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Validation of Parent-Reported Injuries to Their Children

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Abstract

Objective—Injury is a leading cause of emergency department visits, disability, and death in children. This study examined the sensitivity and specificity of parental report of children's specific injuries.

Methods—A prospective validation study was conducted in 3 urban pediatric emergency departments from August 2010 to July 2011. Parents of injured children completed a survey at 2-weeks following the emergency department visit, and their responses were compared to injury data that were abstracted from medical records.

Results—Parent surveys were completed for 516 injured children. Sensitivities were 0.75 for all fractures and 0.88 for extremity and skull fractures. Internal organ injuries were generally less accurately reported by parents than fractures. Specificity estimates all exceeded 0.95.

Conclusions—This telephone-administered and mailed self-administered survey enabled parents to accurately report specific head and extremity injuries.

Practical Applications—This survey may be a useful tool for pediatric injury surveillance activities.

Keywords

child; adolescent; cross-sectional study; survey; injury prevention

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Author Contributions

MRZ, RKM, DRD, and AEC contributed to conception and design; contributed to acquisition, analysis, and interpretation of data; drafted, critically revised, and gave final approval of the manuscript.

Declaration of Conflicting Interests

The author(s) declared no potential conflicts of interest with respect to the research, authorship, and/or publication of this article.

Background

Unintentional injury continues to be a leading cause of death and acquired disability for children and adolescents worldwide.¹ In 2009–2010, an estimated 35% of US emergency department (ED) visits for children 18 years and younger were due to injuries.² Assessing the frequency and severity of specific injuries for which children and adolescents seek emergency care may provide useful information for injury prevention and health care planning efforts. While detailed review of medical records is typically required to identify injuries and classify severity, this process is time intensive and often cost prohibitive, particularly for population-based and multisite data collection efforts. Several population-based surveys of adults and parents exist (eg, the Center for Disease Control and Prevention's various national health care surveys)³ that could be leveraged to provide a population-based means of assessing the frequency of specific types of injuries to children and adolescents via parent report for little to no additional cost. Utilizing data previously collected from a multisite validation study of a parent-reported survey of child injuries,⁴ we examined the sensitivity and specificity of parent report of specific injuries experienced by children.

Methods

Study Design and Sample

Data were collected as part of a prospective multisite validation study in 3 geographically diverse urban pediatric EDs between August 2010 and July 2011.⁴ Briefly, children who presented to a participating ED after an injury were assessed for eligibility. Eligible children were younger than 18 years of age, had an English-speaking parent or legal guardian, and had a confirmed injury with an Abbreviated Injury Scale severity score ≥ 2 .⁵ All patients with any type of facial fracture or concussion were also included. Minor injuries (eg, skin contusions, small lacerations) and suspected child abuse were excluded. All children presenting to the EDs who were passengers in motor vehicle crashes were also eligible, regardless of whether they had a confirmed injury. There were 2 reasons for including these patients: the primary study sought to examine parent report of child injuries following motor vehicle crashes, and we wanted to capture some noninjured patients to determine if parents reported injuries when one did not exist. The original study validated parent report of moderate and greater severity injuries by body region (eg, upper extremity fracture) but not by specific type of injury (eg, forearm fracture).⁴ Children were recruited during the working hours of research staff in the ED (generally 8 AM to midnight, daily). This study was approved by each participating site's institutional review board.

Sources of Injury Data

After providing informed consent, parents were randomly assigned to receive either a self-administered paper survey by mail or a telephone interview. For parents assigned to the self-administered mode, up to 2 surveys were mailed with a self-addressed stamped envelope. For parents allocated to the telephone mode, up to 6 telephone contact attempts were made, varying the day of the week and the time of day when calls were placed. Parents who did not respond to the survey via the mode initially assigned were switched to the alternate mode.

Development and validation of the survey instrument have been described.⁴ Basic demographic information was collected, including child's age and sex and parent's age, sex, race/ethnicity, and highest level of education completed. The survey queried parents about specific injuries that their children may have experienced (eg, concussion, pneumothorax, solid organ injury, femur fracture), which allowed us to determine the severity for each parent-reported injury. The survey instrument is available upon request.

After parents completed the survey, their children's ED and inpatient electronic medical records were abstracted via a standardized protocol. Abstraction data were collected with REDCap (Research Electronic Data Capture), hosted at the coordinating site.⁶ A single investigator (M.R.Z.) trained and certified in Abbreviated Injury Scale coding reviewed the abstracted data and scaled all injuries using the most recent version of the scale's manual.⁵ Each injury documented in the medical record was assigned a unique Abbreviated Injury Scale code based on its anatomy, body region (head, face, neck/back/spine, thorax, abdomen, upper extremity, and lower extremity), and severity. All injuries with an Abbreviated Injury Scale score ≥ 2 , reflecting moderate or greater severity injuries, were included in these analyses. Additionally, facial fractures and concussion were considered moderate severity injuries.

Statistical Analysis

Frequencies and percentages were used to summarize categorical variables, and *P* values were calculated with Pearson chi-square tests. Sensitivity (the probability that parents reported a specific medically documented injury) and specificity (the probability that parents did not report a specific injury when there was no medical record documentation of an injury) were estimated with exact 95% confidence intervals. Sensitivity and specificity were calculated for 15 injuries: concussion, skull fracture, facial fracture, cranial hemorrhage, pneumothorax, lung contusion, rib fracture, spleen injury, liver injury, vertebral fracture, clavicle fracture, humerus fracture, forearm fracture, lower leg fracture, and femur fracture. For injury-specific calculations of specificity, children classified as "uninjured" according to the medical record included those who may have experienced a different injury. All statistical analyses were conducted with SAS 9.2 software (SAS Institute Inc, Cary, North Carolina).

Results

Parent surveys were completed for a total of 516 children. The majority of children were boys (59.5%), and the mean age of participating children was 8.5 ± 5.3 years. The majority of children (68.9%) were discharged home following their evaluation in the ED.

The most frequently documented injuries were concussions and forearm fractures (Table 1). The sensitivity and specificity for each injury are also shown in Table 1. Sensitivity estimates ranged between 0.96 (for femur and facial fractures) and 0.22 (for lung contusions). The sensitivity for all fractures was 0.75. Internal organ injuries, such as cranial hemorrhage (sensitivity = 0.69), pneumothorax (sensitivity = 0.43), and lung contusions (sensitivity = 0.22), were generally less accurately reported by parents than fractures. Specificity estimates all exceeded 0.95 (Table 1). All parent-reported clavicle

fractures, pneumothoraces, and lung contusions were confirmed in the medical record. There were a number of specific injuries for which parents reported an injury that was not documented in the medical record. Specifically, 50% of rib fractures, 41% of facial fractures, 40% of vertebral fractures, 27% of cranial hemorrhages, and 21% of concussions reported by parents were not documented in the medical record.

When injury-specific sensitivities and specificities were compared for patients with only 1 injury versus 2 or more injuries, there were no substantial differences in test characteristics.

Discussion

We previously demonstrated that parents can accurately report specific body regions with moderate and greater severity injuries to their children. The current study extends our previous findings to evaluate the accuracy of parent report at the level of specific injuries. Our current results indicate that parents can report specific extremity fractures with high sensitivity and specificity. Sensitivity was poorer for injuries that are less likely to require a specific intervention (eg, a surgical procedure, casting) or are not plainly visible, which may affect parent recall. As suggested in our first study, many of these children may have had multitrauma with other more serious injuries that required memorable medical attention, and we have since made modifications to the survey to improve the sensitivity for these injuries. Conversely, there were several injuries—including concussions; facial, vertebral, and rib fractures; and cranial hemorrhages—reported by parents but not documented in the medical record, suggesting that parents may overreport such injuries via survey. It is not clear whether this reflects poor wording or response choices in the survey, lack of parent comprehension of physician communication about the child's injury, or limitations of medical record documentation—although with the possible exception of concussions, these injuries would all be detected by radiographic imaging and well documented. Further research is needed to understand the etiology of parent overreport of injuries to determine if it can be mitigated through further revisions to the survey instrument.

A notable limitation of this study is the relatively small sample sizes for several of the specific injuries of interest, which resulted in wide confidence intervals around our point estimates of sensitivity and specificity. Additional studies with larger sample sizes are required to more definitively determine parents' ability to report these injuries via survey.

Conclusion

Unintentional injury continues to be a leading cause of death and acquired disability for children and adolescents worldwide, requiring continued injury prevention and health care planning efforts. Utilizing existing population-based surveys of adults and parents may provide a unique opportunity to minimize the costs associated with detailed medical record reviews, which are typically used to obtain information about child injuries. These analyses provide evidence that a parent-reported data collection instrument can be utilized to obtain valid information about specific injuries experienced by children, without the additional costs or time required for extensive medical record reviews.

Parents can identify specific head and extremity injuries with a high level of accuracy, but they have limited ability to identify internal organ injuries. This tool can be successfully used as a screening or surveillance instrument for clinical or injury prevention research for these injuries.

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Table 1

Validity of Parent-Reported Injuries Compared to Medical Record Data.

Injury	Total	In Medical Record	Sensitivity (95% CI)	Not in Medical Record	Specificity (95% CI)
Concussion	99	78	0.82 (0.73, 0.89)	21	0.95 (0.92, 0.97)
Forearm fracture	70	66	0.93 (0.84, 0.98)	4	0.99 (0.98, 1.00)
Lower leg fracture	53	49	0.88 (0.76, 0.95)	4	0.99 (0.98, 1.00)
Skull fracture	51	46	0.88 (0.77, 0.96)	5	0.99 (0.98, 1.00)
Intracranial hemorrhage	33	24	0.69 (0.51, 0.83)	9	0.98 (0.96, 0.99)
Humerus fracture	28	24	0.92 (0.75, 0.99)	4	0.99 (0.98, 1.00)
Femur fracture	25	24	0.96 (0.80, 1.00)	1	0.99 (0.99, 1.00)
Facial fracture	39	23	0.96 (0.79, 1.00)	16	0.97 (0.95, 0.98)
Clavicle fracture	21	21	0.75 (0.55, 0.89)	N/A	N/A
Vertebral fracture	15	9	0.82 (0.48, 0.98)	6	0.99 (0.97, 1.00)
Spleen injury	7	5	0.83 (0.36, 1.00)	2	0.99 (0.96, 1.00)
Liver injury	6	5	0.71 (0.29, 0.96)	1	0.99 (0.99, 1.00)
Pneumothorax	3	3	0.43 (0.10, 0.82)	N/A	N/A
Rib fracture	6	3	1.00 (0.31, 1.00)	3	0.99 (0.98, 1.00)
Lung contusion	2	2	0.22 (0.03, 0.60)	N/A	N/A

Abbreviation: N/A, secondary to zero counts.