) tests, the results were determined using the Greenhouse-Giesser correction, adjusting the degrees of freedom to correct for when violations of the sphericity assumption were found. For analyses involving correlations, results are presented using Spearman Rho, as a test statistic robust to non-normally distributed data violations. For tests involving multiple comparisons between and
within groups, the Bonferroni correction was applied to correct for family-wise error; results based on this correction are reported.

**Results**

**Injury-Risk Behaviours**

*Rate of Injury-risk Behaviour*

Descriptive statistics indicated that 80% of infants engaged in injury-risk behaviours during the study. On average, infants spent longer time within the crawling stage of motor development ($M = 139$ days; $SD = 47$), compared to both sitting ($M = 44$ days; $SD = 28$), and walking ($M = 38$ days; $SD = 25$). Hence, in order to account for the varying lengths of time infants spent within each motor-development stage, occurrence of injury-risk behaviour was analyzed and reported using rate data, rather than frequency (count) data. As shown in Table 1, there were no significant differences across mobility status, $F(1.54, 98.29) = .32$, $ns$, or as a function of infant sex, $F(1, 64) = .10$, $ns$. On average, infants engaged in risk behaviors at a rate of .05 per day or about 1.5 risk behaviors per month.

Results from a Spearman’s rank-order correlation revealed that injury-risk behaviours were positively correlated across motor-development stages: sit to crawl, $r = .33$, $p < .01$, crawl to walk, $r = .27$, $p < .05$. Thus, infants who are engaging in injury-risk behaviours when sitting, are continuing to do so across motor-development stages.

*Types of Injury-Risk Behaviours*

To investigate the types of injury-risk behaviours reported by parents at different levels of mobility status, and whether this varied as a function of infant sex, a split-plot ANOVA was conducted with mobility status (3: sit, crawl, walk) and type of injury-risk behavior (5: rolling, cruising, mouthing/touching hazards, crushing-risk behaviors, climbing) as within-participant factors, and infant sex (male, female) as the between-participant factor; note that drowning-risk
behaviours were excluded due to their infrequency (see Table 2). Results revealed a main effect of risk behaviour type, $F(4, 76) = 4.12, p < .01, \eta^2_p = .18$. Pairwise comparisons, with a Bonferroni correction, revealed that risk behaviours categorized by mouthing/touching hazards were significantly greater, with climbing marginally greater, than those characterized by rolling-related behaviour ($M_{\text{Diff}} = .21, p < .05; M_{\text{Diff}} = .19, p = .05$, respectively).

**Beliefs about Injury-Risk Behaviours**

In order to examine parents’ beliefs regarding their infants’ injury-risk behaviour, a series of separate ANOVAs were conducted with mobility status (3: sit, crawl, walk) as the within-participant factor and infant sex (male, female) as the between-participant factor. The following statements were examined for parental endorsement ratings: ‘How much can parents prevent these types of behaviours?’; ‘How much do you ‘worry’ about your infant getting hurt from doing these types of things?’; ‘How well do you think your infant understood that you do not want him/her to do this?’; ‘How much does your infant understand about the danger of doing this?’ Results indicated that on average, parents somewhat endorsed the statement that parents can prevent these types of behaviours, with no significant difference across motor-development level ($M = 3.17, SD = 1.21; M = 2.93, SD = .98; M = 3.52, SD = 1.03$, respectively) or sex (male $M = 3.26, SD = .81$; female $M = 3.16, SD = .81$). A main effect of mobility was found for parent’s ratings of how much they worry about their infant getting hurt from engaging in the risk behaviour, $F(2, 38) = 4.06, p < .05, \eta^2_p = .18$. Pairwise comparisons, with a Bonferroni correction, revealed that parents were significantly more worried about their infant getting hurt at walking ($M = 4.01, SD = .95, \text{worry a fair amount}$), in comparison to sitting ($M = 3.35, SD = 1.10, \text{worry somewhat}, p = .05$), and not significant in comparison to crawling ($M = 3.56, SD = .72, \text{worry a fair amount}, p = .056$). Examining parent’s beliefs about how much their infant
understands that they should not engage in the behaviour revealed a significant main effect of mobility, $F(1.46, 27.73) = 14.04, p < .01$, $\eta^2_p = .43$, and infant sex, $F(1, 19) = 5.16, p < .05$, $\eta^2_p = .21$. Specifically, parents rated their infant to have greater understanding at walking ($M = 2.13$, $SD = .83$, a little), followed by crawling ($M = 1.61$, $SD = .41$), and then sitting ($M = 1.33$, $SD = .42$, not at all), with higher ratings of understanding reported for female infants ($M = 1.85$, $SD = .39$, a little) compared to male ($M = 1.46$, $SD = .39$, not at all). Thus, parents generally believe their infants possess limited understanding about not engaging in the injury-risk behaviour.

Finally, results revealed parents believe infants possess more understanding of the danger of engaging in risk behaviour at walking ($M = 1.83$, $SD = .98$, a little), in comparison to both sitting ($M = 1.13$, $SD = .31$, not at all), and crawling ($M = 1.24$, $SD = .49$, not at all), $F(1.31, 24.79) = 11.10, p < .01$, $\eta^2_p = .37$. However, parents reported fairly low ratings overall. Thus, parents seem to have the knowledge that infants’ are not capable of judging their own risk of injury.

Correlations were conducted at each level of mobility in order to examine the relationship between rate of injury-risk behaviour and parent perceptions of these behaviours, including ratings of ‘worry’ that the infant will get hurt and ratings of how ‘typical’ the risk behaviours were for infants at that stage. At crawling, the more risk behaviours, the more parents worried about their infant being injured, $r = .28, p < .05$. However, at walking, higher rates of injury-risk behaviour were rated as highly typical, $r = .35, p < .05$, and these did not evoke worry about injury, $p > .05$.

**Caregiver Supervision**

Descriptive analyses indicated that mothers were the primary supervisors for the majority of injury-risk behaviours documented (84%), followed by fathers (14%), and other (1%). The majority of injury-risk behaviours occurred while infants’ were within view of supervisors (sit:
83%, crawl: 81%, walk: 79%), and within reach of supervisor at sit (70%) but more often beyond reach at crawl (58%) and walk (59%). In order to investigate the level of supervision in place when infants engaged in injury-risk behaviours, several ANOVAs were conducted.

**Attention and Proximity**

To examine the supervisor’s level of attention and proximity to the infant, an ANOVA was conducted with mobility status (sit, crawl, walk) and supervision status (3: in view/in reach, in view/out of reach, and out of view/out of reach) as within-participant factors, and infant sex (male, female) as the between-participant factor; note that since it rarely happened (~1%) that supervisors were out of view/in reach, this category was excluded. Results revealed a significant main effect of supervision status, $F(2, 38) = 4.56, p < .05, \eta^2_p = .19$, such that the proportion of instances in which infants were ‘in view/in reach’, was significantly higher than when they were ‘out of view/out of reach’ ($M_{Diff} = .26, p < .05$). Proportions are shown in Table 3.

**Continuity**

To examine the continuity of parent supervision, an ANOVA was performed with mobility status (sit, crawl, walk) as the within-participant factor and infant sex (male, female) as the between-participant factor. The dependent variable was average minutes since infant was last seen, with the sample restricted to those who provided data at all three motor milestones. As displayed in Table 4, the continuity of parents’ supervision did not change significantly across mobility stage, $F(2, 34) = .57, ns$, or as a function of infant sex, $F(1, 17) = 1.77, ns$. On average, supervisors checked on the infant after 1.13 minutes ($SD = 1.00$).

**Beliefs About Supervision**

Parents were asked to endorse their extent of agreement with the statement that closer supervision would have prevented their infant’s engagement in the injury-risk behaviour, with
higher ratings representing higher levels of endorsement (1 = *not at all*; 2 = *a little*; 3 = *somewhat*; 4 = *a fair amount*; 5 = *very much agree*). An ANOVA was conducted with mobility status (3: sit, crawl, walk) as the within-participant factor and infant sex (male, female) as the between-participant factor. Results revealed that on average, parents *somewhat* endorsed the statement that closer supervision would have prevented their infant’s injury-risk behaviour, consistent across motor-development (\(M = 2.97, SD = 1.27; M = 3.31, SD = .82; M = 3.08, SD = 1.19\), respectively) and sex (male \(M = 3.42, SD = .80\); female \(M = 2.90, SD = .80\)). Correlations were conducted at each level of mobility in order to examine the relationship between these ratings that ‘closer supervision would have prevented the behaviour’ and continuity of supervision. At both crawling and walking, longer lapses in supervision were associated with higher endorsement of the statement that closer supervision was needed to prevent risk behaviours, \(r = .33\) and \(.71\), respectively, \(p < .01\).

**Infants’ Injuries**

**Rate of Injury**

Examining the rate of injury at each level of mobility revealed a significantly higher injury rate at walking (\(M = 2.4\)/month, \(SD = 0.45\)/month), compared to both sitting (\(M = 1.2\)/month, \(SD = 0.48\)/month) and crawling (\(M = 1.2\)/month, \(SD = 0.15\)/month), \(F(1.22, 74.78) = 7.44, p < .01\), \(\eta^2_p = .11\). Thus, rate of injury risk mirrors motor development skill acquisition, with independent mobility yielding the most frequent injuries.

**Types of Injury Sustained**

To examine whether there was an interaction between types of injury sustained during infancy, mobility status and infant sex, an ANOVA was conducted. Mobility status (3: sit, crawl, walk) and injury type (2: cuts/scrapes/punctures, bumps/bruise/crushing) were entered as within-
participant factors, and infant sex (male, female) as the between-participant factor; note that the injury type for burn and any of cuts/scrapes/punctures and bumps/bruise/crushing were not included due to infrequent reporting. As displayed in Table 5, a significant main effect of injury type was found, whereby the proportion of injuries characterized by bumps/bruise/crushing was significantly higher than those characterized by cuts/scrapes/punctures, $F(1, 21) = 29.02, p < .01, \eta_p^2 = .58$.

**Predictors of Injury**

A regression was conducted for each motor development stage, in order to determine if rate of injury-risk behaviours and continuity of supervision (i.e., average number of minutes since parent last saw infant) predicted infant injury (rate); because there were no sex differences obtained in any ANOVAs for any of the variables of interest, this variable was not included. For a complete summary of the regression results, see Table 6.

**Sitting**

Although the overall model with rate of risk behaviour and continuity of parental supervision did not significantly predict infant injury, $F(2, 36) = 2.87, ns$, rate of injury-risk behaviour was found to predict infant injury, accounting for a .38 standard deviation in infant injury with every 1 point increase in rate of injury risk behaviour ($\beta = .38, p < .05$).

**Crawling**

When the rate of injury-risk behaviour and continuity of supervision were examined for their predictive effect, the model accounted for 54% of the variance in infant injury, $R^2 = .54$, $F(2, 53) = 31.13, p < .001$. However, the only significant predictor of infant injury was rate of injury-risk behaviour, which uniquely accounted for a .73 standard deviation in infant injury with every 1 point increase in rate of injury risk behaviour ($\beta = .73, p < .001$).
Walking

Rate of injury-risk behaviour and continuity of supervision produced a marginally significant predictive effect on the outcome variable, $R^2 = .18$, $F(2, 30) = 3.18, p = .056$. When the variables were examined for their individual predictive value, rate of injury-risk behaviour was found to be the only significant predictor of infant injury-risk at walking ($\beta = .39, p < .05$).

In summary, rate of injury-risk behaviour was found to be the only significant predictor of infant injury at all stages of motor development. Continuity of supervision (minutes since last saw infant) did not have a direct effect on injuries sustained.

Finally, in order to test if rate of injury-risk behaviour predicts rate of injury across levels of mobility, a series of simple linear regressions were conducted. Rate of risk behaviour at sitting was found to significantly predict injury at crawling [$R^2 = .25, F(1, 61) = 19.83, p < .01; \beta = .50, t = 4.45, p < .01$] and walking [$R^2 = .11, F(1, 61) = 7.50, p < .01; \beta = .33, t = 2.74, p < .01$], uniquely accounting for 25%, and 11% percent of the variance in injury rate, respectively. Similarly, rate of risk behaviour at crawling was found to significantly predict injury at walking [$R^2 = .43, F(1, 61) = 46.65, p < .01; \beta = .66, t = 6.83, p < .01$], accounting for 43% of the variance in injury rate. Thus, earlier patterns of risk behaviors showed carryover effects to influence injury risk at later stages too.

Discussion

Unintentional injury poses a serious health threat to children at all ages worldwide. Examining the death rate of unintentional injury by age, infants (<1 year of age) experience the greatest threat (Xu et al., 2016), with the majority of these injuries occurring in the home where most of their time is spent (Pearce et al., 2012). Critical to healthy development, infants learn and experience the world through active exploration of their environment around them.
Unfortunately, infants’ motor-development and ability to navigate through their environment precedes their cognitive capacity to identify and assess the presence of risk around them (Longobardi et al., 2016; Pearce et al., 2012). Hence, infants’ safety depends on the practices of their caregivers. One recognized time that seems to pose challenges for caregivers’ keeping their infant safe is when infants acquire new motor milestones (Agran et al., 2003). At these points in development, epidemiological data reveal increases in the frequency of injuries. Little is known, however, about the nature and scope of injury-risk behaviours or caregiver supervision patterns during infancy. Addressing this gap, the current study applied a process-analytic approach with the aims being to study injury-risk behaviours at three stages of motor development (sit, crawl, walk), identify the patterns of supervision in place when infants engaged in risk behaviours at these stages, and explore how these factors relate to actual in-home injuries sustained by infants during this longitudinal study.

**Contextual Analysis of Injury-Risk Behaviours**

*Does the rate of injury-risk behaviour change across development?*

The present study found that infants are not at any increased risk of engaging in injury-risk behaviours as they develop in motor ability. Importantly, these findings demonstrate that even pre-mobile infants are capable of engaging in behaviours that can result in injury. This is consistent with evidence that falls from change tables is highly common even among pre-mobile infants who are not yet able to roll onto their side consistently (Hollwarth, 2013). Thus, it is important that parents understand that infants engage in injury-risk behaviours at all stages of motor-development.

Although these results did not find the rate of injury-risk behaviours to vary with development, we did find evidence to suggest that some infants were at an increased risk for
continued engagement in injury-risk behaviours over time. Specifically, infants who were engaging in more injury-risk behaviours earlier in their development, were continuing to engage in more injury-risk behaviours across development. These findings suggest evidence for a certain degree of stability in infant risk-taking. This pattern could reflect temperamental differences that emerge during infancy and lead some infants to be more active and exploratory than others (Gartstein & Rothbart, 2003). Parent safety practices also may contribute because more frequent and effortful safety practices are often needed for children who engage in high levels of risk behaviours (Morrongiello & Dawber, 1998). Thus, an interaction of child and parent factors may contribute to create injury risk throughout infancy.

What types of injury-risk behaviours are infants engaging in?

While the types of risk behaviours infants engaged in remained the same across development, the way in which they physically engaged in these behaviour was influenced by their developmental capabilities at the time. For example, infants at the crawling stage may exhibit a climbing risk behaviour by reaching and pulling themselves up onto something, whereas infants at the walking stage of development may demonstrate this same risk by physically climbing up the stairs. In addition, infant development is far from straightforward, with the acquisition of motor milestones marked by high intra-individual variability. For example, some infants may remain in one stage of development for long periods of time, with others progressing quickly or “straddling” two stages for a period of time (Morrongiello & Cox, 2016). The mastery of new motor skills takes time and practice, and may pose its own injury risk to infants who are just learning to coordinate the movement of their limbs while simultaneously navigating through their environment. Indeed, some infants’ in our sample were reported to be
occasionally engaging in behaviours that exceeded their developmental skill level, which may partly be why parents’ had perceived them as being risky behaviours in the first place.

The current study found infants to engage in substantially more risk behaviours involving mouthing/touching hazards and climbing in comparison to rolling-related risks. This may reflect a tendency for parents to be more acutely attuned to injury threats posed by infants rolling (i.e., injuries resulting from infants rolling off change tables) and to take precautions to prevent these behaviours from happening. This may also be a risk behaviour that is more salient and thus, easier to anticipate, as the extent to which the act of rolling poses an injury threat depends on the environment in which the infant is in. For example, if an infant is left unattended on a change table, rolling would then pose an imminent threat of injury to the infant, whereas, this behaviour would not pose the same threat of danger to an infant placed on a level ground (i.e., away from any steps/drops). It is understandable then, that parents may be better able to anticipate certain risk behaviours (e.g., highly publicized ones, such as falling from heights), in comparison to others that may be less salient. Indeed, parents are often unaware of the common safety threats their infants are at risk for across development (Hollwarth, 2013; Morrongiello & Dayler, 1996; Nansel et al., 2002). Thus, it may be of interest for future research to consider the types of injury-risk behaviours parents of young infants are most attune to, and examine the social-cognitive factors that may be influencing their decision to safeguard against some more than others. In an effort to identify some of these parent factors and offer insight into how they may shape their safety decisions, the current study collected a number of parent belief ratings regarding their infants’ injury-risk behaviours.
Beliefs about Injury-Risk Behaviours

Generally, parents were significantly more worried about their infant getting hurt while in the walking stage of motor-development, which is appropriate because injury rates were highest during this stage. However, infants’ frequency of engaging in risk behaviours during the walking stage did not correlate with worry, but with ratings that these behaviours are typical. This is surprising because frequent risk behaviours predicted injuries for walking infants. These diverse findings suggest that parents of frequent risk takers are misinterpreting the frequency of these behaviours as typical of infants at this stage, rather than recognizing that these pose risk of injury. Consistent with the current findings, many studies have found that parents often underestimate the likelihood of injury to their child (Morrongiello & Dayler, 1996; Morrongiello & Kiriakou, 2004; Morrongiello, Zdieborski, Sandomierski, & Lasenby-Lessard, 2009).

Fortunately, parents reported having fairly low beliefs regarding their infants’ understanding of the danger associated with engaging in the risk behaviour. In contrast, past research with older children has shown that parents usually overestimate young children’s understanding of safety (Morrongiello, Midgett, & Shields, 2001) and ability to manage injury-risk situations (Lewis, DiLillo, & Peterson, 2004; Morrongiello & Dayler, 1996). It may be, therefore, that once children acquire language production skills then parents confuse the child’s ability to restate a rule with their ability to understand the rule (Morrongiello et al., 2001).

Supervision in the Context of Injury-Risk Behaviours

How were infants being supervised when they engaged in injury-risk behaviours?

Generally, parents had infants in view at the time of a risk behaviour (80%) but they were out of reach about 55% of the time (see Table 3). Previous research with toddlers suggests that proximity is the most important dimension for preventing injuries (Schnitzer et al., 2015),
especially because they can act quickly and impulsively and do not follow verbalizations to stop (Morrongiello & Dawber, 1998). This may explain why ‘continuity’ in supervision alone did not predict injury outcomes. Interestingly, on average parents reported about a 1 minute lapse in time since they last saw their infant at the time of the risk behaviour. This highlights how quickly infants can act and engage in injury-risk behaviours (Morrongiello, Marlenga, Berg, Linneman, & Pickett, 2007). Clearly, parents often failed to anticipate their infant’s risk behaviour and they were unable to intervene fast enough given their beyond-reach location.

Infant motor-development is marked by high intra-individual variability, making it next to impossible for caregivers to accurately predict precisely when the next developmental milestone will be met (Adolph, Cole, & Vereijken, 2015). This complicates the role of caregivers in protecting their infants from injury-risk. For instance, in some circumstances, what constitutes normal infant behaviour one second, may quickly turn into a behaviour likely to result in injury. This change in circumstance may occur so rapidly, that even close and attentive supervision is not enough in removing this threat. Consider, for example, an infant who is just learning to cruise by using the support of a couch and other furniture to maintain balance. A caregiver in this situation may be providing close supervision and encouraging their infant, in an effort to promote their developmental growth. However, the infant may quickly be put in harm’s way if they then attempt to use an unsteady object for support, putting them at risk for a fall, or attempt to pull themselves up by holding onto an unsteady object, putting them at risk for a crushing injury. While the supervisor in this circumstance may or may not have been able to successfully intervene before the infant experienced an injury, the infant had still engaged in a behaviour that could have resulted in harm, regardless of the outcome. Moreover, in some cases, the supervisors themselves can even be the ones to introduce the threat of injury to their infant, creating an
environment in which an otherwise normal infant behaviour could be considered risky (e.g., a supervisor places infant in their lap, while at the same time inadvertently putting them within reaching distance of a hot cup of coffee).

These examples illustrate just how quickly infants may spontaneously engage in new behaviours that put them at risk for injury, and demonstrates that while active supervision may increase the likelihood of effective intervention and prevention of actual injury, it alone is not enough to mitigate the occurrence of risk behaviour altogether. Thus, it is important that parents be made aware of the types of injury-risk behaviours their infants are likely to engage in during early development, so that they may be better able to anticipate and safeguard against the occurrence of these behaviours. It is also both unlikely and unrealistic to expect parents to be able to provide constant, uninterrupted supervision to their infants. For these reasons it becomes critical that parents utilize appropriate supervision, characterized by some degree of stability in attention and proximity to the infant (Morrongiello, 2005), and encouraged to implement safety precautions to safeguard children from environmental hazards for when active supervision is either not desired or possible (Morrongiello et al., 2004a, 2004b).

Beliefs about Supervision and Injury-Risk Prevention

It is interesting that parents did not highly agree that closer supervision could have prevented their infant from engaging in the injury-risk behaviour. This could reflect a belief that injuries are part of childhood and not preventable, which has been noted before (Morrongiello & Dayler, 1996). It is also possible that if they feel they are nearly-continuously keeping their child in view (~ 1 minute since last saw the child), then they may not realize the importance of proximity and, instead, conclude that supervision won’t necessarily prevent injuries. Indeed, parents in our sample only somewhat believed that parents can prevent risk behaviours. This is
unfortunate, given that the decision to actively mitigate child injury-risk is often compromised by caregivers’ belief that injuries are unavoidable, resulting in them being less likely to assume personal responsibility in preventing them (Gaines & Schwebel, 2009). From a prevention standpoint, it is therefore important that parents of young infants not only understand that these injury-risks are preventable, but that successful injury prevention involves both close supervision and environmental modifications (i.e., baby proofing), with the knowledge that infant development is highly unpredictable and that both are necessary in protecting their infants from harm.

Interestingly, for infants at the crawling and walking stages of development, parents who reported longer lapses in parental supervision at the time of the risk behaviour had also expressed stronger beliefs that providing closer supervision could have prevented their infant from engaging in the risk behaviour. Thus, it is also possible that parental beliefs regarding closer supervision are influenced by a variety of factors, one of which being infant motor-development. For mobile infants at least, parents who had left their infants alone for longer periods of time had demonstrated an understanding that had they checked on their infant earlier, and provided closer supervision, then their infants’ risk behaviour may have been prevented. Whereas, for pre-mobile infants, this did not appear to be the case, as parental lapses in supervision at the time of the risk behaviour had no relation with their beliefs about providing closer supervision in order to prevent such incidences. It could be that parents’ beliefs regarding closer supervision is dependent on how risky they perceive their infant’s environment to be and the extent to which infants are independently capable of accessing hazards around them. For example, if a parent believes their infant to be incapable of moving from one place to another, and perceives their environment to be safe, then the extent to which they believe that closer supervision would have
prevented the risk behaviour would have little, if any, relation to the number of minutes they left their infant unattended. However, as stated before, infant development is highly unpredictable and infants may transition from one stage of mobility to the next very suddenly, and often times, unexpectedly. Thus, it is dangerous for parents to make assumptions regarding their infants’ capabilities, as there is no certainty that an infant won’t engage in a new motor skill when out of view.

**Contextual Analysis of Experienced Injuries**

*What types of injuries are infants experiencing?*

Infants were most at risk to sustaining injury during the walking stage of motor-development. This is consistent with developmental literature which posits that children’s risk of injury increases with age (Dal Santo, Goodman, Glik, & Jackson, 2004; Grossman & Rivara, 1992). Of the 576 injuries, the majority (72%) were characterized by bumps, bruises, crushing injuries, followed by cuts, scrapes and punctures (23%). Peterson and colleagues (2002) also found bumps and bruises to be the most commonly reported in-home injuries in young children (see also Morrongiello et al., 2004a).

*What predicts infant injury?*

Consistent with previous research (Morrongiello et al., 2004a), risk-taking was found to be a predictor of in-home injury. The present study, however, provides the new finding that this relation holds even during infancy when children have limited motor skills. In addition, not only was rate of risk behaviour found to predict injury within the same motor-development status, but they were also found to predict infant injury risk at later stages.

Although injury-risk behaviours were found to predict infant injury, the number of minutes that infants were left unsupervised leading to the risk-behaviour was not found to predict
the likelihood of injury. This finding makes sense given that our sample consisted of infants at various stages of motor-development, where the likelihood of their ability to reach and interact with hazards in the environment is largely dependent on their level of motor ability. For example, in the case of pre-mobile infants, whether or not they are receiving constant supervision won’t matter, as long as they are placed in a safe environment suitable to their developmental level (i.e., hazards removed from reach, infants are placed on a level ground, etc.). In addition, simply providing continuous supervision in the form of keeping a watchful eye on the infant would do little to protect against injury if caregivers are out of reach of their infant at the time of the risk behaviour; at these young ages, saying ‘stop’ is not going to deter a risk behaviour that is about to be executed. Indeed, a successful measure of supervision requires an evaluation of caregiver continuity in both attention to and proximity from the child (Morrongiello, 2005; Schnitzer et al., 2015). As such, examining the predictive effect of supervisor continuity on its own is likely ineffective because it is only one component measure of supervision. In future research, therefore, developing a measure that integrates all three dimensions of supervision will be important and may yield different results than obtained when just continuity is measured.

**Limitations and Directions for Future Research**

Although this study offers important insight about infant injury-risk, there are some limitations to the design of this study that should be addressed in future research. First, the study’s sample was quite small ($n = 85$) and homogenous in respect to demographics, with the majority of participants being Caucasian, earning an annual family income of at least $80,000, and had completed some form of secondary education. Thus, this study is limited in the extent to which the findings are generalizable. Future research should consider expanding the participant sample to include a more diverse population, and consider additional factors that past research
has found to interfere with parents’ ability to provide active and continuous levels of supervision including: being a single parent, having to watch multiple children, caregivers experiencing depression, abuse or illicit drug abuse (Morrongiello & Cox, 2016). Additionally, the study did not collect information on whether these were first time parents and research has shown that first time parents are less likely to identify hazards that pose injury-risk to their children (Gaines & Schwebel, 2009).

Second, while the use of the same self-report measures have been utilized in other studies and these have been validated (Morrongiello et al., 2004a, 2004b), there is always the risk that the information parents reported was false in an attempt to appear more favourably. Specifically, given that this was a study examining infant injury-risk, it is possible that parents underreported the amount of injuries and risk behaviours their infants engaged in. Also, it is possible that infants sustained additional injury and engaged in more risk behaviours out of the view of caregivers, and thus, went unreported. Also, the data collected did not include any information on the extent to which parents were implementing environmental safety precautions, which may well have influenced the degree to which they were supervising at the time of the risk behaviour. Thus, future research should consider incorporating this as an additional measure along with supervision level when investigating infant injury-risk.

Finally, given the study’s limited sample size we were unable to employ certain statistical methods (i.e., growth curve modelling), which are more favorable than using repeated-measures ANOVAs to investigate how injury-risk behaviours and injury rates change across infant development.
Conclusion

This study used a participant event-recording methodology to track infant risk behaviour and minor in-home injuries across motor-development. Stability was found in the rate of infant risk taking across development, with risk behaviours successfully predicting infant injury both within and across development. As infants engaged in more risk behaviours at crawling, parents expressed higher fear that their infant would be injured from such activity. Whereas, the more risk behaviours infants engaged in at walking, the more parents endorsed these behaviours as being typical of infants at that stage.

While the rate of risk behaviour was not found to change, infant injury did and was greatest when infants could walk. It is possible that while the levels of supervision provided to infants during risk taking were sufficient in preventing injury during earlier stages of development, they were ineffective in preventing them by the time infants had reached independent mobility and were capable of faster movements. Indeed, the majority of risk behaviours at walking were found to occur while supervisors were beyond reach of infant. Fortunately, our results suggest that as infants became mobile, parents began to understand that closer supervision could have prevented their infants from engaging in the risk behaviour.
References


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Table 1

*Average Rate (SD) of Injury-Risk Behaviours by Infant’s Sex and Motor-Development*

<table>
<thead>
<tr>
<th>Motor Development</th>
<th>Male</th>
<th>Female</th>
<th>Overall</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>$M(\text{SD})$</td>
<td>$M(\text{SD})$</td>
<td>$M(\text{SD})$</td>
</tr>
<tr>
<td>Sit</td>
<td>.05(.08)</td>
<td>.05(.07)</td>
<td>.05(.08)</td>
</tr>
<tr>
<td>Crawl</td>
<td>.04(.07)</td>
<td>.04(.07)</td>
<td>.04(.07)</td>
</tr>
<tr>
<td>Walk</td>
<td>.05(.11)</td>
<td>.04(.06)</td>
<td>.05(.09)</td>
</tr>
</tbody>
</table>

*Note.* SD = standard deviation.
Table 2

*Mean Proportions (SD) for Type of Injury-Risk Behaviours Separated by Infant Motor-Development*

<table>
<thead>
<tr>
<th>Motor Development</th>
<th>Types of Injury-Risk Behaviours</th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Rolling</td>
<td>Cruising</td>
<td>Mouthing/</td>
<td>Crushing</td>
<td>Climbing</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Touching</td>
<td>Related</td>
<td>Related</td>
</tr>
<tr>
<td>Sit</td>
<td>.18(.33)</td>
<td>.13(.27)</td>
<td>.33(.43)</td>
<td>.19(.33)</td>
<td>.13(.26)</td>
</tr>
<tr>
<td>Crawl</td>
<td>.03(.09)</td>
<td>.14(.24)</td>
<td>.25(.28)</td>
<td>.13(.25)</td>
<td>.40(.34)</td>
</tr>
<tr>
<td>Walk</td>
<td>.05(.22)</td>
<td>.21(.28)</td>
<td>.32(.39)</td>
<td>.06(.16)</td>
<td>.28(.35)</td>
</tr>
<tr>
<td>Overall</td>
<td>.09(.14)</td>
<td>.16(.16)</td>
<td>.30(.24)</td>
<td>.13(.16)</td>
<td>.27(.23)</td>
</tr>
</tbody>
</table>

*Note. SD = standard deviation. The proportion scores do not sum to 1.0 because water-related risk behaviours were not included in the analysis on types of injury-risk behaviour.*
Table 3

*Mean Proportion (SD) Values for Supervisor Attention and Proximity to Infant at The Time of Injury-Risk Behaviour as a Function of Infant Mobility*

<table>
<thead>
<tr>
<th>Motor Development</th>
<th>Supervision Level</th>
<th>In View/In Reach* M(SD)</th>
<th>In View/Out of Reach M(SD)</th>
<th>Out of View/Out of Reach* M(SD)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sit</td>
<td></td>
<td>.58(.45)</td>
<td>.28(.39)</td>
<td>.13(.31)</td>
</tr>
<tr>
<td>Crawl</td>
<td></td>
<td>.38(.34)</td>
<td>.38(.33)</td>
<td>.23(.35)</td>
</tr>
<tr>
<td>Walk</td>
<td></td>
<td>.39(.43)</td>
<td>.37(.42)</td>
<td>.21(.37)</td>
</tr>
<tr>
<td>Overall</td>
<td></td>
<td>.45(.26)</td>
<td>.34(.22)</td>
<td>.19(.22)</td>
</tr>
</tbody>
</table>

*Note. SD = standard deviation. Proportions do not sum to 1.0 because out of view/in reach was not included in the analysis.*

*In view/in reach was significantly greater than out of view/out of reach, p < .05.*
Table 4

*Average Number (SD) of Minutes since Parent Last Saw Infant as a Function of Infant’s Sex and Motor Development*

<table>
<thead>
<tr>
<th>Motor Development</th>
<th>Male</th>
<th>Female</th>
<th>Overall</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sit</td>
<td>1.83(2.12)</td>
<td>.83(1.31)</td>
<td>1.25(1.72)</td>
</tr>
<tr>
<td>Crawl</td>
<td>1.42(2.28)</td>
<td>.93(.87)</td>
<td>1.14(1.59)</td>
</tr>
<tr>
<td>Walk</td>
<td>1.07(.62)</td>
<td>.72(1.01)</td>
<td>.86(.87)</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td>1.44(.99)</td>
<td>.83(.99)</td>
<td>1.13(1.00)</td>
</tr>
</tbody>
</table>

*Note.* SD = standard deviation.
Table 5

*Mean Proportions (and standard deviations) for Injury Type by Motor-Development*

<table>
<thead>
<tr>
<th>Motor Development</th>
<th>Cuts/Scrapes /Punctures**</th>
<th>Bumps/Bruise/ Crushing**</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sit</td>
<td>.26(.29)</td>
<td>.71(.33)</td>
</tr>
<tr>
<td>Crawl</td>
<td>.20(.20)</td>
<td>.77(.21)</td>
</tr>
<tr>
<td>Walk</td>
<td>.27(.36)</td>
<td>.68(.36)</td>
</tr>
</tbody>
</table>

*Note.* The proportion scores do not sum to 1.0 because two other injury types were not included here due to infrequent reporting and were not included in the analysis on injury types.

**Bumps/bruise/crushing was significantly greater than cuts/scrapes/punctures at each level of mobility, $p < .01$.**
Table 6

*Summary of Multiple Regression Analysis for Variables predicting Infant Injury Rate*

<table>
<thead>
<tr>
<th>Motor Development</th>
<th>Variable</th>
<th>$R^2$</th>
<th>$F$</th>
<th>$\beta$</th>
<th>SE</th>
<th>$t$</th>
<th>$p$</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Model</td>
<td>.14</td>
<td>2.87</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Sit</strong></td>
<td>Rate of RB</td>
<td>.38</td>
<td>.13</td>
<td>2.40*</td>
<td>.02</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Supervision</td>
<td>.09</td>
<td>.01</td>
<td>.57</td>
<td>.57</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Model</strong></td>
<td>.54</td>
<td>31.13**</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Rate of RB</td>
<td>.73</td>
<td>.06</td>
<td>7.79**</td>
<td>.00</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Crawl</strong></td>
<td>Supervision</td>
<td>-.12</td>
<td>.00</td>
<td>-1.26</td>
<td>.21</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Model</strong></td>
<td>.18</td>
<td>3.18</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Rate of RB</td>
<td>.39</td>
<td>.27</td>
<td>2.37*</td>
<td>.03</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Walk</strong></td>
<td>Supervision</td>
<td>-.17</td>
<td>.02</td>
<td>-1.01</td>
<td>.32</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

*Note. *p < .05; **p < .001. $\beta =$ Standardized Beta Coefficient. The supervision variable refers to the number of minutes since parent last laid eyes on infant.*
# Appendix A: Motor-Development Checklist (MDC)

**Date of Call/Visit (mm/dd/yyyy)**

<table>
<thead>
<tr>
<th>Action</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Rolling</strong></td>
<td>Roll onto back from front</td>
</tr>
<tr>
<td></td>
<td>Roll onto front from back</td>
</tr>
<tr>
<td><strong>Sitting</strong> (Level 1)</td>
<td>Pull to sit without head-lag</td>
</tr>
<tr>
<td></td>
<td>Sitting up with back support</td>
</tr>
<tr>
<td></td>
<td>Sitting up without back support</td>
</tr>
<tr>
<td></td>
<td>Sits without support and holds object</td>
</tr>
<tr>
<td><strong>Standing</strong> (Level 2)</td>
<td>Pull self-up to stand</td>
</tr>
<tr>
<td></td>
<td>Cruise along while holding on</td>
</tr>
<tr>
<td></td>
<td>Momentarily standing without holding on to any supports</td>
</tr>
<tr>
<td></td>
<td>Sustained standing without holding on to any supports</td>
</tr>
<tr>
<td><strong>Standing to Sitting</strong> (Level 2)</td>
<td>Get to sitting from standing without good control</td>
</tr>
<tr>
<td></td>
<td>Sits down from standing with good control</td>
</tr>
<tr>
<td></td>
<td>Squats without support</td>
</tr>
<tr>
<td></td>
<td>Stoop and recover</td>
</tr>
<tr>
<td><strong>Crawling</strong> (Level 3)</td>
<td>Crawl or move forward on stomach</td>
</tr>
<tr>
<td></td>
<td>Crawl or move backward on stomach</td>
</tr>
<tr>
<td></td>
<td>Crawling forward on hands/knees</td>
</tr>
<tr>
<td></td>
<td>Crawling backward on hands/knees</td>
</tr>
<tr>
<td><strong>Climbing</strong> (Level 4)</td>
<td>Climbing on things</td>
</tr>
<tr>
<td></td>
<td>Crawling up stairs</td>
</tr>
<tr>
<td></td>
<td>Goes down stairs on bottom or crawling backwards</td>
</tr>
<tr>
<td><strong>Walking</strong> (Level 5)</td>
<td>Walking without support (at least 3 steps)</td>
</tr>
<tr>
<td></td>
<td>Walking backwards</td>
</tr>
<tr>
<td><strong>Running</strong> (Level 6)</td>
<td>Running without support</td>
</tr>
<tr>
<td><strong>Stairs</strong> (Level 6)</td>
<td>Goes up stairs by standing</td>
</tr>
<tr>
<td></td>
<td>Goes down stairs standing</td>
</tr>
</tbody>
</table>
Appendix B: Injury-Risk Behaviour Form

Infant Injury-Risk Behaviour Diary Sheet  Participant #: 

Today’s Date (DD/MM/YY): ___________ Time when this happened: ___________

1. **Who was supervising at the time:** ___ Mom  ___ Dad  ___ OTHER [Who: ___________]

2. **Describe exactly what the child did that was dangerous:** __________________________

3. **Where did the child do this** (room, location in room): ____________________________

4. **Were you able to catch the child in the act or did you become aware of this after s/he did it?**
   ___ became aware of his/her behaviour afterwards
   ___ caught him/her in the act

   *How did you become aware of what the child was doing or had done?*
   ___ Heard something  ___ Saw something  ___ Someone alerted me  ___ Child said it
   ___ Parent intuition made me check on child  ___ Other [WHAT: ________________________]

5. **About how many times has the child done this before today?** Enter a number: ______

6. **Has s/he ever gotten hurt before doing this?**  ___ No  ___ Yes

7. **What room was supervisor in + doing what?** ____________________________

8. **At the time the child did this, s/he was:**
   ___ in view of supervisor OR ___ out of view of supervisor [CHECK ONLY ONE]
   ___ within reach of supervisor OR ___ beyond reach of supervisor [CHECK ONLY ONE]

   *How many minutes had it been since the supervisor had last laid eyes on the child?* ______ mins

*Use this scale to answer these few questions* (circle the appropriate number)

1 = not at all  2 = a little  3 = somewhat  4 = a fair amount  5 = very

1. **How surprised were you by what your child did today?**  1  2  3  4  5
2. **How likely is it that your child will try this again?**  1  2  3  4  5
3. **How much can parents prevent these types of behaviours?**  1  2  3  4  5
4. **How typical are these types of behaviours at this age?**  1  2  3  4  5
5. **How much do you ‘worry’ about your child getting hurt from doing these types of things?**  1  2  3  4  5
6. **How intensely did you react to your child doing this today?**  1  2  3  4  5
7. **How much does your child understand about the danger of doing this?**  1  2  3  4  5
8. **How well do you think your child understood that you do not want him/her to do this?**  1  2  3  4  5
9. **How much do you agree that closer supervision would have prevented him/her from doing this?**  1  2  3  4  5
10. **How compliant do you think your child will be about not doing this in the future?**  1  2  3  4  5
Appendix C: Injury Diary Form

‘MY INFANT GOT HURT’ - DIARY FORM

Date (dd/mm/yy): ________________  Time: ________________ AM / PM

Briefly describe what happened to result in your child getting hurt: ________________________________________________
________________________________________________________________________________________________________

1. What part of his/her body got hurt? ______________________________________

2. What was the type of injury? (e.g., bump, bruise, puncture, scrape, cut, crushing injury, burn, etc):
________________________________________________________________________________________________________

3. Where was your child exactly?_______________________________________________

4. What was your child doing at the time?_______________________________________

5. How serious do you think the injury...
   ...actually was? ...might have been?
   1 = Not at all serious          1 = Not at all serious
   2 = A tiny bit serious         2 = A tiny bit serious
   3 = Somewhat serious          3 = Somewhat serious
   4 = Pretty serious            4 = Pretty serious
   5 = Very serious              5 = Very serious

6. Where were you at the time your child got hurt? ________________________________

7. What were you doing at this time? ____________________________________________

8. Who actually was ‘in charge’ of the child at the time of the injury?
   ______ Me
   ______ My partner/spouse
   ______ Older sibling: [age __________ years]
   ______ No one in particular
   ______ Other: Who?________________________________________

9. Who do you think is most responsible for your child getting hurt (Check only one)?
   ______ No one really (bad luck)    ______ Child    ______ Me    ______ Other person

10. Had the child ever before done what led to him/her getting hurt:
      ______ Not with me but probably has done it before
      ______ No (not as far as I know)
      ______ Yes: Ever hurt before? ______ Yes ______ No

11. Which of the following best describes the level of supervision of the child by the person in charge at the time the child was hurt? Please answer both part A and B.

   a) Pick ONE of the following and then answer the question that follows, if there is one:

      ______ Person in charge was beyond reach of the child
Appendix C (Continued)

[Was the person within yelling distance of child? Yes_____ No_____]

_____ Person in charge was within reach of the child

[Was the person touching/holding the child? Yes_____ No_____]

_____ I don’t know the person’s proximity to the child

b) **Pick ONE** of the following:

_____ Person in charge was **constantly watching** the child

_____ Person in charge was not constantly watching but was **constantly listening** in on the child

_____ Person in charge was **intermittently** listening in or watching the child

[About how frequently was the person checking on the child: every _____ minutes]

_____ I don’t know how attentive the person was to the child at that time

12. Sometimes, supervision can make a difference for whether or not a child gets hurt and other times it really doesn’t make much difference because children get hurt doing things that are typical of how children behave. So there isn’t much one can do about it even if you are right there supervising them.

Think about how your child got hurt, and then select **ONE** answer to tell me whether you agree **OR** disagree with the following statement, and how much:

“**Probably, closer supervision would have prevented him/her from getting hurt.**”

*(Select one answer from the following 6 choices)*

I **disagree** with the statement:  
I **agree** with the statement:

| 1 = Completely | 4 = Completely |
| 2 = Moderately | 5 = Moderately |
| 3 = A little | 6 = A little |

13. How typical do you think it is for children at this age to get hurt in this way?

| 1 = Not typical at all | 4 = Very typical |
| 2 = A bit typical | 5 = Completely typical |
| 3 = Pretty typical |

14. Knowing your child, how likely do you think it is that he/she might get hurt again in this way while at home?

| 1 = Not at all likely | 4 = Fairly likely |
| 2 = A bit likely | 5 = Very likely |
| 3 = Somewhat likely |

15. At this time, have you done anything special, or do you plan to do anything special, to decrease the likelihood that your child would get hurt again this way in the future?

_____ **YES**  _____ **NO**  If yes: **What**?

Did you do it already or is this something you plan to do? _____ **Done**  _____ **Plan to do**
Appendix D: Coding Manual

**General Coding Notes.**

(1) **Within a category:** enter whichever sub-code applies, but only select one.

- If more than one sub-code applies for a RB entry, only code for the actual RB, not for the behaviours leading up to the RB (e.g., see #2 for clarification)
- If there is no number ranking within sub-codes, and more than one sub-code applies, then you can code all that apply

(2) **Different RB for the same entry:** If the child does more than one risk behaviour of different types (different categories) then code for both (rule: Only one risky behaviour is coded unless both are clearly different and both individually are clearly risk behaviours)

- e.g., if the child climbs on a chair (Climbing) and then tries to jump to the table (Jump) then both get coded.
- **BUT** be careful not to code for multiple behaviours when one is clearly just an extension of another: e.g., If the parent says the child crawled to the stairs and then says the child’s arm touched the top step, the latter is just an extension in time of the former and not a new RB.

(3) **Recording time of RB:**

- If there are multiple times written on the RB form (e.g., 5:15PM; 5:30PM; 5:45PM) we assume that the parent simply did not want to fill out 3 RB forms, and that the exact same RB occurred at all 3 (or however many) time points. Enter the RB sheet for each corresponding time indicated on the form (e.g., you would have three separate RB entries for 5:15PM, 5:30PM and 5:45PM).
- For RB forms where a time range has been indicated (e.g., 5:30-6PM), assume that the parent was not sure of what time the RB actually occurred, so they wrote a range as an approximation. Enter the mid-range as the time (e.g., 5:45PM).

(4) **Dealing with Missing Dates**

- If there are risky forms with dates missing, and there are no other ways of finding out what date the RB occurred (i.e., not on calendar sheets) then ignore these forms and do not enter. We wouldn’t be able to use any of these sheets for analyses because we wouldn’t be able to link them up with their correct motor-development level (we need the dates for this), thus it would make the data useless.

(5) **Stair related behaviours:** always indicate if something was stair related (e.g., code under the appropriate sub-code if stairs are involved).

- If they just say ‘climb the stairs’ then we assume UP.
- Anything involving ‘step or mantle’: will be coded as ”steps”
- If it’s just ONE step (versus stair case) then it’s not stairs. It’s either climbing/crawling…or whatever the context suggest
Appendix D (Continued)

(6) Issues related to RB “opening cupboard drawers”:

- Clarify: If the parent says ‘opening cupboard or drawer’ as the concern, then you need to try and determine if the concern is accessing something like a hazardous substance in that drawer (poison concern= code it as OPENING/PUTTING IN MOUTH) OR closing the door on their fingers (crushing injury concern = code it as PUSHING/PULLING).

  ***If you can’t distinguish this based on the parent’s report then code it as PUSHING/PULLING.

(7) Climbing versus pull to stand:

- Let us assume that ‘lifting self onto something’ or ‘pulling self onto something’ is coded as CLIMBING unless it is clear they stood up then it would be PULL TO STAND

(8) High chair RBs:

- If the concern is the child falling when in the high chair (e.g., rocking) but there is no mention of food or objects in the child’s mouth, then assume the concern is FALLING from a height (not choking) and code it under FALLING FROM HEIGHT

(9) For a single entry, if multiple RB are reported, and one resulted in an injury: e.g. fell and bumped head among another behaviour (e.g. pull to stand), just code the RB that did not result in an injury. IF a RB entry involves an injury (e.g., “Fell on her face”) this is not a RB, it is an outcome (injury), and therefore, should NOT be coded at all.

Codes:

ROLLING SELF [falls]

Sub-codes:

- Rolling or doing something in a way/location that can lead to a fall off a table or diaper change table (1) [anything related to a change table goes here for coding] UNLESS THE BEH FITS IN ANOTHER CATEGORY. SO IF THEY SAY STANDING ON A CHANGE TABLE THEN CODE IT UNDER STANDING

- Rolling in a way/location that can lead to a fall – not related to change table (2)

NOTES: They may not mention “rolling” per se, but if they are concerned about the child falling off a change table or table, we are assuming ‘rolling self’ is the risk behaviour so it is coded as such. Even if they say “child sitting on change table”, it still goes here. Anything change table related goes in the rolling-self category. If rolls with momentum going over or sitting up, just categorize the rolling
Appendix D (Continued)

CRAWLING [falls]
Sub-codes:
- UP (increasing height) [If it is stairs related it gets coded below, not here]
- DOWN from a higher point [If it is stairs related it gets coded below, not here]
- SAME level (ASSUME this unless they say otherwise)
- Stairs – up or at bottom of stairs in any way
- Stairs – down or at top of stairs in any way
- Other

NOTES: If child is head first (e.g. going down stairs) assume they are crawling; same with if it says ‘facing forward’ on stairs. If ‘crawling out an open door’, it gets coded in the ‘same level’ sub-category. If they refer to ‘a step’ or ‘mantle’ (ONE, not staircase) then DO NOT code this under stairs. If they refer to step or mantle and don’t specify whether they were crawling or climbing, assume it’s climbing and code below. ALSO, assume that ‘scooting’ is a type of crawling and code this here. If we don’t know whether they are crawling up or down the stairs, assume they are crawling up.

CLIMBING (includes ‘pulling self-up on something or lifting self onto something’) [falls]
Sub-codes:
- UP (increasing height) [If it is stairs related it gets coded below, not here]
- DOWN from a higher point [If it is stairs related it gets coded below, not here]
- SAME level (ASSUME this unless they say otherwise)
- Stairs – up or at bottom of stairs in any way
- Stairs – down or at top of stairs in any way
- Other

NOTES: If response says “climbing on dishwasher” – don’t code for climbing; only code for the “touching… unsafe object (BECAUSE while the dishwasher is a common household object, if it is open this could have been prevented). Stepping onto mantle holding onto TV stand= goes into climbing category. If they just say “stepping up” (e.g. involving step and not stairs) is considered climbing: if one climbs up and down you just code the latter.
If they just say “climb the stairs” then assume UP. -something like “climbed on brother’s back” = goes in ‘up’
-if stepping up/down is done while hanging onto something (e.g. table), just code the climbing
-stepping up on mantle = climbing, not pull to stand
-if it just says went up the stairs, you can assume this is climbing
-climbed up car seat and rocked in it = gets coded just as climbing
-lifting self to knees holding onto something= considered climbing up
-doesn’t have to say “climbing” explicitly to go here; e.g. if child is standing at bottom of stairs trying to get knee up this is considered climbing
Appendix D (Continued)

PULL TO STAND/STANDING/STEPPING/JUMPING/CRUISING/WALKING [falls]
Sub-codes:

- Pull to stand action of any type 1
- Standing 2
- Stepping from one object to another (e.g., bed to nightstand) 3
- Jumping 4
- Cruising or walking in a risky way (e.g., unstable object as a support, sharp edges that they might hit, slippery floor) 5
- Stairs related in any way 6
- Walking related fall concern (7)

NOTES: ‘CRUISING’ means walking along holding onto something for support, like a table, so if the parent does not indicate this then code it as either Standing or Walking as you think appropriate. If stepping up/down is done while hanging onto something (e.g., table), code the climbing NOT here. If they refer to a step’ or ‘mantle’ (ONE, not staircase) then code this either under climbing or crawling NOT stair related. Stepping up on mantle = climbing, not pull to stand.

- If child doesn’t pull anything to stand but simply stands up, you can sub-categorize this as “pull to stand”
- If response says “pull self up on X” (e.g. on hearth), this is climbing, not pull to stand because they need to stand for it to be pull to stand
- If response deals with standing/holding onto drawer and almost closed it on fingers – standing doesn’t get coded; if deals w/ standing and pulling drawer – standing doesn’t get coded
- If says pull to stand and then standing while bracing self, using object – only code the pull to stand, not the standing
- It’s assumed the concern is falling when code for pull to stand, so don’t always need to code falling
- If does pull to stand then almost pulls object over, only the pull to stand gets coded
  - Cruising is normally done at one level – so it would not be holding onto something while climbing a step for example
- Cruising relates to if child is walking by holding onto furniture
- Pull to stand and then cruising in risky way = only code cruising
- For responses that say pulled open kitchen drawer/stood up – code in pushing pulling… and also pull to stand
- If pull self ONTO something it goes in climbing; but if just pull self up it goes here
- If walking is the behaviour, check to see if the concern is falling, or if the concern is walking in a risky way (e.g. walking around table; head at height of corners) – coded differently
Appendix D (Continued)

FALL FROM A HEIGHT IS THE CONCERN but it does not fit elsewhere
Sub-codes:

- NOT STAIR RELATED/ MOVING AROUND AT A HEIGHT/LUNGING (1)
- STAIR or STEP RELATED (2)

NOTE. *Only use this category when you cannot code a fall from height concern in another category.* For example, if the parent had said child crawled somewhere and now could fall, it would be coded under CRAWLING and NOT HERE. SO for this category, **HOW the child got into the fall-risk situation is not known** (e.g., mom just says ‘child might fall off step’ or she just says ‘child is on couch edge and could fall off’) **OR is known, but does not fit elsewhere** (e.g., child is in high chair or some other type chair and rocking the chair and concern is it will fall over). If the concern is the child falling when in the **high chair** (e.g., rocking) **but there is no mention of food or objects in the child’s mouth, then assume the concern is FALLING from a height (not choking) and code it under the appropriate category.** On mantel leaning onto table = falling concern. Walking to gate and hanging off gate = fall concern

ANYTHING WATER RELATED [drowning]
Sub-codes:

- Bathtub: standing/climbing/playing with toys, etc- anything in bathtub 1
- Other 2

NOTES: If child is playing with toys/ doing an activity in the bath it doesn’t get coded as well-simply code the bathtub

OPENING/PUTTING IN MOUTH [choking, poisoning]
Sub-codes:

- Opening (eg, cupboard, drawer) 1 [NOTE whether opening a drawer/cupboard goes here or under PUSHING/PULLING/MOVING depends on if the parent concern is poisoning (code= here), or crushing the hand (code = Pulling/Pushing/Moving and not here)]
- Mouth related – object involved (e.g., coins in mouth, glue/paint/substances are considered objects, cords) 2
- Mouth related – food involved (eg, stuffed bread in mouth) 3
- Rocking or other movement when they have food in mouth (eg, rocking in high chair) 4
- Rocking or other movement when they have an object in mouth (e.g. coins in mouth) 5
- Mouth related- medication involved (e.g. child puts Advil in mouth) 6

NOTES: -if deals w/ hazardous substance, then it goes here; if deals w/ closing door on finger then it goes in pushing/pulling category. If don’t know if it deals w/ hazardous substance/crashing injury, then put it under pushing/pulling category. Any seat gets coded like high chairs do (e.g. booster seat). “Sleeping on her stomach” would be coded under mouth related-object as the concern is suffocation. IF THE RB IS ROCKING BUT THEY DON’T MENTION ANY OBJECT OR FOOD THEN CODE THIS AS ‘FALL FROM A HEIGHT IS CONCERN’
Appendix D (Continued)

PUSHING/PULLING/MOVING objects [bumps, bruises, crushing injuries]

Sub-codes:

- Pulling object (e.g., stair gate) 1
- Pushing object (e.g., high chair) 2
- Other movement that could result in object falling over 3 (e.g., rocking bookcase back and forth)
- Opening OR closing (e.g., drawer, cupboard) 4 [NOTE whether opening a drawer/cupboard goes here, or under OPENING/PUTTING IN MOUTH depends on if the parent concern is poisoning (code= Opening/Putting in Mouth) or crushing the hand (code= here)]

NOTES: If concern is child crushing drawer on their fingers, it goes under this (within the opening/closing subcategory). For responses that say pulled open kitchen drawer/stood up – code in pushing pulling, and also pull to stand. Standing holding gate and swinging it back and forth = code as pushing/pulling – pushing

TOUCHING/REACHING FOR/PLAYING WITH – unsafe/off limits things [general injury]

Sub-codes:

- Putting fingers into things 1 (e.g., “wanted to stick fingers in humidifier-fan part”)
- Stair OR STEP related (eg, playing with toys on stairs) 2
- Touching/Reaching/Playing with COMMON HOUSEHOLD OBJECT that most homes would have (e.g., safety scissors, oven, toilet, chairs, phone charger, cords or plugs, books, fireplace, etc.) 3
- Touching/Reaching/Playing with UNSAFE OBJECT THAT COULD BE PREVENTED or ELIMINATED NEAR CHILD (e.g., boiling water, hot element, hot tea, sharp knife, file cabinet, balloons, pet related, bib hanging on a chair, decorative plate). 4
- Other 5
- Touching/Reaching/Playing - relating to garbage 6

NOTES: Touching/reaching for/playing with category = if it’s something parent did/didn’t do, then it goes in the ‘unsafe’ sub-category, but if the child just interacted with a dangerous item then it goes in the ‘common household item’ category. If response says something like “going after dog food” it goes in this category under unsafe object; if the response says the child put it in their mouth it would go in opening/putting in mouth category. If child is standing and touching dangerous item (e.g. hot fireplace), only the touching gets coded, not the standing. Stairs in this category only gets coded if there’s no mention of crawling to or standing on stairs. By the unsafe object code that could have been eliminated- this means prevented: For example: if the dishwasher is open and the child goes for utensils, the dishwasher is a common household object, however, the utensils could be an unsafe object that could have been prevented. Also “Went for dog's tail” could have been prevented (thus, unsafe). If it is a cord in the wall that can’t really be prevented then it is common household. BUT if it is an empty electrical socket (they could have safety features on it to prevent injury, therefore could be prevented and UNSAFE.
Appendix E: Reduced Coding Scheme

1. Rolling Sub-codes:
   - Rolling or doing something in a way/location that can lead to a fall off a table or diaper change table
   - Rolling in a way/location that can lead to a fall – not related to change table

2. Cruising:
   - PULL TO STAND/STANDING/STePPING/JUMPING/CruISING/WALKING
     Sub-codes:
     - Pull to stand action of any type
     - Standing
     - Stepping from one object to another
     - Jumping
     - Cruising or walking in a risky way
     - Stairs related in any way
     - Walking related fall concern
   - FALL FROM A HEIGHT IS THE CONCERN Sub-codes:
     - Not stair related/moving around at a height
     - STAIR or STEP RELATED

3. Mouthing/touching hazards:
   - OPENING/PUTTING IN MOUTH [choking, poisoning] Sub-codes:
     - Opening
     - Mouth related – object involved
     - Mouth related – food involved
     - Rocking or other movement when they have food in mouth
     - Rocking or other movement when they have an object in mouth
     - Mouth related- medication involved
   - TOUCHING/REACHING FOR/PLAYING WITH – unsafe/off limits things
     Sub-codes:
     - Putting fingers into things
     - Stair OR STEP related
     - Touching/Reaching/Playing with COMMON HOUSEHOLD OBJECT
     - Touching/Reaching/Playing with UNSAFE OBJECT
     - Touching/Reaching/Playing - relating to garbage

4. Crushing-related behaviour:
   - PUSHING/PULLING/MOVING objects [bumps, bruises, crushing injuries]
     Sub-codes:
     - Pulling object
     - Pushing object
     - Other movement that could result in object falling over
     - Opening OR closing
5. Climbing:

- **Crawling [falls] Sub-codes:**
  - UP (increasing height) [*If it is stairs related it gets coded below, not here*]
  - DOWN from a higher point [*If it is stairs related it gets coded below, not here*]
  - SAME level (ASSUME this unless they say otherwise)
  - Stairs – up or at bottom of stairs in any way
  - Stairs – down or at top of stairs in any way

- **CLIMBING [falls] Sub-codes:**
  - UP (increasing height) [*If it is stairs related it gets coded below, not here*]
  - DOWN from a higher point [*If it is stairs related it gets coded below, not here*]
  - SAME level (ASSUME this unless they say otherwise)
  - Stairs – up or at bottom of stairs in any way
  - Stairs – down or at top of stairs in any way