Preventive Medicine Reports 13 (2019) 146–152

Contents lists available at ScienceDirect

Preventive Medicine Reports

journal homepage: www.elsevier.com/locate/pmedr

Changes in parents' perceived injury risk after a medically-attended injury to their child

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ARTICLE INFO

Keywords:
Negative recency
Gambler's fallacy
Child injury
Risk perception
Emergency medicine
Injury prevention

ABSTRACT

Unintentional injuries are a major cause of hospitalization and death for children worldwide. Since children who sustain a medically-attended injury are at higher risk of recurrence, it is crucial to generate knowledge that informs interventions to prevent re-incidence. This study examines when, in the year following a medically-attended injury, parents perceive the greatest risk of injury recurrence. Since perception of injury risk is associated with parental preventive behavior, this can inform decisions on the timing of parent-targeted interventions to prevent re-injury. Study participants were 186 English-fluent parents of children 0 to 16 years, presenting at the British Columbia Children's Hospital for an unintentional pediatric injury. Parents were excluded if their child had a disability or chronic health condition. Perceived risk of the same and of any injury recurring were elicited from parents, when they sought treatment at the hospital, as well as one, four, and twelve months later. The study ran between February 2011 and December 2013. Mixed-effects models were used to analyze changes in parents' responses. Analysis indicates that perceived risk of the same injury recurring did not change. However, perceived risk of any injury recurring increased from baseline to first follow-up, then decreased during the rest of the year. Overall, perceived risk of any injury was higher for parents whose child had a history of injuries. Visits to the Emergency Department for a pediatric injury may not be optimal timing to deploy injury prevention interventions for parents. Follow-up visits (when parents' perceived risk is highest) may be better.

1. Introduction

As a major cause of hospitalization and death for children around the globe (Peden et al., 2008), unintentional pediatric injuries are a priority for prevention. Given that parents' behavior can significantly affect the incidence of unintentional injuries (Petrass et al., 2011), interventions to change their behavior should be informed by evidence on the factors that motivate preventive measures against re-incidence. In the present study, we investigate parents' perception of injury risk, because it is known to influence parents' safety behavior (Beirens et al., 2008; Morrongiello et al., 2012; Lam, 2001a; Barton and Huston, 2012; Beirens et al., 2010). More specifically, we focused on perceived risk of recurrence following a Medically Attended Injury (MAI).

Evidence indicates that interventions to prevent childhood injuries should aim to increase parents' perception of injury risk (Beirens et al., 2010; Cloutier et al., 2011; Glik et al., 1991; Morrongiello et al., 2009; Hogan et al., 2017). Among parents of children 0 to 24 months, perceived risk of unintentional poisonings is associated with preventive behaviors (e.g., safely storing cleaning products) (Beirens et al., 2010). Among parents of children 0 to 4 years, risk perception influences protective behavior against burns, cuts and falls (e.g., installing safety gates on the stairs) (Beirens et al., 2008; Morrongiello et al., 2012). Furthermore, higher perception of risk is associated with higher levels of supervision of school-aged children in pedestrian environments (Lam, 2001a; Barton and Huston, 2012).

MAIs are considered an opportunity for injury prevention interventions, because they increase parents' perception of injury risk (Glik et al., 1991; Morrongiello et al., 2009). A cross-sectional study reported that parents whose child had sustained a MAI in the previous year were more likely to report higher scores of perceived injury risk, compared to those who had not (Glik et al., 1991). Similarly, a case-control study, found that, compared with controls, parents of children who had

Abbreviations: MAI, Medically Attended Injuries; ED, Emergency Department; BOI, Burden of Injury; HRQL, Health Related Quality of Life; PTSD, Post-Traumatic Stress Disorder

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https://doi.org/10.1016/j.pmedr.2018.12.008
Received 5 August 2018; Received in revised form 31 October 2018; Accepted 16 December 2018
Available online 18 December 2018

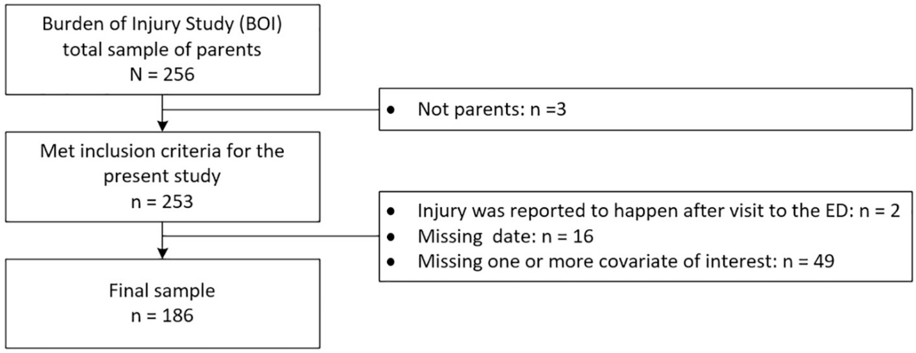

Fig. 1. Sample selection in relation to the Burden of Injury study. Study conducted at the British Columbia Children's Hospital, between February 2011 and December 2013.

sustained a MAI: (a) had an increased perception of injury risk, (b) believed the potential injury could be more severe, (c) had more concern about their child's risky behaviors, and (d) attributed the injury to their own, as well as their child's behaviors (Morrongiello et al., 2009).

The above research indicates that children's MAIs increase parents' perception of injury risk and, thus, make them more willing to engage in preventative behavior. However, lack of longitudinal data makes it difficult to determine how long this state of heightened awareness lasts, if it changes over time and whether and when it peaks (immediately after or weeks later). This knowledge could inform timing of injury prevention interventions within the health care system. If perceived risk of recurrence is highest the day of injury, then evidence would favor deploying interventions during the visit to the Emergency Department (ED). However, if perceived risk of re-injury increases in the weeks following a MAI, then evidence would favor interventions deployed during follow-up visits (e.g., when removing a cast).

This paper is aimed to determine if parental perceived risk of re-injury changes over time. Based on psychological research on probability learning (Jarvik, 1951; Barron and Leider, 2010; Hertwig et al., 2004), we hypothesize that parents' perceived risk of re-injury increases in the following weeks, rather than decrease or remain stable. From the perspective of an individual parent, MAIs are rare events. A child may be a passenger in a car, a pedestrian, play in a playground, or practice a sport daily for months or years, before sustaining an injury related to these activities. These experiences would suggest to parents that it would take several exposures to the activity before another injury occurs. As time post-MAI passes without incident, parents may begin to believe their child is "running out of luck" and re-injury is more likely. This way of "guesstimating" the probability of events based on experience has been termed *gambler's fallacy* (Jarvik, 1951), and it occurs when people learn about the likelihood of chance events through personal experience, rather than statistics (Barron and Leider, 2010; Farmer et al., 2017). We propose the gambler's fallacy is likely to emerge in the context of unintentional child injuries, because parents: (a) typically do not have access to information on rates or probabilities of each type of injury; (b) are known to rely on their experience to make judgments of injury risk (Glik et al., 1991; Morrongiello et al., 2009; Miron-Shatz et al., 2010; Lee and Rowe, 1994); and (c) regard unintentional injuries as resulting from bad luck (Morrongiello and Hogg, 2004).

2. Methods

2.1. Study design and setting

The research reported here uses a subsample of the Burden of Injury Study (BOI) (Schneeberg et al., 2016); a one-year longitudinal investigation into Health Related Quality of Life and post-traumatic stress in a cohort of children and their caregivers, who presented to a level-1 trauma center with an injury. Families participating in the BOI study were asked to complete a baseline and three follow-up questionnaires. Baseline questionnaire included demographic information, whether the child has sustained other MAIs in the previous year, circumstances surrounding the injury (e.g., perceived control over the incident), such as time of the day, activity (e.g., cycling), and spatial location (e.g., road), children's Health-Related Quality of Life (HRQL), Post-Traumatic Stress Disorder (PTSD), and parents' judgment of the likelihood of re-injury. Follow-up questionnaires encompassed HRQL, PTSD, parents' perceived control over the incident, and their judgment of the likelihood of re-injury. At each time point, parents were asked to report the date they completed the questionnaire. Additionally, survey data were linked with hospital records (e.g., triage assessment). The BOI collected data from February 2011 through December 2013 and was approved by the University of British Columbia/Children's and Women's Health Centre of British Columbia Research Ethics Board (details elsewhere (Schneeberg et al., 2016)).

2.2. Recruitment and follow-up procedures

Parents were recruited in the ED or hospital wards. In the ED, after hospital records confirmed an injury complaint, research assistants would approach parents, obtain consent, and give them baseline questionnaires. In hospital wards, clinical staff were consulted before approaching participants. Parents of hospitalized children were over-sampled to ensure representation of more severe injuries. Parents were asked to complete follow-up questionnaires one, four, and 12 months after baseline. They were sent follow-up packages, even if they had not returned the previous one. Participants were also given the option to complete the survey online, and received a $2-dollar gift card for each questionnaire they completed.

2.3. Participants

Participants were parents of injured children, fluent in English, and residents of British Columbia, Canada. Grandparents and other relatives were excluded; parents of children were excluded if injury was intentional or if their child had a disability or a chronic health problem before the injury. As shown in Fig. 1, out of the 256 participants included in the BOI study, three did not meet inclusion criteria, two provided inaccurate injury dates, 16 had a date missing, and 49 had one or more variables missing. The final dataset comprised 186 cases.

Since questionnaire items pertaining the present study (i.e., risk perception questions) were introduced 10 months after data collection for the BOI started, it is important to clarify how this sample of 186 parents was achieved. Participants who were recruited before the new questionnaire items were introduced, answered risk perception questions at either first, second or third follow-up, but not at baseline. Those recruited after the questionnaire was changed, answered risk

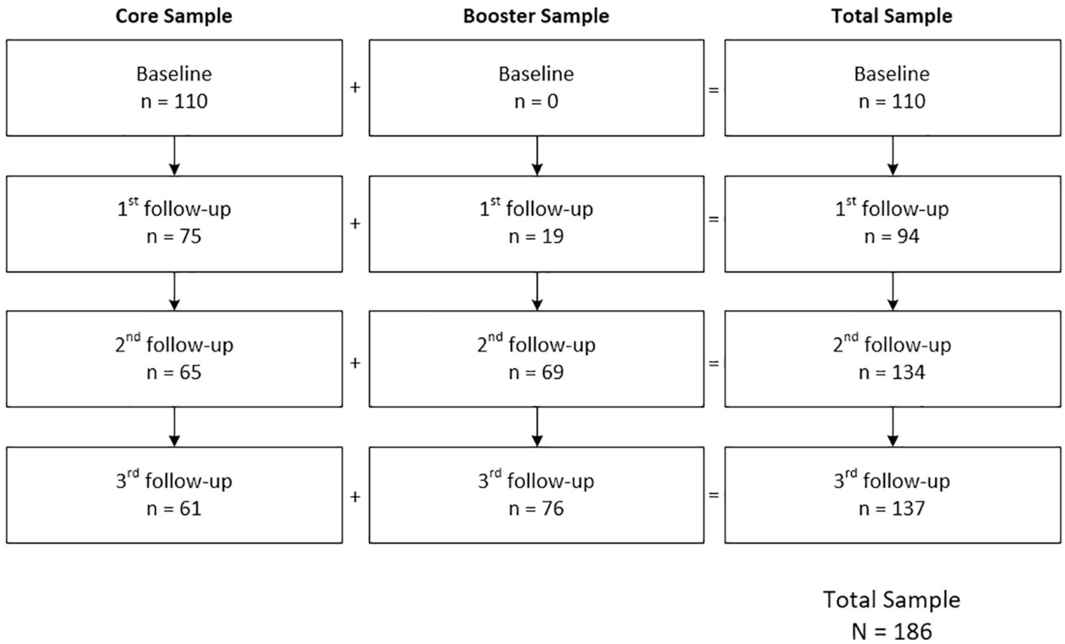

Fig. 2. Core and booster sample distribution by time point. Study conducted at the British Columbia Children's Hospital, between February 2011 and December 2013.

Table 1
Sample characteristics (n = 186).

Variable	Number (%)/mean (SD)
Parent gender	
Fathers	53 (28.5)
Mothers	133 (71.5)
Socioeconomic status[a]	
1st Quintile	24 (12.9)
2nd Quintile	24 (12.9)
3rd Quintile	37 (19.9)
4th Quintile	32 (17.2)
5th Quintile	69 (37.1)
Child gender	
Girls	69 (37)
Boys	117 (63)
Child age	8.2 (4.6)
PaedCTAS	
1 and 2	50 (26.9)
3	40 (21.5)
4 and 5	96 (51.6)
Hospitalized[b]	
Yes	59 (31.7)
No	127 (68.3)

[a] Approximated with the neighborhood income quintile (Statistics Canada, nd).
[b] As indicated in hospital records. Study conducted at the British Columbia Children's Hospital, between February 2011 and December 2013. PaedCTAS = Paediatric Canadian Triage and Acuity Score; a 5-level ordinal scale (1 = critical condition; 5 = non-urgent), based on a physiological assessment of the child by a specially trained triage nurse.

perception questions at baseline and all follow-ups. This latter group constitutes the "core" sample of the study. Following recommended practice for statistical analysis of longitudinal data (Wu, 2010; Hox, 2010), we also included data from participants who were recruited before questionnaire update and thus answered risk perception questions at follow-ups but not at baseline. This group constitutes the "booster" sample. See Fig. 2 for a summary of the core and the booster sample distribution by time point, and Table 1 for sample characteristics.

Injury details are available in the BOI paper (Schneeberg et al., 2016). The most common injury diagnoses were minor external injuries (37%), and upper and lower extremity fractures (36%). Most injuries occurred during leisure/entertainment activities (32%) and sports/exercise at school, club, or gym (31%).

2.4. *Measures*

Using a 7-point Likert scale (from "very low" to "very high"), parents' perceived risk of injury recurrence was elicited with two questions: (1) "How much of a chance do you think the event could happen to your child again?" and (2), "In general, the chance of your child being injured again in the future is:" These items were made to elicit likelihood "guesstimates" instead or judgments of risk, because: (a) the gambler's fallacy refers specifically to people's expectations of event occurrence irrespective of its valence (positive or negative); and (b) it was important to separate the likelihood "guesstimates" from the valence ascribed to the injury, because some parents do not necessarily regard all child injuries as undesirable, but rather as a normal part of growth and development (Morrongiello and Dawber, 2000). Additionally, the items refer specifically to the parent's child rather than children generally, to circumvent their *optimism bias* (i.e., a tendency to believe one's child is less susceptible to injuries than other children) (Rosales and Allen, 2012).

Time since injury was measured in days, recoded as months, and used in analysis as a continuous variable. Time-invariant covariates included: (1) child's and parent's gender, as mothers tend to believe boys as more likely to sustain unintentional injuries than girls, and fathers tend to be more tolerant to injuries than mothers (Morrongiello and Dawber, 2000; Morrongiello et al., 2010; Brussoni et al., 2013); (2) child's age, because parental perception of injury risk is known to increase with age (Lam, 2001b; Garling and Garling, 1993); (3) parents reporting at baseline that the child had sustained a MAI in the previous year, which has been shown to increase perceived risk (Glik et al., 1991; Morrongiello et al., 2009); and (4) severity of the injury, because it is directly related with perceived injury risk (Morrongiello et al., 2009). The latter was approximated using the Paediatric Canadian Triage and Acuity Score (PaedCTAS; a 5-level ordinal scale where 1 = critical condition; 5 = non-urgent) (Gravel et al., 2012); scores are based on a physiological assessment of the child by a specially trained triage nurse (Gouin et al., 2005). Forward difference contrast coding was used to compare adjacent scores (3 versus 4, 4 versus 5, and so on) (UCLA:

Table 2
Longitudinal analysis of parents' perceived risk of the same and of any injury recurring (n = 186).

Model and covariates	Parameter estimates		Adjusted *P* value
	Crude (CI)[a]	Adjusted (CI)	
Model 1: Perceived risk of the same injury repeating			
Time	0.01 (−0.03 to 0.02)	0.01 (−0.04 to 0.02)	*P* = .623
PaedCTAS 1 and 2 versus 3	−0.48 (−1.13 to 0.10)	−0.56 (−1.17 to −0.02)	*P* = .073
PaedCTAS 3 versus 4 and 5	−0.65 (−1.23 to −0.14)	−0.59 (−1.17 to −0.06)	*P* = .032
Child is boy	0.54 (0.07 to 1.00)	0.56 (0.10 to 1.01)	*P* = .013
Model 2: Perceived risk of any injury repeating			
Time	−0.01 (−0.03 to 0.01)	0.30 (0.10 to 0.53)	*P* = .003
Slope discontinuity at first follow-up	−0.35 (−0.56 to 0.14)	−0.33 (−0.56 to − 0.13)	*P* = .002
PaedCTAS 1 and 2 versus 3	−0.61 (−1.16 to 0.01)	−0.51 (−1.08 to 0.08)	*P* = .087
PaedCTAS 3 versus 4 and 5	−0.12 (−0.73 to 0.41)	−0.14 (−0.61 to 0.33)	*P* = .605
Child had injuries 12 months before baseline	0.81 (0.31 to 1.36)	0.72 (0.21 to 1.21)	*P* = .005

CI = Confidence interval or parameter estimates. PaedCTAS = Paediatric Canadian Triage and Acuity Score; a 5-level ordinal scale (1 = critical condition; 5 = non-urgent), based on a physiological assessment of the child by a specially trained triage nurse.
[a] With the exception of time, which is the main variable of interest, all crude estimates are adjusted for time and, when applicable, discontinuity in slope. Study conducted at the British Columbia Children's Hospital, between February 2011 and December 2013.

Statistical Consulting Group, 2017). PaedCTAS has been found to adequately approximate injury severity (Yates et al., 2016).

We also considered two time-variant covariates related to perceived control, which is known to influence risk perception (Slovic, 1987): (1) perceived control over the injury incident, which was elicited with the question "How much control did you feel you had to stop the event from happening?" (measured on 7-point Likert scale); and (2) whether the parent perceived the event as a "freak accident" (e.g., getting hit by a duck while riding a rollercoaster), which was elicited with the question "Would you say this incident was a 'freak event'? (Yes/No)."

2.5. Statistical analysis

Separate analyses were conducted for each outcome variable: perceived risk of the **same** injury recurring and perceived risk of **any** injury recurring. Analysis was conducted in the lme4 package for R. Discontinuous linear mixed-effects models with random intercepts by individual and fixed slopes were used. Mixed-effects models produce valid inference from unbalanced datasets (Gardiner et al., 2009). Correlations among repeated observations were not constrained. Model building followed guidelines by Singer and Willet (2003). First, a model without covariates was fit. Second, time and a discontinuity in time were entered and tested for significance, one at a time. Finally, covariates of interest were introduced and tested one by one. In each step, deviance-based hypothesis test was used to determine significance, as it is more reliable than single parameter tests (Hox, 2010; Singer and Willet, 2003). Covariates were kept in the model until all predictors were entered. In subsequent rounds of model building, covariates that were significant in the previous rounds were entered first. Predictors with consistently non-significant effects ($P > .05$) were removed from the model, and predictors found to be multivariably significant were retained. Two separate model building procedures were followed: one for perceived risk of the same injury and one for the perceived risk of any injury.

Since PaedCTAS categories 1 and 5 were infrequent (6% and 2% respectively), they were collapsed into three categories: 1 and 2, 3, and 4 and 5. Forward difference coding (UCLA: Statistical Consulting Group, 2017) was used to compare adjacent categories (e.g., 1 and 2 versus 3, 3 versus 4 and 5). Predicted marginal means were derived from the final models using the LS Means package for R version 2.25-5.

Mechanism of missing data was investigated with the Missing Values Analysis (MVA) function of IBM SPSS Statistics 24. Patterns of missing values in outcome variables, covariates, and demographics, and circumstances of the injury (e.g., respondent was present when injury occurred) were examined. Mechanism of missing data was determined based on cross-tabulations, *t*-tests, Little's test of Missing Completely At Random (MCAR), and data collection logs. Sensitivity analysis was conducted to examine potential bias resulting from missing observations.

3. Results

3.1. Perceived risk of injury recurrence

Table 2 summarizes results from the two models: parents' perceived risk of the same (Model 1) and parents' perceived risk of any injury recurring (Model 2). Contrary to our hypothesis the perceived risk of the *same injury* recurring did not change over time. Furthermore, it was lower for more severe injuries (as indicated by PaedCTAS) and higher if the injured child was a boy. Perceived risk of the *same injury* recurring was not associated with child age, parent gender, having a child sustain a MAI within a year before baseline, perceived control, or the belief that the incident was a freak accident.

Perceived risk of *any injury* recurring changed over time in a discontinuous way: increased between baseline and the first follow-up and then decreased thereafter. Additionally, the overall trajectory was lower for severe injuries (PaedCTAS 1 and 2) and higher if the child had an injury within a year before baseline. Perceived risk of *any injury* recurring was not associated with child age, child gender, parent gender, perceived control, or the belief that the incident was a freak accident.

Fig. 3 describes changes in parents' perceived risk of any injury recurring, separately for parents whose child sustained a MAI within a year before baseline versus parents whose child did not. The discontinuous change in perceived risk of any injury was the same for both groups: an upward trend from baseline to first follow-up (around six weeks). The only difference is that the overall perceived risk was higher for the former group. The severity of the injury (not shown in the figure) had the opposite effect: the discontinuous trajectory was identical across different degrees of injury severity, but was lower overall for the critical ones (PaedCTAS 1).

3.2. Sensitivity analyses

To examine if the increase in perceived risk of any injury recurring at first follow-up was an artifact of missing observations and changes in the sample across time points, a third model was fitted. As Model 1a in Table 3 shows, the increase is still present among participants who had valid observations at first follow-up (n = 94). A final model of perceived risk of any injury recurring was fitted, so as to examine if the

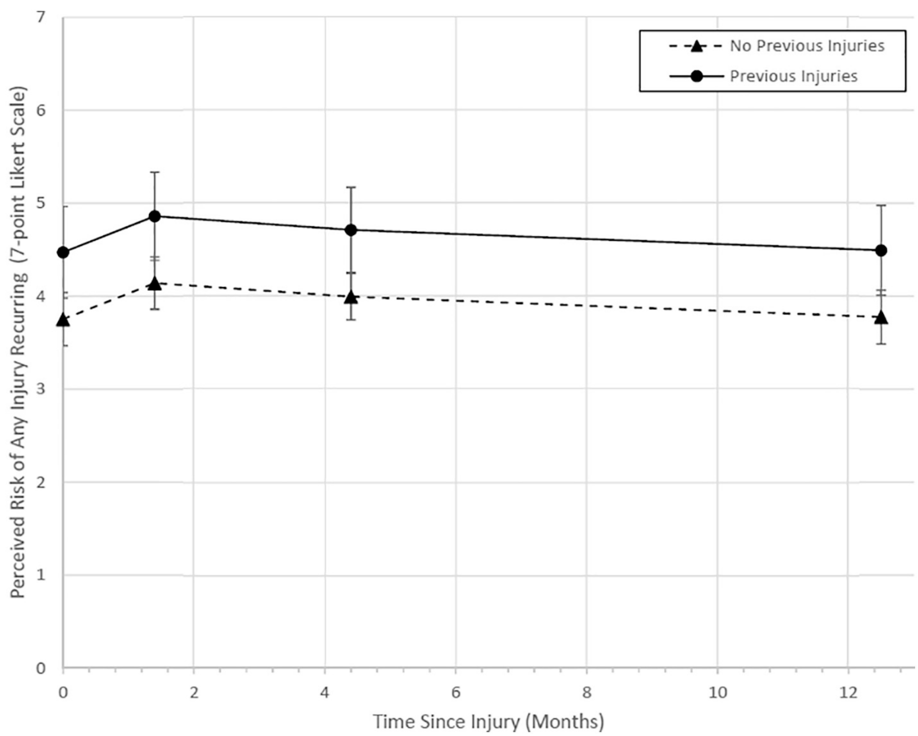

Fig. 3. Predicted marginal means of perceived risk of any injury recurring, in the year following medically-attended injury to their child. Parents who reported their child had sustained an injury within the previous year (solid line), reported an overall higher perceived risk of re-injury compared with parents who did not (dashed line). For both groups, the perceived risk of re-injury peaked approximately six weeks after injury. This confirms our hypothesis that, shortly after experiencing a MAI to their child, parents generally do not expect another injury to occur. A few weeks later, however, parents believe re-injury is more likely. The subsequent downward trend may reflect that, as months pass without incident parents become desensitized to the possibility of re-injury. Study conducted at the British Columbia Children's Hospital, between February 2011 and December 2013.

effect also persists when the sample includes those participants who skipped the "freak accident" question. As Model 1b in Table 3 shows, the effect holds.

4. Discussion

We examined whether parents' perception of re-injury risk changed during the year after their child sustained a MAI. We predicted that the perceived risk of injury repeating would be higher months later than the day it happened. Results are partially inconsistent with our prediction, but still address our research objective.

Parents' perceived risk of the *same* injury recurring remained stable throughout the year. Moreover, it was lower if the child was a girl or had sustained moderately severe to critical injuries (PaedCTAS 1, 2, or 3). This suggest that parents attempted to use predictors of risk (e.g., child gender, severity of the injury) to "guesstimate" the likelihood of recurrence. Parents' perceived risk of the *same* injury recurring was not associated with having injuries sustained a year before baseline. Since the gambler's fallacy emerges when people base their "guesstimates" on previous occurrences of the event (Barron and Leider, 2010), this could explain why the perceived risk of the *same* injury did not follow the predicted trajectory. Each of these results is consistent with research showing that: (a) parents expect boys to get more injuries than girls (Morrongiello and Hogg, 2004; Morrongiello and Corbett, 2008) and (b), when making likelihood judgments based on experience, people tend to see rare events (e.g., moderately severe to critical injuries) as less likely to occur than more frequent ones (e.g., less urgent injuries) (Ungemach et al., 2009; Costello et al., 2018).

Table 3
Sensitivity analyses.

Model and covariates	Parameter estimates	P value
Model 1a: Perceived risk of any injury repeating (n = 94)[a]		
Time	0.22 (0.00 to 0.46)	*P* = .627
Slope discontinuity at first follow-up	−0.24 (−0.49 to 0.01)[b]	*P* = .049
Model 1b: Perceived risk of any injury repeating (n = 205)[c]		
Time	0.31(−0.13 to 0.50)	*P* = .438
Slope discontinuity at first follow-up	−0.33 (−0.53 to −0.14)[b]	*P* < 001

CI = Confidence interval or parameter estimates.
[a] This model was fitted in a subsample comprising only participants' valid observations at the 1st follow-up.
[b] Adjusted for time.
[c] This model was fitted in a sample that included those participants that skipped the question: "Would you say this incident was a 'freak event'?" Study conducted at the British Columbia Children's Hospital, between February 2011 and December 2013.

The perceived risk of *any* injury recurring exhibited an upward trend consistent with the gambler's fallacy, but only between baseline and first follow-up. Furthermore, it changed direction and decreased slowly thereafter. The downward trend after first follow-up may reflect that, as time passes without incident, the effect of experiencing an injury to one's child wears off, and parents slowly become desensitized to the possibility of re-injury. We also found that the perceived risk of *any* injury recurring was higher overall if the child had sustained injuries in the year before baseline, which indicates parents relied on previous injury incidents to "guesstimate" recurrence of any injury. This suggests that, irrespective of the discontinuous change over time, experiencing a MAI increased general perceived risk for as long as 12 months (previous reports indicated eight (Glik et al., 1991; Morrongiello et al., 2009)). These results are consistent with findings from laboratory experiments on probability learning, where agents (human participants or computers) have to rely on previous events to judge the probability of a frequent, small gain versus a rare, big loss (e.g., earning $1 dollar versus losing $20 dollars) (Plonsky et al., 2015). Finally, the perceived risk of any injury was overall lower for more severe injuries, irrespective of the discontinuous change over time. This may reflect the fact that more serious injuries are less frequent and therefore less likely to repeat, which, in turn, may affect parents' overall "guestimate" of the likelihood of any future injury. This hypothesis should be explored further.

Findings from our study should be interpreted in light of the following limitations: first, mothers and parents from higher socioeconomic status were overrepresented in the sample. This may influence overall perceived risk in opposite directions: women tend to report higher perceived risk than men (Harris et al., 2006). However, affluent parents may have provided lower ratings of injury risk because they tend to live in neighborhoods with lower traffic or have more resources to engage in prevention (e.g., supervising children, purchasing safety equipment). This limitation, however, does not affect our main results, as the focus of our study was not to estimate the overall mean perceived risk, but to examine how it changes over time. Second, there is some uncertainty regarding the increased (and subsequent) decrease in perceived risk of any injury, as indicated by the overlapping confidence intervals of predicted marginal means at baseline and follow-ups. Third, the high number of missing observations could have artificially produced the gambler's fallacy effect. For example, participants with missing values at first follow-up may have, on average, low perceived risk of any injury recurring and their absence may have artificially increased the overall mean in this time point. However, this is unlikely. If this were the case, we should have also seen a similar effect in perceived risk of the same injury repeating, since both analyses use the same sample and both outcomes are correlated with each other. Furthermore, the effect holds when the analysis is conducted on the subsample of participants with completed first follow-up (n = 94). Finally, our analyses excluded parents who did not answer the “freak accident” question. These individuals may be have been unfamiliar with the expression and, thus, demographically different (i.e., English is not their first language). This limitation, however, does not affect the gambler's fallacy finding because: (1) believing the injury event was a freak accident was not associated with the perceived risk of any injury recurring, and (2) the fallacy effect holds when the analysis is conducted on a sample that includes participants with missing values in the “freak accident” question.

To our knowledge, this is the first study to use probability learning to derive testable predictions regarding changes in parents' perceived risk of re-injury in the year following a MAI. Sensitivity analysis indicated that the gambler's fallacy effect remained despite missing observations, and our results are consistent with previous studies on injury prevention (Glik et al., 1991; Morrongiello et al., 2009; Morrongiello and Hogg, 2004; Morrongiello and Corbett, 2008) and current probability learning theory (Barron and Leider, 2010; Miron-Shatz et al., 2010; Plonsky et al., 2015). This increases confidence in our findings. Importantly, our results lend credence to a novel hypothesis: timing may be a factor influencing the effectiveness of behavior change interventions to prevent pediatric re-injury.

5. Conclusions

ED visits for a child injury have been proposed as an opportunity for effective pediatric injury prevention education (Zonfrillo et al., 2014), because they are hypothesized to represent awareness raising moments and calls to action (Melzer-lange et al., 2013). However, no difference has been found in studies comparing injury prevention interventions on parents of injured children versus parents visiting for other reasons (Gielen et al., 2007; Gittelman et al., 2012). Moreover, studies examining interventions in the ED have produced mixed results (Sullivan et al., 2017; Gittelman et al., 2006; Johnston et al., 2002; Cushman et al., 1991). Our study provides a plausible explanation for this puzzling finding: since the increased perception of re-injury risk may not be fully realized until weeks later, ED interventions (which typically happen the day of the injury) may not be timed to take full advantage of the increased perceived risk of re-injury associated with a MAI. Future research should compare the effectiveness of two hospital-based injury prevention interventions that differ only in timing: during the ED visit versus four to six weeks later.

Funding source

This study was funded by the Canadian Institutes of Health Research, Grant #TIR-104028. The funding agreement ensured the authors' independence in designing the study, interpreting the data, writing, and publishing the report. Salary support for Drs. Brussoni and Mâsse was provided by the British Columbia Children's Hospital Research Institute. Dr. Brussoni also received salary support from the Michael Smith Foundation for Health Research.

Financial disclosure

The authors have no financial relationships relevant to this article to disclose.

Conflicts of interest

The authors have no conflicts of interest relevant to this article to disclose.

Acknowledgements

We thank Erica Zallen MD, for her work in data collection and Rollin Brant PhD, for his advice on statistical analysis, handling missing data, and using discontinuous mixed-effects models.

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