

METHODOLOGIC ISSUES

Comparison of two methods for assessing injuries among preschool children

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Injury Prevention 2002;8:79–82

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Background: Most studies of injuries use health services records or recall rather than prospective methods, and there is no information on how these different methods compare. This study was aimed at comparing a report (retrospective) with a diary (prospective) for recording childhood injuries.

Methods: The study included 1273 and 620 children, the retrospective and prospective subsamples, respectively, from a population based birth cohort in Pelotas, southern Brazil. The reported incidence of injuries in the preceding month were compared with those reported over month by diary (prospective study).

Results: Both methods were well accepted and 92.7% of the diaries were returned. One or more injuries per child month were reported for 20.8% (retrospective) and 48.4% (prospective) of the children. The total number of reported injuries for the 620 children were 145 (retrospective) and 715 (prospective). Using the prospective method as the gold standard, the retrospective method detected only 20.2% of all injuries. Under-reporting did not vary significantly with maternal education, but was greater (51.8%) for injuries requiring medical care than for those managed at home (18.3%; $p=0.003$).

Conclusions: The diary was well accepted and resulted in higher incidences of reported injuries than the recall method, particularly for injuries that did not require medical care. Use of this method should be promoted to provide more complete epidemiological information to guide preventive strategies.

Most studies on the incidence of injuries among children are based either on parental recall or on health service registries.^{1,2} Both sources may lead to substantial underestimation of the actual injury rates, because many injured children do not receive medical care, or due to inaccurate recall. A possible alternative is to use parents to actively monitor injuries to their children. Peterson *et al* suggested that mothers and children themselves could be used to describe and understand the circumstances associated with injury occurrence,² but their method was only used for small samples due to its qualitative nature. Kotch *et al* used a prospective diary completed by parents to record injuries for a sample of 656 children.³ Marsh and Kendrick compared six methods of having parents complete diaries on minor injuries and near misses—postal, telephone and clinic visit questionnaires, each with or without a financial incentive. Diaries delivered personally during a clinic visit had the lowest response rate (by post) but the most accurate reporting.⁴ In a further analysis they used diaries to obtain information on near misses as well as minor injuries.⁵

Although some authors compared incidences of injury resulting from different recall periods in retrospective studies,⁶ a Medline search did not produce any comparisons of retrospective and prospective methods.

In the present paper, we compare the incidence of injuries in a population based cohort of children aged 4–5 years in an urban Brazilian community, based on the data obtained by diaries filled in by the children's caretakers with the number of injuries reported by the same caretakers for the 30 days preceding the interview. Our hypothesis is that prospective data collection through diaries produces a more complete reporting of the childhood injuries than retrospective data collection through interviews.

METHODS

Pelotas is a city of 350 000 inhabitants in a relatively developed area of southern Brazil. In 1993, all 5304 children born in the

city's five maternity hospitals were examined soon after birth. Hospital deliveries account for more than 99% of all births in the city. A systematic sample of 20% of the birth cohort, and all children with low birth weight, were examined at home at the age of 12 months. We located 1363 (93.4%) of the 1460 children selected for follow up. Further details of the study are available elsewhere.⁷

Sample size calculations were aimed at detecting a 50% increase in the injury rate according to the diary, relative to the retrospective questionnaire. With alpha equal to 5% and 90% power, 603 children would be required to detect this difference, assuming an injury rate of 25% in the retrospective method.

From November 1997 to April 1998 an attempt was made to locate the 1363 children examined at the age of 12 months (of which 93% were found). For this study, a systematic sample of 681 children was selected from those seen at 12 months of age. It was not possible to enroll 61 children, so that the study sample had 620 children. Their median age was then 54.3 months. Seven trained interviewers used standardized, pre-tested questionnaires to collect information from the child's caretaker on the history of injuries in the previous 30 days. An ethnographic study preceding the main survey helped identify local terms to define injuries. When an injury was reported, information was collected on type, location, circumstances in which it occurred, and care seeking practices. Injuries were classified according to the 10th revision of the *International Classification of Diseases*, and included codes V01–V99, W01–W80, W86, X01–X32, X40–X49.⁸ The caretakers were then asked to keep a diary recording all injuries involving the child for 30 days after the interview, and received detailed instructions. This diary was printed on cardboard and was accompanied by a set of instructions with examples. The form contained the same variables as in the retrospective questionnaire.

Quality control measures included revisits to 10% of the families to check the repeatability of key questions, same day

Table 1 Characteristics of the original cohort seen in 1993 (5304 children), the 1997 follow up (1273 children), and the study sample (620 children); results are number (%)

	Original cohort	1997 Follow up	Retrospective and prospective studies
Sex	(n=5290)	(n=1273)	(n=620)
Boys	2603 (49.2)	669 (52.6)	291 (46.9)
Girls	2687 (50.8)	604 (47.4)	329 (53.1)*
Birth weight (g)	(n=5304)	(n=1264)	(n=615)
≥2500	4779 (90.1)	1138 (90.0)	553 (89.9)
<2500	525 (9.9)	126 (10.0)†	62 (10.1)†
Maternal schooling (years)	(n=5301)	(n=1267)	(n=617)
None	137 (2.6)	30 (2.4)	14 (2.3)
1-4	1359 (25.6)	322 (25.4)	145 (23.4)
5-8	2448 (46.2)	592 (46.7)	303 (48.9)
≥9	1357 (26.6)	323 (25.5)	155 (25.0)
Family income (minimum wages)‡	(n=5304)	(n=1248)	(n=606)
≤1	984 (18.6)	215 (17.2)	102 (16.5)
1-3.0	2279 (43.0)	407 (32.6)	202 (32.6)
3.1-6.0	1218 (23.0)	343 (27.5)	159 (25.6)
6.1-10	437 (8.2)	138 (11.1)	76 (12.3)
>10	386 (7.3)	145 (11.6)	67 (11.1)

*p<0.001.

†Weighted results, due to oversampling of low birthweight children; ‡in 1997 a minimum wage was worth \$107.5.

revision of all completed questionnaires, double data entry, range, and consistency checks.

Data analyses included frequency distributions and χ^2 test to compare proportions. A sensitivity-like ratio was calculated by dividing the number of injuries reported retrospectively with the number recorded in the diary. This ratio is based on the assumption that an equal number of injuries would be expected in the month preceding the initial survey as in the subsequent (diary) month. An added assumption is that the diary was the “gold standard” providing more information than the retrospective method. In all analyses the different probabilities of selection were taken into account by giving suitable weights for each child. The analyses were done using Epi-Info v.6.04⁹ and SPSS for Windows.¹⁰

RESULTS

Table 1 shows the characteristics of the birth cohort and of the study samples that were compared. The three groups were similar in terms of sex, birth weight, maternal schooling, and family income.

Using the retrospective method, 115 children (18.5%) suffered one injury, 13 (2.1%) two, and one (0.2%) three or more. Using the prospective method, a much higher number of injured children was reported: 141 children (22.7%) with one injury, 85 (13.7%) with two, and 74 (12.0%) with three or more. This difference is highly significant ($\chi^2 = 98.4$; p<0.001); see table 2.

Table 2 shows reported injuries by mechanism. According to both methods, falls were the most frequent, followed by

Table 2 Frequency and characteristics of injury events according to the retrospective and prospective methods; results are number (%)

Variable	Retrospective study	Prospective study	Ratio between retrospective and prospective results
Number of injuries*			
None	491 (79.2)	320 (51.6)	-
1	115 (18.5)	141 (22.7)	-
2	13 (2.1)	85 (13.7)	-
≥3	1 (0.2)	74 (12.0)	-
Total number of children	620 (100.0)	620 (100.0)	
Injury mechanism†			
Falls	102 (70.3)	253 (84.3)**	0.40
Collision with object	19 (13.0)	66 (22.0)	0.29
Cutting objects	9 (6.2)	67 (22.3)	0.13
Burns	4 (2.8)	17 (5.6)	0.24
Animal bites	3 (2.1)	17 (5.6)	0.18
Other	16 (11.0)	61 (20.3)	0.26
Total number of injuries	145	715	
Type of injury‡			
Bruises/abrasions	67(46.2)	206 (68.7)**	0.33
Cuts	28(19.3)	67 (22.3)**	0.42
Haematomas/concussions	29 (20.0)	87 (29.0)***	0.33
Burns	4 (2.1)	17 (5.6)	0.24
Others	11 (7.6)	41 (13.6)	0.27
Total number of injuries	145	715	

Percentages may exceed 100% since some injury events were due to more than one mechanism or lead to more than one type of injury.

*Using as the denominator the number of children studied; $\chi^2 = 98.36$, p<0.001.

†Using as the denominator the total number of injury events reported.

p<0.001; *p=0.01.

collisions with objects. However, the prospective method was more likely to yield reports of injuries by cutting objects and of contusions. In the retrospective study, most reported cuts were caused by falls or by hitting a blunt object. Bruises/abrasions, cuts, and haematomas were the most common injury according to both methods.

Table 3 shows a comparison of the number of injuries by the type of management and by maternal education. The last column shows the ratio between the results of the two methods. For every 100 children reported to have been injured using the diary, only 43 were reported retrospectively; and for every 100 injury episodes, 20.2 were reported. Reporting did not vary according to maternal education, but injuries requiring medical care were most often reported. There were no significant differences between the two methods regarding who was looking after the child or place of the injury.

DISCUSSION

Several methods have been employed for investigating injuries in childhood, including health record reviews and surveillance in emergency departments, etc, and population based studies, both retrospective and prospective.

Health service based studies may be affected by under-registration and lack of consistency in recording clinical findings or by variability in care seeking patterns due to the severity of the injury, social class, distance from services, and type of payment required. Retrospective population based studies, on the other hand, may be affected by poor recall.

If adequately prepared and culturally acceptable, diaries are believed to provide better information than retrospective methods providing that there is good compliance.¹¹ The literature review did not yield any studies comparing prospective and retrospective methods. If parents can be used as reliable observers, prospective information, by improving the report on minor injuries, can make a important contribution in the understanding of child injury epidemiology and to the design of preventive strategies.⁵ In the present study, there was a high compliance with the use of the diary. We attribute this to the careful explanation of the diary when it was delivered and also to its collection at home, when it was verified with the mother.

The most important limitation of this study is that the comparison made refers to different periods of time. Although the expected number of injuries is the same for both periods of observation (before and after interview), the observed number of injuries is subject to random variation, which could explain part of the differences found.

To estimate under-reporting in the retrospective information, it was necessary to use the prospective results as the "gold standard", even though under-reporting may also occur with diaries. The magnitude of under-reporting is evident

Key points

- Brazilian mothers were willing and able to complete a diary recording injuries in their children over a one month period.
- The diaries resulted in five times as many accidents being reported than a retrospective questionnaire applied to the same mothers.
- Compared with the diary, the retrospective questionnaire was less likely to omit accidents requiring medical care.
- Diaries should be used more often in investigations of the incidence and nature of childhood injuries.

from the fact that the prospective method led to 2.3 times more children being reported having suffered an injury than with the retrospective method, and to almost five times more injuries being detected. Low levels of schooling were not associated with under-reporting, contrary to our hypothesis that well educated mothers would give more importance to injuries happening to their children and thus recall better such events.

As expected, however, under-reporting was less likely for the more severe injuries. But it was surprising to discover that, even for these, only half as many injuries requiring medical care were reported retrospectively compared with the diary method. One possible explanation is that families, when completing the diaries, became more aware of injuries and this resulted in higher care seeking rates. Although this can explain part of the difference, it seems unlikely that such awareness would double the number of injuries actually brought to medical attention. Therefore, a large part of the difference must be due to the fact that families forget to report even more severe injuries requiring medical care. Due to the multiplicity of health care providers in the town, it was not possible to check the information against medical records.

In conclusion, families in a middle income developing country can be taught to use diaries to record child injuries. It is quite possible that the same would apply to adult injuries. Diary keeping provides much more complete information than is obtained through retrospective questionnaires. Use of diaries may, therefore, provide an improved basis for guiding policy decisions on injury prevention. They also provide information on the characteristics and circumstances of injuries that may be used for planning and evaluating such programs.⁵

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Table 3 Comparison of the number of injuries detected through the retrospective and prospective methods, stratified by type of management and by maternal education

	Retrospective Study	Prospective study	Ratio between retrospective and prospective results
Type of management			
Taken to a health provider	14	27	0.52*
Treated at home	96	522	0.18
No treatment needed	35	166	0.21
Total number of injuries	145	715	0.20
Maternal education (years)			
≥9	29	81	0.36
5-8	71	149	0.48
0-4	29	70	0.41
Children with injuries	129	300	0.43
Total number of injuries	145	715	0.20

* χ^2 test for association between type of study and type of injury management, $\chi^2=8.3$, $p<0.001$.

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REFERENCES

- 1 **Irwin CE**, Cataldo MF, Matheny AP, et al. Health consequences of behaviors: injury as a model. *Pediatrics* 1992;**90**:798–807.
- 2 **Peterson L**, Farmer J, Mori L. Process analysis of injury situations: a complement to epidemiological methods. *J Soc Issues* 1987;**43**:33–44.
- 3 **Kotch JB**, Dufort VM, Stewart P, et al. Injuries among children in home and out-of-home care. *Inj Prev* 1997;**3**:267–71.
- 4 **Marsh P**, Kendrick D. Using a diary to record near misses and minor injuries—which method of administration is best? *Inj Prev* 1999;**5**:305–9.
- 5 **Marsh P**, Kendrick D. Near miss and minor injury information—can it be used to plan and evaluate injury prevention programmes? *Accid Anal Prev* 2000;**32**:345–54.
- 6 **Mock C**, Acheampong F, Adjei S, et al. The effect of recall on estimation of incidence rates for injury in Ghana. *Int J Epidemiol* 1999;**28**:750–5.
- 7 **Victora CG**, Morris SS, Barros FC, et al. Breastfeeding and growth in Brazilian infants. *Am J Clin Nutr* 1998;**67**:452–8.
- 8 ftp.cdc.gov/pub/Health_Statistics/NCHS/Publications/ICD10.
- 9 **Dean AG**, Dean JA, Coulombier D. *Epi-Info, version 6.04a, a word processing, database, and statistics program for public health on IBM-compatible microcomputers*. Atlanta, GA: Centers for Disease Control and Prevention, July 1996.
- 10 **Norussis NJ**. *Statistical package for social sciences for Windows*. Chicago, IL: SPSS, 1993.
- 11 **Moser CA**, Kalton G. *Survey methods in social investigation*. 2nd Ed. London: Butler & Tanner, 1979.

LACUNAE

Multiple impairment

A Welsh man has been banned from driving for 18 months. The speeding, one armed, drunk driver, holding a mobile phone to his ear, jumped a red light (*The Sunday Age*, Melbourne, November 2001; contributed by Ian Scott).

Protest causes car manufacturer to change ads

The rising road toll and complaints from motoring groups has forced Alfa Romeo Australia to change its national advertising campaign. The complaints centred on the promotion of speed at a time when Victoria's road toll is the worst in a decade. The Victorian road user group, RACV, accused Alfa Romeo of irresponsibility in its "Festival of Speed" advertisements, noting that 41% of road deaths this year were related to excess speed. An Alfa spokesman said that the ads were intended to celebrate Alfa's victory in the 2001 European touring car championship. The ads were withdrawn and are to be changed to make clear that they are about motor sport and "that the only place where speed is glamorous is on the race-track". The RACV called for the development of a code of practice for car related advertising practice similar to that adopted in many European countries (*The Age*, Melbourne, December 2001; contributed by Ian Scott).

Copy cat rope scene leaves boy hung up

As millions of South Africans celebrated Youth Day on June 16, an imaginative young boy from Langa almost turned the day into one of tragedy for his family, by playing out a hanging scene he had witnessed on TV two days earlier. The SABC1 television series *Hlala Kwabafileyo*, has a huge following country-wide and audiences watched in horror at last week's episode, when the main character in the film, Baba Mhlongo, hanged himself. But little Thando Ngwevela, aged 4, who attends St Anthony pre-primary school in Langa, Cape Town, took things too literally, when he copied the hanging scene while playing alone in his backyard. According to Noyu, his mother, Thando took a small chair and placed it next to the washing line, before tying a length of the line around his neck. He then kicked the chair from beneath his feet. A distraught Noyu said she was with her friend when she heard her son's cries for help. Spotie Ngweveka, Thando's grandmother said the boy told her later that he had tried to kill himself because he had seen it on *Hlala Kwabafileyo*. In the film, viewers saw Mhlongo hang himself. But the whole episode has brought condemnation from some quarters. All that remains of the boy's ordeal are scars on the side of his neck—a grim reminder of what might have been (*City Vision*, South Africa, June 2001; contributed by Nelmarie du Toit).