Using an injury diary to describe the ecology of children’s daily injuries

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Abstract

Problem: Two problems were addressed in this study. First, are daily injury diaries an effective means to gather information about children’s unintentional injuries? Second, what are the circumstances of children’s injuries as recorded through the diary method? Method: Two studies were conducted with a total of 172 children to describe the ecology of children’s daily unintentional injuries. Families completed a daily diary for 14 days, describing the circumstances surrounding the injuries children experienced each day. Results: Descriptive data is provided on the locations, causes, and types of injuries children incurred, as well as who was present when they were injured. Daily injury rate was modestly related to the number of major injuries children had incurred in their lifetimes. Discussion: The diary methodology was an effective means to study the ecology of children’s daily injuries. Children’s injuries occur in a wide range of circumstances that can be quantified through diary techniques. Impact on Industry: Data obtained from daily injury diaries may be useful in a variety of areas, including study of the etiology of childhood injury, design of interventions to prevent injury, and engineering of toys and playground equipment for children.

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1. Introduction

Unintentional injuries are the leading cause of mortality in children under age 18 (National Safety Council, 2001). Injuries are responsible for the death of more American children than all other physical diseases combined (Rodriguez & Brown, 1990) and are responsible for over 2 million years of life lost annually (Routh, 1997). For these reasons, behavioral scientists have become increasingly interested in understanding and preventing unintentional childhood injuries.

Most injury research to date has focused on major lifetime injuries as a benchmark for identifying children at high risk for injury. Assessment of major lifetime injuries, often characterized as the number of lifetime injuries requiring a visit to a hospital or medical professional, has several advantages. Researchers can measure children's major injuries relatively quickly and accurately by asking parents to complete brief questionnaires or by examining insurance or hospital records. Further, major lifetime injuries are a good index of injury proneness because they often have significant consequences for children and their families, particularly when the injury results in long-term disability.

Although assessing major lifetime injuries is valuable, Peterson and her colleagues have emphasized the importance of examining minor, daily injuries to supplement research on more major injuries (e.g., Peterson & Brown, 1994; Peterson, Cook, Little, & Schick, 1991; Peterson, Harbeck, & Moreno, 1993; Peterson, Saldana, & Heiblum, 1996). As Peterson explains, major injuries are low base rate events—most children have very few major injuries requiring medical care. Among those children who have several major injuries over the course of childhood, relatively long time periods often elapse between major injuries. Although less problematic for epidemiological research, this is an impediment for behavioral research on unintentional injuries. To gather information concerning the circumstances of an injury, researchers would ideally interview those involved in the incident soon after it had happened. Even with a relatively large sample of children, it could take years to accumulate sufficient data on the antecedents of major injuries in such a manner.

One way to circumvent the practical obstacles to obtaining information about the antecedents of major injuries is to retrospectively ask caregivers about the circumstances surrounding a major injury. In fact, this is the technique most frequently used in unintentional injury research (e.g., Manheimer & Mellinger, 1967; Plumert, 1995; Pulkkinen, 1995; Schwebel & Plumert, 1999). However, interviews or questionnaires completed long after an injury suffer from recall bias; parents may unintentionally forget many of the details surrounding injury incidents (Harel et al., 1994; Peterson et al., 1993).

Peterson and her colleagues suggest that minor daily injuries may provide a useful window into injury proneness because such injuries do not suffer from low base rates (Peterson & Brown, 1994; Peterson et al., 1991, 1993; Peterson, Saldana, et al., 1996). As every caregiver knows, children injure themselves in the course of their day-to-day activities with relative frequency. An advantage of high base rate events such as minor injuries is that the likelihood of recall bias is reduced. That is, because researchers can collect information about minor injuries soon after they occur, parents are less likely to
forget the details surrounding the injuries. Further, events such as minor injuries that occur with reasonable frequency yield higher numbers of events in a short amount of time, allowing more statistical power and greater opportunity to search for patterns of injury proneness in individual children.

A few studies have examined minor injuries through the use of telephone interviews with families. In one study, for example, biweekly interviews were conducted with 8-year-old children and their parents to document parents’ interactions with their children after an injury (Peterson, Bartelstone, Kern, & Gillies, 1995). Results indicated that the majority of injuries did not result in implementation of any parental intervention. Those interventions that did occur were in the form of lectures, and in most cases, the children did not recall hearing the lectures.

Morrongiello (1997) used daily structured telephone interviews over a 2-week period to examine sex differences in injury proneness among 6-, 8-, and 10-year-old children. Results indicated that boys reported more injuries than did girls in their interviews. Boys were also more likely to experience injuries with peers and to tell their parents about their injuries. Furthermore, boys and girls interpreted their injuries in different ways. Boys were more likely to attribute their injuries to bad luck and more likely to say that their injuries were less severe than were girls. Girls attributed their injuries to their own behavior and rated injuries as more severe than the boys.

Finally, Peterson et al. (1991) used phone interviews to examine aspects of the circumstances surrounding children’s minor injuries. The locations of the incidents and level of supervision were recorded for children’s injuries on a biweekly basis over the course of 1 year. They concluded that injuries occurred more frequently in the places where children spent the most time, such as their schoolyard and their living room, with two exceptions (injuries on playgrounds and on roadways). Parental supervision varied greatly by location, but was most likely in dangerous places such as at bodies of water, in automobiles, and in the kitchen.

The goals of the present investigation were twofold. First, from a methodological viewpoint, the authors sought to determine whether a diary method is an effective means to collect information about children’s minor, daily injuries. To date, most research examining children’s minor daily injuries has been conducted through telephone interviews (Morrongiello, 1997; Peterson et al., 1991, 1993, 1995; Peterson, Brown, Bartelstone, & Kern, 1996; Peterson, Heiblum, & Saldana, 1996; Peterson, Saldana, et al., 1996). Although telephone interviews are an effective means to collect information on childhood injuries, they are time-consuming and somewhat intrusive to the research participants. Therefore, an injury diary was developed as an alternative means to examine the circumstances surrounding children’s daily injuries. Other research has shown that diaries are an effective means to collect health-related information (e.g., Verbrugge, 1980). Further, diaries were viewed as less intrusive than telephone calls because families could schedule to complete the diaries when they felt it most convenient each evening. Although there is some risk of false negative reports (Peterson et al., 1993), use of a diary to collect information about children’s injuries is unlikely to yield false positive reports. In other words, families are unlikely to report injuries that did not really occur.
The second goal of the present study was empirical. The researchers sought to answer four questions about the circumstances surrounding children’s daily injuries:

1. What types of injuries do children experience?
2. Who is present when children are injured?
3. Where do injuries tend to occur?
4. What causes injuries to occur?

The answers to these questions were viewed as providing a better understanding of the ecology of daily injuries that could be used both to identify risk factors for injury and to develop interventions to prevent injury. Information such as the nature of the injury, who was there when it occurred, and the location of the injury incident are all important aspects of understanding injury processes (Finney et al., 1993). Initial steps toward this goal have been made, particularly in identifying the location (Peterson et al., 1991) and severity (Peterson, Heiblum, et al., 1996; Peterson, Saldana, et al., 1996) of minor daily injuries, and in identifying sex differences in minor daily injuries (Morrongiello, 1997). However, much of the context surrounding the circumstances of unintentional injuries remains unknown.

Two studies were conducted. Study 1 is presented briefly because its primary objective was to test the practicality of using the diary methodology. Study 2 is presented in greater length; it served to refine the diary methodology and to more carefully describe the ecology of children’s unintentional daily injuries.

2. Study 1

2.1. Method

2.1.1. Participants

Eighty-seven 6-year-old children were recruited from rural communities, a small city, and a university town. The families represented a wide range of socioeconomic backgrounds and were primarily Caucasian. A total of 43 boys and 44 girls participated; they had a mean age of 6 years and 4 months (range = 5 years and 7 months up to 7 years and 2 months).

2.1.2. Procedure

Children were invited to the laboratory to participate in another study on children’s unintentional injuries (Plumert & Schwebel, 1997; Schwebel & Plumert, 1999). During the laboratory session, parents completed the Unintentional Injury Questionnaire (UIQ), a brief questionnaire reporting all lifetime injuries children had experienced that required a visit to a medical professional and the approximate age at which the injury occurred. In almost all cases, the mother completed this questionnaire (three fathers completed the form). Details about the UIQ are available elsewhere (Plumert, 1995).

Following the laboratory session, a research assistant explained the diary to both the child and the parent. Families were instructed to complete the diary each night before the
child went to sleep. For each injury, parents recorded the type of injury, the severity of the injury, the people present when the injury occurred, the circumstances of the injury, and the treatment given. The diary was completed each night for 14 consecutive days. If families forgot to fill out the diary in the evening, they were permitted to complete it the next morning. If the diary was forgotten beyond the next morning, the previous day was skipped and the diary was resumed the next evening and parents were asked to make up the missed day at the end of the 2-week period. Nine percent of the entries were completed in the morning rather than at night. Twenty-eight percent of the families forgot 1 or more days but still provided complete diaries with 14 days entered. Diaries were completed between March and October when the weather was warm and children were likely to spend time outdoors.

To deal with possible misinterpretations concerning what constituted an “injury” (Peterson, Brown, et al., 1996), families were instructed to record anything they considered injurious to the children. Coders later removed any injuries that did not include some sort of tissue damage or objective pain on the part of the child, and therefore did not appear to be a legitimate injury.

2.1.3. Compilation of data

Two trained research assistants coded the data. Four primary variables were of concern: (a) the type of injury, (b) who was present when the injury occurred, (c) where the injury occurred, and (d) what caused the injury. The number of injuries and the severity of each injury were also coded.

Type of injury was subdivided into four categories: (a) bump/bruise, (b) burn, (c) cut/scrape, and (d) sprain/strain. Bumps and bruises were considered any injury caused by contact with another object that did not pierce the skin but did cause some sort of pain or damage to surface tissues. Burns were any injury caused by contact with any hot object (e.g., hot chocolate, iron, pizza). Cuts and scrapes were any injuries caused by contact with an object that pierced the skin, either through a sharp, piercing contact or through friction. Sprains and strains were coded for any injury caused by overuse or overextension of a body part. Remaining injuries were classified as uncodable and were excluded from the analyses on the types of injuries children experienced. These included injuries where insufficient information was provided by the parent as well as injuries that did not clearly fit into one of the categories. A mean proportion of .08 injuries was classified as uncodable.

The determination of who was present when the child was injured was divided into the following categories: adult nonrelatives (e.g., coaches, teachers, babysitters); adult relatives (e.g., parents, grandparents, aunts, uncles); child nonrelatives (e.g., peers, teammates, classmates); and child relatives (e.g., siblings, cousins). On occasion, more than one category was coded for an injury since several people could be present when an injury occurred (e.g., both parents and siblings). Instances in which the child was alone when he or she was injured were also coded. Injuries for which the parent provided insufficient information about the people present at the time of the injury were classified as uncodable and were excluded from the analyses on who was present when the injury occurred. A mean proportion of .02 injuries was classified as uncodable.
Three categories were used to classify where the injury occurred: (a) homes, (b) playgrounds/streets/athletic fields, and (c) school/church. The home category included an injury at any home, whether the child’s own home or someone else’s. It included both injuries that occurred inside the home and injuries that occurred in the yard or porch of the home. The playgrounds/streets/athletic fields category included any areas where children frequently play actively, including school and park playgrounds, streets, alleys, sidewalks, bicycle trails, soccer fields, basketball courts, gymnasiums, swimming pools, and so on. The school/church category was scored for any injury occurring inside schools, churches, temples, or synagogues. Remaining injuries were classified as uncodable and were excluded from the analyses on injury location. These included injuries where insufficient information was provided by the parent as well as injuries occurring in places that did not fit cleanly into the other categories such as automobiles, grocery stores, and malls. A mean proportion of 0.48 injuries was considered uncodable.

Cause of the injury was classified as one of the following actions: (a) touching objects, (b) falling down, (c) running into things, or (d) inflicted by others. The touching objects category included injuries caused by contact between the child and an object that the child chose to touch. Examples include touching a wooden park bench and getting a splinter, touching or eating something hot and burning oneself, or touching a broken bottle and cutting oneself on the glass. The falling down category included any instance of the child falling from an erect (or, on occasion, seated) position to the ground and injuring him/herself during or as a consequence of the fall. Examples include tripping and falling on a curb, falling off a bicycle, or falling during a soccer game. The running into things category included any example of the child moving into an object or person. The injury occurred through contact with the other item. Examples include bumping one’s head on a table, bruising a knee on a chair corner, or a child running into a father’s sharp belt buckle. The inflicted by others category included any injury caused by an object, person, or animal moving into the child and causing an injury. Examples include being hit by a baseball during a game, being splashed in the eyes while playing in a chlorinated swimming pool, or punches, bites, and kicks by siblings and pets. The remaining injuries were classified as uncodable and were excluded from the analyses on the causes of injuries. These included injuries where insufficient information was provided in the diary as well as injuries that did not fit cleanly into one of the above categories. A mean proportion of 0.16 injuries was classified as uncodable.

Severity of injury was coded on a 4-point scale. The most minor injuries—those requiring no treatment—received a score of 1. Minor injuries requiring home first aid were given a score of 2; those that were more major, but still did not require professional medical treatment were given a score of 3. Unlike those injuries scoring a 2, injuries coded with a severity of 3 generally required multiple types of treatment (e.g., washing, ointment, and bandages) or required substantial amounts of time for treatment (e.g., cleansing and bandaging for more than 10 min). Finally, those injuries requiring professional medical treatment were given a score of 4.

Kappa was computed for each of the coded categories to assess reliability between the two coders. For the four major variables of interest (type of injury, who was present, location of injury, and cause of injury), kappa was computed on 23–24% of the sample.
and ranged from 0.77 to 0.93. For severity of injury, kappa was computed on 15% of the sample and was 1.00.

2.2. Results

Data analysis was carried out in three steps. First, the number and severity of the injuries that were reported in the diaries was examined. Next, each of the four questions above concerning the context of children’s daily injuries was examined: (a) the types of everyday injuries children experience; (b) who is present when children are injured; (c) where injuries tend to occur; and (d) what causes daily injuries. Finally, the correlation between minor and major injuries was examined. Follow-up tests were conducted using Tukey–Kramer tests ($\alpha = 0.05$).

2.2.1. Number and severity of injuries

Over the course of the 2-week diary, children and their parents reported a mean of 7.70 injuries ($S.D. = 4.74$, range $= 1–33$). Results from a one-way ANOVA suggest boys and girls reported similar numbers of injuries, $F(1,85) = 1.88$, ns, (boys: $M = 7.00$, $S.D. = 5.12$; girls: $M = 8.39$, $S.D. = 4.27$).

The mean severity of injuries reported in the diaries was 1.30 ($S.D. = 0.23$). Results from a one-way ANOVA suggest boys and girls reported similar severity of injuries, $F(1,85) = 0.39$, ns.

2.2.2. Types of injuries

Children experienced cuts/scrapes ($M = 0.47$, $S.D. = 0.22$) and bumps/bruises ($M = 0.40$, $S.D. = 0.20$) most frequently, with burns ($M = 0.07$, $S.D. = 0.01$) and sprains/strains ($M = 0.03$, $S.D. = 0.07$) occurring less frequently. The scores were entered into a Sex (2) $\times$ Injury Type (4) repeated measures ANOVA, which yielded a significant main effect of injury type, $F(3,255) = 170.02$, $p < .01$. Follow-up tests indicated that children experienced significantly more cuts/scrapes than any other type of injury. They also experienced bumps/bruises significantly more than burns or sprains/strains. Other differences were not significant.

2.2.3. Who was present when injuries occurred

On average, a mean proportion of .08 injuries occurred while the child was alone. Injuries occurred most frequently with an adult relative present ($M = 0.43$, $S.D. = 0.26$), followed by a child relative ($M = 0.38$, $S.D. = 0.25$), a child nonrelative ($M = 0.37$, $S.D. = 0.26$), and an adult nonrelative ($M = 0.20$, $S.D. = 0.21$). A Sex (2) $\times$ Who Was Present (4) repeated measures ANOVA yielded a significant main effect of who was present, $F(3,255) = 14.46$, $p < .01$. Follow-up tests indicated that injuries occurred more frequently with adult relatives, child relatives, or child nonrelatives present than they did with adult nonrelatives present. No other differences were significant.

2.2.4. Where injuries occurred

Children were injured most frequently on playgrounds, streets, and athletic fields ($M = 0.26$, $S.D. = 0.19$), followed by homes ($M = 0.21$, $S.D. = 0.19$), and schools and
churches ($M = .05$, $S.D. = 0.11$). A Sex (2) × Injury Location (3) repeated measures ANOVA yielded a significant main effect of injury location, $F(2,170) = 30.52$, $p < .01$. Follow-up tests indicated that injuries occurred more frequently on playgrounds/streets/athletic fields and at homes than at schools/churches. No other differences were significant.

2.2.5. Causes of injuries

Children were injured most frequently by running into things ($M = 0.28$, $S.D. = 0.21$), followed by falling ($M = 0.24$, $S.D. = 0.22$), injuries inflicted by others ($M = 0.19$, $S.D. = 0.20$), and touching things ($M = 0.13$, $S.D. = 0.18$). A Sex (2) × Injury Cause (4) repeated measures ANOVA yielded a significant main effect of injury cause, $F(3,255) = 6.73$, $p < .01$. Follow-up tests indicated that the only significant differences were that children were more likely to be injured by falling or by running into things than they were by touching things.

2.2.6. Major lifetime injuries and minor daily injuries

On the UIQ, the children’s parents reported a mean of 1.07 lifetime injuries requiring professional medical attention ($S.D. = 1.15$, range = 0–5). A one-way ANOVA comparing boys and girls approached traditional levels of significance, $F(1,85) = 2.91$, $p < 0.10$, indicating that boys experienced slightly more major lifetime injuries ($M = 1.28$, $S.D. = 1.32$) than did girls ($M = 0.86$, $S.D. = 0.93$). The correlation between minor daily injuries and lifetime injuries requiring medical treatment was in the expected direction but at a surprisingly modest level, $r(86)=.07$, ns. Controlling for sex did not significantly alter the magnitude of the correlation ($r(84)=.10$, ns).

2.3. Discussion

The results of this study indicate that the diary method is an effective means to gather information about the circumstances surrounding children’s minor day-to-day injuries. Children incurred about one unintentional injury every 2 days, although some children incurred injuries much more frequently. Injuries tended to be bumps and bruises or cuts and scrapes and occurred most frequently on playgrounds, streets, and athletic fields, followed closely by homes. Children experienced injuries with a range of people present and injuries were caused most often by the actions of falling and running into things. The correlation between minor daily injuries and lifetime injuries requiring medical treatment was not significant and surprisingly modest.

Although these results suggest that the diary approach is a promising one, a few methodological and pragmatic problems surfaced with the version of the diary used in this study. Most problematic was the fact that some parents were very descriptive in their accounts while others were not, causing insufficient detail for accurate coding in some reports and a large amount of uncodable data, particularly for the location of injuries category.

To address this problem, a second study was conducted with a revised diary. Based on the coding categories developed in Study 1, the revised diary used a multiple-choice format to obtain much of the information. This format, besides being easier and quicker for
parents to complete, resulted in greater uniformity of detail in responding. Eight-year-old children along with 6-year-old children were included. One concern from Study 1 was whether the children might have had inaccurate recall of injuries that occurred when their parents were not present. Because 8-year-olds have developed better memory skills and are, most likely, more accurate reporters of their own injuries, older children were included in Study 2. Thus, Study 2 adopted some changes to the format of the diary and examined children from two age cohorts. Again, it was geared specifically toward identifying the circumstances surrounding children’s daily injuries, including: (a) the types of injuries children experience, (b) who is with children when they are injured, (c) where injuries occur, and (d) what causes injuries.

3. Study 2

3.1. Method

3.1.1. Participants

Eighty-five 6- and 8-year-old children participated in Study 2. The sample was demographically similar to that in Study 1 and included 41 eight-year-olds (21 boys, 20 girls) with a mean age of 8 years and 7 months (range = 8 years and 1 month up to 9 years). The 6-year-old sample included 44 participants (21 boys, 23 girls) with a mean age of 6 years and 7 months (range = 5 years and 10 months up to 7 years and 1 month).

3.1.2. Procedure

The procedure of Study 2 was identical to that of Study 1, with the exception that the diary in Study 2 asked families to complete a series of multiple choice questions followed by a short written description of the injury. The multiple-choice questions corresponded to the areas of particular concern in this study: what type of injury children experienced, the people there during the injury, where the child was when injured, and the cause of the injury.

Twenty-two percent of the families forgot 1 or more days but still provided complete 14-day diaries. Completion of the diary the following morning was not a problem in Study 1, so this information was not collected in Study 2. All participants completed Study 2 diaries between the months of March and July.

3.1.3. Compilation of data

Coding of data was identical to that of Study 1. The revised diary format permitted coders to rely primarily on multiple choice information and supplement that information with the parent’s narrative description of the injury. Type of injury was subdivided into four categories: (a) bump/bruise, (b) burn, (c) cut/scrape, and (d) sprain/strain. An average proportion of 0.16 injuries fell into “other” categories and could not be classified. Four categories were used to determine who was present when the child was injured: child relatives, adult relatives, child nonrelatives, and adult nonrelatives. Injuries occurring while the child was alone were also scored. On average, only .01 of the injuries could not
be classified using these categories. Three categories were used to classify where the injury occurred: (a) homes, (b) playgrounds/streets/athletic fields, and (c) school/church. A mean proportion of 0.11 injuries was classified as “other” location. Cause of the injury was classified as one of the following actions: (a) touching objects, (b) falling down, (c) running into things, or (d) inflicted by others. On average, .08 of injuries was classified as “other.”

Reliability between the two coders for the four major variables was computed on 21–30% of the sample. Kappas were good, ranging from 0.81 to 1.00. Injury severity was coded for reliability on 16% of the sample; kappa was 1.00.

3.2. Results

Data analysis was carried out in three steps: (a) the number and severity of injuries reported in the diaries; (b) the types of everyday injuries children experience, who is present when children are injured, where injuries tend to occur, and what causes the injuries; and (c) the relationship between minor and major injuries. Follow-up tests were conducted using Tukey–Kramer tests (alpha=.05).

![Fig. 1. Study 2: types of injuries.](image-url)
3.2.1. Number and severity of injuries

Families reported a mean of 5.60 injuries in the diaries (S.D. = 3.64, range = 0–16). An Age (2) × Sex (2) ANOVA yielded a marginally significant effect of sex, $F(3,81) = 2.52$, $p = .06$. Boys ($M = 6.31$, S.D. = 3.95) tended to have more daily injuries than did girls ($M = 4.91$, S.D. = 3.20). The number of injuries reported did not differ significantly for 6-year-olds ($M = 5.84$, S.D. = 3.83) and 8-year-olds ($M = 5.34$, S.D. = 3.45). Families reported injuries with a mean severity of 1.32 (S.D. = 0.31) on the 4-point scale. An Age (2) × Sex (2) ANOVA yielded no significant effects.

3.2.2. Types of injuries

Fig. 1 presents the mean proportions and standard deviations of each type of injury. An Age (2) × Sex (2) × Injury Type (4) repeated measures ANOVA yielded a significant main effect of injury type, $F(3,234) = 77.03$, $p < .01$. Follow-up tests indicated that bumps/bruises and cuts/scrapes were significantly more frequent than sprains/strains and burns.

3.2.3. Who was present when injuries occurred

On average, only 11% of the injuries occurred when children were alone. Fig. 2 illustrates who was present when children were injured. An Age (2) × Sex (2) × Who Was Present (4) repeated measures ANOVA yielded a significant main effect of who was present, $F(3,234) = 17.67$, $p < .01$. Follow-up tests indicated that injuries occurred signifi-
significantly more frequently with child relatives, adult relatives, and child nonrelatives than they did with adult nonrelatives. Injuries with child relatives were significantly more common than those with child nonrelatives.

Fig. 3. Study 2: where injuries occurred.

Fig. 4. Study 2: where injuries occurred, by age and sex.
3.2.4. Where injuries occurred

Fig. 3 shows the mean proportions and standard deviations of the locations of reported injuries. An Age (2) × Sex (2) × Injury Location (3) repeated measures ANOVA yielded a significant main effect of injury location, $F(2,156) = 76.53$, $p < .01$. Follow-up tests indicated that all three locations were significantly different from each other. Injuries occurred most frequently at homes, less frequently on playgrounds/streets/athletic fields, and least frequently at schools/churches.

There was also a significant Age × Sex × Injury Location interaction, $F(2,156) = 8.75$, $p < .01$ (see Fig. 4). Simple effects tests revealed a significant Sex × Injury Location interaction for 8-year-olds, $F(1,36) = 13.29$, $p < .01$, but not for 6-year-olds, $F(1,42) = 0.86$, ns. Further simple effects tests revealed a significant effect of Injury Location for 8-year-old boys, $F(2,36) = 11.60$, $p < .01$, and for 8-year-old girls, $F(2,36) = 54.73$, $p < .01$. Eight-year-old boys were injured approximately equally often at home as they were on playgrounds/streets/athletic fields, and much less often at schools/churches. Eight-year-old girls were much more likely to be injured at home than on playgrounds/streets/athletic fields or at schools/churches.

3.2.5. Causes of injuries

Fig. 5 illustrates the mean proportions and standard deviations of the causes of reported injuries. An Age (2) × Sex (2) × Injury Cause (4) repeated measures ANOVA
yielded a significant main effect of cause of injury, $F(3,234) = 8.73, p < .01$. Follow-up tests indicated that injuries were more likely to occur through running into things, falling, or when inflicted by others than by touching objects. No other differences were significant.

3.2.6. Major lifetime injuries and minor daily injuries

Parents reported a mean of 1.21 lifetime injuries requiring medical injury (S.D. = 1.42, range = 0–6). An Age (2) × Sex (2) ANOVA yielded a marginally significant effect of sex, $F(1,81) = 3.59, p < 0.10$. Boys averaged slightly more injuries ($M = 1.50$, S.D. = 1.63) than did girls ($M = 0.93$, S.D. = 1.20). There was no significant difference in the number of lifetime injuries reported for 6-year-olds ($M = 1.39$, S.D. = 1.45) and 8-year-olds ($M = 1.02$, S.D. = 1.37).

The correlation between the total number of injuries reported in the diary and the number of lifetime injuries requiring medical treatment approached traditional significance levels, $r(84) = 0.19, p < 0.10$. Results were similar after controlling for age ($r(82)=.18$, $p=.10$), sex ($r(82)=.15$, ns), and sex and age ($r(81)=.14$, ns).

3.3. Discussion

Study 2 offers further support for the diary method as a useful means of gathering information about the circumstances of children’s daily unintentional injuries. The overall pattern of results was similar to Study 1, but the multiple-choice format of the diary led to more codable data than in Study 1. Again, children experienced an injury about every 2–3 days in this sample. Boys reported slightly more injuries than did girls, but there were no age differences among the 6- and 8-year-olds in the sample. Children had more bumps/bruises and cuts/scrapes than burns or sprains/strains. Injuries occurred least frequently with adult nonrelatives and more frequently with adult relatives, child nonrelatives, and particularly with child relatives. Results for injury location differed somewhat from Study 1. For 6-year-olds, injuries occurred more frequently at home than on playgrounds/streets/athletic fields, and occurred least frequently at schools/churches. Among 8-year-olds, a similar pattern emerged among girls, but boys had about the same number of injuries at playgrounds/streets/athletic fields as they did at home. When cause of injury was considered, injuries occurred most frequently by children running into things, falling, or by others. The correlation between minor daily injuries and lifetime injuries requiring medical treatment was again modest.

The Age × Sex × Injury Location interaction highlights the interplay between age and gender in children’s injuries. At age 6, boys and girls tended to injure themselves in similar places—most frequently at home, followed by outdoor play areas, and then schools and churches. By age 8, gender differences were apparent. Eight-year-old girls were injured more frequently at home and less frequently on playgrounds/streets/athletic fields. Eight-year-old boys were injured with about equal frequency on playgrounds/streets/athletic fields as at home. These differences may reflect development of sex-typed behaviors. Although boys and girls generally begin sex-typed play well before age 6, boys have strong preferences for active, outdoor activities while girls tend to engage in less active, indoor activities (Alexander & Hines, 1994; Lever, 1998; Liss, 1983). It may be that older
children are permitted more freedom and therefore parents may allow 8-year-old boys to be active in more athletic, playground activities than 6-year-old boys (Eisenberg, 1983). Eight-year-old girls, when offered parallel independence may choose to stay in homes instead of playing outdoors (Eisenberg, 1983).

The location of 6-year-old children’s injuries differed somewhat between Study 1 and Study 2. In Study 1, 6-year-olds tended to injure themselves with approximately equal frequency on playgrounds/streets/athletic fields and at homes. In Study 2, 6-year-old children tended to hurt themselves more frequently at homes and less frequently on playgrounds/streets/athletic fields. A comparison of the two studies indicates that the proportion of injuries that occurred on playgrounds/streets/athletic fields was almost identical, but the proportion of injuries that occurred at homes was much greater in Study 2 than in Study 1. In addition, the proportion of uncodable data dropped from 0.48 in Study 1 to 0.11 in Study 2. This pattern of results suggests that many of the unclassifiable injuries in Study 1 were those that occurred at homes. Thus, the discrepancy between the two studies seems to be coding difficulty rather than an actual difference in where injury incidents are most likely to occur.

4. General discussion

Overall, results from this investigation suggest that an injury diary completed by children and their parents is an effective means to learn about the circumstances of minor, daily injuries. Four major areas were considered: (a) the types of injuries children and their parents reported (children experienced cuts/scrapes and bumps/bruises most frequently); (b) who was present when children were injured (injuries occurred with about equal frequency with child and adult relatives and with child nonrelatives, but far less frequently with adult nonrelatives such as teachers, babysitters, and coaches) (c) location of injuries: (across both studies, injuries occurred least frequently in schools and churches; injuries on streets, playgrounds, and athletic fields were more common in Study 1, and with the exception of 8-year-old boys, injuries at home were most frequent in Study 2) (d) finally, the cause of children’s injuries: (injuries most commonly resulted from running into things and falling, and least commonly from touching dangerous objects).

The findings that injuries tend to occur most frequently at homes and on athletic fields, streets, and playgrounds, and that injuries tend to occur most frequently with individuals such as peers, parents, and siblings make intuitive sense. These are the places and people with whom children spend the most time, so it would be expected that these are the places and people with whom they would be injured most frequently (Peterson et al., 1991). Churches and schools, where injuries occurred least frequently, are also the places where children generally receive the most adult supervision—supervision that perhaps limits the number of injuries children incur in those settings.

Given this, injury prevention campaigns should be directed toward the environments where children play most frequently and with the least adult supervision. Continued efforts at improving home and playground safety are necessary to reduce the number of injuries occurring to children. Furthermore, interventions targeted at the people who
spend time with children, including parents and peers, may be useful to reduce childhood injury rates.

In both studies, children experienced many more cuts/scrapes and bumps/bruises than they did burns or sprains/strains. Likewise, children in both studies tended to be injured most frequently by falling down or by running into things and least frequently by touching objects. This pattern of findings underscores a possible link between the types of injuries children commonly experience and the types of actions that commonly lead to injuries: actions like falling down and running into things may result in cuts/scrapes and bumps/bruises. Burns are obviously the result of touching hot objects. Thus, it seems likely that the high frequency of cuts/scrapes and bumps/bruises in these studies was the direct result of the kinds of actions that frequently result in injury. One implication of this finding is that attempts to prevent particular types of injuries should be targeted at the types of actions that frequently cause those injuries.

One unexpected result was the finding that the number of daily injuries was modestly related to the number of lifetime injuries children experience requiring medical attention. There are three possible explanations for this finding. One hypothesis is that imperfect methods to measure injuries were used. Most measures of injury proneness, and particularly measures of major lifetime injuries, suffer from low base rates and, therefore, low statistical variance within a sample. Likewise, imperfections in the diary method may have contributed to the low correlations between minor daily and major lifetime injuries. Study 2, which used an improved diary, resulted in a higher correlation than Study 1 did.

In both studies, anecdotal evidence suggests some families tended to report more injuries than other families did simply because some families were more diligent about reporting even the smallest of injuries while others used a higher threshold to define what should be recorded in the diary. Thus, despite our efforts to define “injury” universally for families, this feat may not have been accomplished and data therefore may have been somewhat inaccurate. A related issue is the notion of injury opportunity. All families completed their diaries for a 2-week warm-weather period, but inevitably the weeks were not equivalent. In other words, some children may have completed diaries during a particularly rainy time period and therefore may have had decreased opportunity for injury during outdoor play.

A second hypothesis to explain the modest correlation between minor daily and major lifetime injuries is that the diary may not have been extended long enough to achieve a reasonable estimate of children’s minor injury rate. It is possible that 2 weeks was not sufficient time to measure children’s minor injuries and that a month-long diary would achieve a higher correlation with children’s major injury history.

A third hypothesis is that lifetime major injuries requiring medical treatment are in fact a theoretically related but independent construct from minor daily injuries. Some children may experience frequent daily injuries but few lifetime injuries requiring medical treatment while other children may experience a relatively large number of lifetime injuries requiring medical treatment but relatively few daily injuries. In addition, some families may be more apt to take their children to a doctor for an injury whereas others would treat that injury at home.

From a methodological standpoint, the study demonstrated that diaries are an effective means of gathering information about children’s everyday injuries. Return rate for the
diaries was high in both studies (95% in Study 1 and 85% in Study 2). Parents did not report any difficulty in comprehending our instructions or in completing the diaries. In fact, several parents anecdotally commented on how they enjoyed completing the diary each evening. They explained that the diary provided an opportunity for individualized time with their children to talk about the day’s activities.

Although it is possible that families did not report all injuries that occurred, the authors feel that this is unlikely. Peterson et al. (1993) suggests false positives are very rare when using this type of methodology—in other words, families are quite unlikely to “create” injuries that did not occur. False negatives—or the lack of reporting events that actually occurred—are a greater risk, but the use of regular, daily measure generally averts significant problems with forgetfulness in reporting (Verbrugge, 1980).

In this particular investigation, the authors focused on providing descriptive information about specific aspects of the circumstances surrounding children’s everyday injuries. The diary methodology could easily be extended to focus on other critical aspects of childhood injuries (Peterson, Farmer, & Mori, 1987). A family relations researcher interested in parenting strategies that encourage safe or dangerous behaviors, for example, could study the interactions between children and parents that are described in an injury diary. Similarly, a behavior analyst could use injury diaries to examine behavioral patterns that may lead to increased injury risk.

The diary methodology could also help researchers design interventions to prevent injuries. Present results suggest that many of children’s injuries were caused by falls and by running into things. Injuries caused by these reasons may be prevented through manipulation of dangerous environments—placing mulch under playground equipment, for example—and through changing children’s behavior patterns—encouraging children to attend to the possibility of potholes on bicycle paths, for example. Results also indicate that injuries occurred somewhat infrequently through the touching of dangerous objects. Perhaps repeated exposure to warnings about touching hot and sharp objects have reduced the prevalence of injuries from touching stoves, irons, knives, broken glass, and so on.

Although injury diaries appear to be a useful means of collecting information about children’s daily injuries, two cautionary notes are warranted. First, it is crucial to emphasize that base rates affect data. In this study, for example, although the investigators did not measure the time children spent in various locations, it is inevitable that the proportion of injuries occurring in each location was greatly affected by the simple fact that children spent more time in some locations than in others. Second, it was found that the multiple choice format used in Study 2, supplemented by a brief narrative of the injury, was more effective than the narrative used in Study 1, particularly in achieving objective coding.

In closing, the present study demonstrates the effectiveness of a daily injury diary to record the circumstances surrounding children’s unintentional injuries. Using a diary, the authors were able to examine the locations, causes, and types of injuries children incurred, as well as who was present when they were injured. Because daily minor injuries have a higher base rate than lifetime major injuries, daily injury diaries may be useful for researchers in a variety of areas, including those studying the etiology of childhood injuries as well as those designing interventions to prevent injuries.
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