ORIGINAL ARTICLE

Unspecified falls among youth: predictors of coding specificity in the emergency department

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Background: Deficiencies in emergency department (ED) charting is a common international problem. While unintentional falls account for the largest proportion of injury related ED visits by youth, insufficient charting details result in more than one third of these falls being coded as ''unspecified''. Non-specific coding compromises the utility of injury surveillance data.

Objective: To re-examine the ED charts of unspecified youth falls to determine the possibility of assigning more specific codes.

Methods: 400 ED charts for youth (aged 0–19 years) treated at four EDs in an urban Canadian health region between 1997 and 1999 and coded as ''Other or unspecified fall'' (ICD-9 E888) were randomly selected. A structured chart review was completed and a blinded nosologist recoded the cause of injury using the extracted data. Differences in coding specificity were compared with the original data, and logistic regression was undertaken to examine variables that predicted assignment of a specific E-code.

Results: A more specific code was assigned to 46% of cases initially coded as unspecified. Of these, 73% were recoded as ''Slips, trips, and stumbles'' (E885), which still lacks the specificity required for injury prevention planning; 2% of charts had no fall documented. Multivariate analysis revealed that dichotomized injury severity (adjusted odds ratio (OR) = 1.75 (95% confidence interval, 1.11 to 2.78)), arrival at the ED by ambulance (adjusted OR = 5.41 (1.07 to 27.0)), and the availability of nurse's notes or triage forms, or both, in the chart (adjusted OR = 3.75 (2.17 to 6.45)) were the strongest predictors of a more specific E-code assignment.

Conclusions: Deficiencies in both chart documentation and coding specificity contribute to the use of non-specific E-codes. More comprehensive triage coding, improved chart documentation, and alternative methods of data collection in the acute care setting are required to improve ED injury surveillance initiatives.

Injury is the leading cause of morbidity and mortality in Canadian children.[1] Among youth (aged 0 to 19 years), unintentional falls are the leading cause of injury resulting in a visit to the emergency department (ED).[1–3] ED data can be used for fall surveillance purposes; however, many jurisdictions do not have a unified and electronic ED information system for accurate data capture. When available, these data are coded according to the *International Classification of Diseases*, version 9 (ICD-9), which includes a supplemental classification system for external causes of injury (E-codes).[4] Complete and specific E-codes provide details of injury intent, mechanism, and circumstances, which can be used for injury surveillance. Previous analyses of youth falls resulting in an ED visit in an urban Canadian health region revealed that approximately one third of these falls are coded as ''Other or unspecified fall'' (ICD-9 E888).[5]

Investigators from numerous international settings have similarly noted the high prevalence of pediatric fall related injuries with unspecific E-codes.[6–12] Non-specific external cause of injury (E-) coding compromises the ability of injury surveillance to contribute to the development of targeted youth fall prevention strategies.

Others have found that factors related to the patient, the injury, and the ED visit (for example, day and time of presentation, severity of injury) are associated with more complete capture of injury information and coding specificity.[13 14] Much less is known, however, about the factors that predict coding specificity of falls in the pediatric population. The identification of characteristics that determine coding specificity has important implications for improving injury surveillance and hence for prevention programming.

If a substantial proportion of unspecified falls can be assigned a more specific E-code, this may constitute an important improvement in our understanding of the epidemiology of injuries caused by falls in the pediatric population. Moreover, the re-prioritization of fall prevention strategies may be possible if such reclassification attempts were successful. Thus the purpose of our study was to investigate the coding specificity of falls coded as E-code 888 (''Other and unspecified falls'') among youth (aged 0 to 19) seen in the ED. Using data from a retrospective chart review, the objectives of this study were first, to determine the proportion of youth falls initially coded as ''unspecified'' that become ''specified'' (that is, were given a more specific E-code) after a chart review; and second, to identify the variables that predicted whether or not a fall initially coded as ''unspecified'' could be given a more specific E-code.

METHODS

Study setting

During the study period, the Capital Health Region served a population of 870 000 (1996 census data) in Edmonton and the surrounding areas in Alberta, Canada, and a large northern Alberta referral population. This region has seven acute care hospitals serviced by full time emergency physicians, and a dedicated children's hospital in which the emergency department serves as the regional pediatric injury referral center.

Design

This retrospective chart review examined a sample of data pertaining to unspecified falls among youth identified from

Table 1 Baseline characteristics of sampled charts (n = 400)

Variable	Frequency (n = 400)	Percent
Demographics		
Age at injury (years) (mean (SD))	8.91 (5.69)	
Sex		
Male	232	58.0%
Female	167	41.8%
Missing	1	0.25%
Characteristics of the ED visit		
ED site		
A	68	17.0%
B	67	16.8%
C	152	38.0%
D	113	28.3%
Day of the week of ED visit		
Weekend (Sat–Sun)	117	29.3%
Weekday (Mon–Fri)	283	70.8%
Season of ED visit		
Summer (June, July, August)	91	22.8%
Autumn (September, October, November)	112	28.0%
Winter (December, January, February)	94	23.5%
Spring (March, April, May)	103	25.8%
Time of ED visit		
Midnight to 07:59	26	6.5%
08:00 to 15:59	148	37.0%
16:00 to 23:59	226	56.5%
Means of arrival at ED		
Ambulance	12	3.0%
Self/parent	388	97.0%
Discharge status		
Admitted to hospital	9	2.3%
Treated and discharged	381	95.3%
Missing	10	2.5%
Severity of injury*		
Severe	142	35.5%
Not severe	258	64.5%
ED charting		
Triage form in chart		
Yes	101	25.3%
No	299	74.8%
Nurse notes in chart		
Yes	221	55.3%
No	179	44.8%
Physician notes in chart		
Yes	389	97.3%
No	11	2.8%
Summary of chart documentation		
Physician notes *and* nurse notes or triage form	262	65.5%
Only physician notes	132	33.0%
Missing/incomplete data	6	1.5%

*Severe injuries were defined as an injury with any of the following characteristics: concussion or other head injury (including lacerations to the head); fracture; neck sprain/strain; requiring admission to hospital or transfer to a different hospital.
Totals may add up to more than 100% owing to rounding.
ED, emergency department.

the Ambulatory Care Classification System (ACCS) database for the health region. Between 1997 and 1999, young people aged 0 to 19 years made 20 317 visits to an ED for a fall related injury (ICD-9 E880–E886.9, E888). Approximately 35% of these visits (n = 7007) were coded as ''Other and unspecified fall'' (ICD-9 E888).

Sampling sites

The number of fall related injuries (both specified and unspecified) resulting in an ED visit varied by the seven EDs in the health region. Four of these seven EDs were purposely selected for involvement in the study. These four sites were selected because they are known to assess and treat the largest number of youth injuries (personal communication, Capital Health Information Services, 2003). Altogether, there were 15 686 fall related visits to these four EDs, and 32% (n = 5072) of these visits were for falls coded as ''Other and unspecified''.

Sampling charts for review

Using a table of random numbers, a weighted random sample was obtained from the 5072 charts for youth (aged 0 to 19 years) who visited one of the four selected EDs with an unspecified fall related injury. Weighting was based on the proportion of pediatric ED visits for a fall from each of the four sites to generate a total sample size of 400. Misclassified, duplicate, or multiple visit charts were randomly replaced until the specified number of charts was obtained from each site.

Data collection

A trained ED research nurse reviewed each patient chart to abstract information available to assign an E-code to the injury and to collect any available contextual information surrounding the incident. To maximize reliability and minimize bias, the same ED research nurse conducted the chart review at all four sites. This nurse had research and clinical experience and was familiar with the ED system, documentation, and physicians' and nurses' writing and shorthand.

A standard data collection form was used. Information collected corresponded to a minimally required dataset and included:

- Patient characteristics (age and sex);
- ED visit characteristics (ED site, date and time of ED visit, means of arrival at ED, discharge status);
- Fall and injury characteristics (injury severity[1], body region of injury, nature of injury, and a narrative description of the cause and circumstance of the injury);
- Chart characteristics (documents available in the chart that are used for coding the injury, including the triage form, nurse's notes, and physician's notes).

Repeat coding

An experienced medical record nosologist subsequently reviewed each data collection form and assigned an appropriate E-code. The nosologist was unaware of the study hypothesis and was blinded to the initial E-code on the chart.

Data analysis

A trained data entry clerk entered the data from the data collection forms into SPSS version 11.0. Fifteen percent (n = 60) of the charts were double entered to check for data entry accuracy. The outcome variable was the post-chart review E-code, specified or unspecified. The percentage of charts that were assigned a more specific E-code was computed, as was a list of the specific E-codes. Univariate analyses were undertaken to assess the relation between the outcome variable and potential predictor variables. Categorical variables are reported as counts and proportions, while continuous variables are reported as mean (SD). Differences are reported using an unadjusted odds ratio (OR) with 95% confidence intervals (CI).

Multivariable logistic regression analysis was carried out to calculate adjusted odds ratios (and 95% CI) and to determine which variables best predicted whether an ''unspecified fall'' would go on to be recoded as ''specified'' after the chart review. Independent predictor variables considered in the

[1]Severe injuries were defined as an injury with any of the following characteristics: concussion or other head injury (including lacerations to the head); fracture; neck sprain/strain; requiring admission to hospital or transfer to a different hospital.

Table 2 E-codes determined from chart review of ''other and unspecified falls''(E888)

Category	E-code	Description	n	Percent
Injuries with specified E-codes			184	46.4%
Specified falls	E884.0	Fall from playground equipment	5	1.3%
	E884.4	Fall from bed	1	0.3%
	E884.5	Fall from other furniture	3	0.8%
	E884.9	Fall from one level to another	8	2.0%
	E885	Slips, trips, and stumbles	134	33.5%
	E886.0	Falls in sports	13	3.3%
	E886.9	Other and unspecified falls on the same level from collision, pushing, or shoving by or with other person	8	2.0%
Strike or collision followed by a fall	E826.0	Pedestrian fall when struck by a pedal cyclist	1	0.3%
	E826.1	Pedal cyclist injured from fall	2	0.5%
	E848	Accident involving toboggan, collision, fell off	1	0.3%
	E917.9	Striking against or struck accidentally by objects or persons	7	1.8%
	E966	Assault (followed by a fall)	1	0.3%
No fall documented on chart (false positive rate)			7	1.8%
Other or unspecified falls	E888	Other or unspecified falls	209	52.3%
Total			400	100.0%

analysis included factors related to the patients (age and sex), the ED visit (day, time, and season of visit, means of arrival at the ED, and ED site), the injury (injury severity, discharge status), and the availability of chart documents.

Ethical considerations

Ethics approval for conducting the chart review was obtained from the Health Research Ethics Board (Panel B), University of Alberta. Administrative/operational approval was obtained from each participating ED. Only the ED research nurse (that is, the chart reviewer) had access to the patient charts. The study investigators only had access to data stripped of any patient identifying information.

RESULTS

Sample

In all, there were seven missing charts, all of which were replaced by randomly sampled charts from the database; the overall sample was 400 charts.

Baseline characteristics

The mean age of patients was approximately 9 years and 58% were male (table 1). ED visits were roughly evenly distributed throughout the days of the week, with 29% occurring on the weekend. Visits were also evenly distributed by season. Most patients (57%) visited the ED between the hours of 4:00 pm and midnight, followed by 8:00 am to 3:59 pm (37%). The great majority of patients (97%) arrived at the ED by themselves or with their parents. The remaining 3% arrived by ambulance. Most of the patients (95%) were discharged after their ED visit, and only 2% were admitted to hospital (3% were missing discharge data). Thirty six percent of patients had an injury classified as severe.

A triage form was present in only 25% of charts; however, this varied by ED from a low of 3% to a high of 81%. Only 55% of charts contained ED nurse notes, while 97% of charts had notes from the ED physician. A summary measure of chart documentation showed that 66% of the charts had physician notes and nurse notes or a triage form, while 33% of charts only had physician notes.

Analysis of coding specificity

Overall, 46% of the charts contained sufficient documentation to allow reassignment of a more specific E-code (table 2). Nearly three quarters (73%) of these specified charts were recoded as ''Slips, trips, and stumbles'' (E855). It was possible to identify a more specific type of fall for 43% of the charts, while another 3% of charts reported a fall but as a result of a strike or collision. For injury surveillance purposes, these injuries are typically not counted in falls.

Two percent of charts had no fall documented (that is, they were false positives). The remaining 52% of charts remained coded as ''Other or unspecified fall''.

Univariate analysis

For the purposes of the univariate (and multivariate) analysis, the outcome variable was dichotomized into specified E-code *v* unspecified E-code. The ''specified'' group included those injuries resulting from a ''specified fall'' and from a ''strike or collision followed by a fall''. False positive cases (n = 7) were excluded from this analysis. Thus, of the remaining 393 charts, 47% had specified E-codes and 53% had unspecified E-codes.

Table 3 provides the results of the univariate analysis comparing charts assigned a more specific E-code after the review with charts whose codes remained unspecified. Severity of injury factors (that is, means of arrival, discharge status, and injury severity) were significantly associated with assignment of a specific E-code. More patients arriving by ambulance (OR = 5.95 (95% CI, 1.29 to 27.8)), admitted to hospital (OR = 9.37 (1.16 to 76.9), and presenting with severe injuries (OR = 1.63 (1.08 to 2.47)) were assigned a specific E-code. Charts with more comprehensive documentation (for example, triage forms or nurse's notes in addition to physician notes) were also more commonly assigned a specific E-code (OR = 2.56 (1.65 to 3.97)). Finally, charts from ED site ''D'' had decreased odds of being assigned a specific E-code compared with the reference site (OR = 0.48 (0.26 to 0.89)).

Multivariable analysis

Before proceeding to the multivariable logistic regression analysis, independent variables were checked for colinearity.

Table 3 Univariate and multivariate analysis of predictor variables of E-code specificity on chart review (n = 393)

	E-code determined from chart review			
	Specified E-code (n = 184)	**E-code remained unspecified (n = 209)**	**Unadjusted OR (95% CI)**	**Adjusted OR (95% CI)**
Demographics				
Age (years) (mean (SD))	9.31 (5.80)	8.59 (5.59)	1.02 (0.99 to 1.06)	1.03 (0.99 to 1.08)
Sex			1.04 (0.70 to 1.56)	1.02 (0.67 to 1.57)
Male	59%	58%		
Female	41%	42%		
Characteristics of the ED visit				
ED site				
A	21%	14%	1.00	1.00
B	17%	16%	0.74 (0.37 to 1.47)	1.17 (0.55 to 2.47)
C	39%	38%	0.69 (0.38 to 1.23)	1.98 (0.96 to 4.08)
D	23%	33%	**0.48 (0.26 to 0.89)**	0.93 (0.47 to 1.86)
Day of visit			1.32 (0.85 to 2.04)	1.28 (0.80 to 2.03)
Weekend	32%	26%		
Weekday	68%	74%		
Season of ED visit				
Summer	26%	20%	1.00	1.00
Autumn	28%	28%	0.77 (0.44 to 1.35)	0.82 (0.45 to 1.49)
Winter	22%	25%	0.69 (0.38 to 1.24)	0.74 (0.40 to 1.40)
Spring	25%	28%	0.68 (0.38 to 1.20)	0.81 (0.44 to 1.48)
Time of ED visit				
Midnight to 07:59	7%	6%	1.00	1.00
08:00 to 15:59	36%	37%	0.85 (0.36 to 2.01)	1.00 (0.38 to 2.58)
16:00 to 23:59	58%	57%	0.89 (0.38 to 2.07)	1.17 (0.46 to 2.95)
Means of arrival			**5.95 (1.29 to 27.8)**	**5.41 (1.07 to 27.0)**
Ambulance	5%	1%		
Self/parent	95%	99%		
Discharge status*			**9.37 (1.16 to 76.9)**	N/A‡
Admitted to hospital	4%	0.5%		
Treated and discharged	96%	99.5%		
Severity of injury†			**1.63 (1.08 to 2.47)**	**1.75 (1.11 to 2.78)**
Severe	42%	31%		
Not severe	58%	69%		
Characteristics of the chart				
Documentation in chart			**2.56 (1.65 to 3.97)**	**3.75 (2.17 to 6.45)**
ED physician notes *and* nurse's notes or triage form	77%	57%		
Only ED physician notes	23%	43%		

*Includes only those charts with discharge status information (n = 389).
†Severe injuries were defined as an injury with any of the following characteristics: concussion or other head injury (including lacerations to the head); fracture; neck sprain/strain; requiring admission to hospital or transfer to a different hospital.
‡Discharge status was not included in the multivariable logistic regression model because of high colinearity with severity of injury and because of the relatively small number of hospital admissions.
Totals may add up to more than 100% owing to rounding.
CI, confidence interval; ED, emergency department; OR, odds ratio.

It was suspected a priori that discharge status and injury severity would be highly associated as admission to hospital was one criterion used for determining severity of injury. Therefore only injury severity was entered into the model.

To yield adjusted odds ratios, all other nine independent variables were entered into the model, despite their significance in the univariate analysis. This technique is consistent with a commonly cited 10% rule of thumb for the number of independent variables to include in a model.[15] The adjusted odds ratios and 95% confidence intervals are included in table 3. As shown, patients presenting with severe injuries or who arrived at the ED by ambulance, and charts with more comprehensive documentation, remained the most significant predictors of being assigned a specific E-code.

DISCUSSION

This study, conducted in an urban Canadian health region, examined 400 charts randomly selected from youth ED visits for a fall that was coded as unspecified. Overall, while thorough evaluation of the chart improved the coding specificity, 52% remained unspecified after the chart review. Consistent with the results of the logistic regression, this highlights the lack of documentation of etiological information associated with injuries seen in EDs. This lack of documentation contributes to poor coding specificity of acute injuries in this health region, and presumably others. Moreover, as the ''unspecified falls'' categorization is commonly employed in the ED, this coding issue represents an important barrier for injury prevention practitioners in Canada and other countries.[6–12]

The vast majority of youth classified as having fallen did in fact fall; only 2% of reviewed charts had no evidence of a fall. It is notable that 46% of the remaining charts were assigned a more specific E-code from the chart review. As evidenced from the logistic regression, severe injuries and charts with more documentation were more likely to be assigned a specific E-code during the chart review. These findings suggest that busy nosologists also make errors when the

etiological causes require extensive searching through non-standardized charts. Consistent with the findings of others,[6] the tendency for nosologists to overuse non-specific E-codes for pediatric falls appears largely to reflect deficiencies in chart documentation. While one possible solution is allocating more nosologist time per chart, the economic consequences of such an effort are probably unjustified. Furthermore, the vast majority (73%) of falls that were specified upon the chart review were coded to E885 (Slips, trips, and stumbles), a category that still lacks the specificity required for injury prevention planning.

There are numerous possible reasons for the lack of chart documentation and poor diagnostic specificity. First, all charts in this health region remain paper based. As such, chart legibility varies and even if the information is documented, coders and staff may be unable to identify the pertinent injury information. Second, these paper charts do not contain any prompting for specific information that would be crucial for improved coding specificity and a better understanding of the epidemiology of childhood injury. Without specific prompting using standardized template charts, it seems unreasonable to expect front line staff to report a set of mandatory injury specific variables. Previous research from this region showed a modest increase in charting pediatric injury information with education[16]; however, this increase may have been short lived. Finally, the use of known preventive injury strategies is also not collected routinely or in a standardized fashion. For example, prompted information on helmet use on the ED chart may increase coding specificity by helping nosologists distinguish sports related falls from general falls.

Relying on emergency physicians for precise and specific injury information seems fraught with non-compliance, illegibility, and lack of standardization.[17] Potential solutions for this problem are many and varied. The first opportunity to collect the necessary injury information exists at triage desks. Electronic prompting in triage, using one of the electronic triage programs,[18] seems an ideal place to start. A second opportunity exists with electronic or paper based template charts, specifically designed for injury. Another option involves having physicians or triage nurses assign E-codes, rather than or in addition to the nosologist.[19 20] While this has been shown to be successful in certain locations, evaluations in other settings are still required before widespread application can occur. Finally, educational interventions seem less likely to work than mandated options.[12] Educating the multitude of learners and staff in the ED—especially in the setting of ED overcrowding—seems an inefficient method to change behaviors. Until such time as some of these proposed interventions are introduced, improved coding of injury charts may not be possible.

Limitations

There are several limitations that require us to interpret these findings cautiously. First, the study was conducted in only one health region. Owing to potential differences in pediatric injury patients and EDs across regions, the generalizability of the results remains uncertain. It is known, however, that other regions similarly rely upon ED paper charts for pediatric fall injury surveillance. These sites would face the same challenges discussed here, including limited chart documentation, insufficient details for injury coding, and a need for real alternatives for injury surveillance data. Thus the study findings are likely to be highly relevant to those settings. Second, our study was conducted using years for which the ICD-9 coding system was used. We recognize the ICD-10 coding system has the potential for providing much more specific categories to code falls; however, the value of this enhanced coding system will be lost if the necessary injury specific information about the fall is not recorded in the first place. If information is not on the chart, the availability of highly specific codes becomes irrelevant. Finally, coding misclassification may have occurred; however, this bias was minimized by blinding the experienced nosologist to the initial E-codes on the chart and by checking the reliability and consistency of coding throughout the data collection process.

Key points

- Injury is the leading cause of death and disability in children.
- Among youth aged 0 to 19 years, unintentional falls account for the largest proportion of injury related emergency department visits; however, one third of these falls are coded as ''unspecified''.
- Non-specific external cause of injury (E-) coding compromises the utility of injury surveillance to assist in the development of targeted youth injury prevention strategies.
- Detailed chart review decreased the proportion of unspecified falls by 46%; however, 73% of these specified falls were recoded as ''Slips, trips, stumbles'' (E885), which still lacks the specificity required for prevention planning.
- Deficiencies in both chart documentation and coding specificity contribute to the use of non-specific E-codes.
- In order to further understand and prevent injuries, more comprehensive triage coding, improved chart documentation, and alternative methods of data collection in the acute care setting are required.

Conclusions

In a typical Canadian paper based emergency department without templated charts, detailed review of pediatric medical charts reduced the number of unspecified falls by 46%. Despite this apparent success, the resources required to reduce unspecified coding of pediatric falls on a broader scale are probably unjustified. Moreover, the improved recoding was limited to a general fall related injury code and would not provide the granular detail required by injury planners. If we are to have a better understanding of the injury pyramid[21] and the causes of acute injury, improved chart documentation and alternate methods of data collection are required.

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BOARD MEMBER BIOGRAPHY

Morag MacKay

Morag MacKay is presently Programme Manager at the European Child Safety Alliance, a programme of Eurosafe, where she is managing the Child Safety Action Plan (CSAP) project. CSAP involves working with 18 countries in Europe to develop national child safety action plans and brings together her areas of interest including surveillance, good practice, and policy development.

Before joining the Alliance in October 2004, Ms MacKay was Director of Plan-it Safe, the child and youth injury prevention centre at the Children's Hospital of Eastern Ontario in Ottawa, Canada for seven years. While there she helped secure over 1.5 million dollars in grants to support local research and program evaluation initiatives. Morag has an undergraduate degree in nursing science and graduate degree in medical science with a specialization in epidemiology.

Ms MacKay's professional activities have largely focused on the prevention and control of children's unintentional injuries and her contributions to the field over the last 13 years have been in the areas of strategic planning for injury prevention, injury surveillance, education, research, program planning, and evaluation.