Pediatric window falls: not just a problem for children in high rises

N L Vish, E C Powell, D Wiltsek, K M Sheehan

Background: Window falls are a frequent cause of injury (15/100 000) among Chicago preschool children. In Boston and New York, public health efforts have successfully decreased window fall injuries. Local data are needed to develop appropriate interventions for Chicago.

Objective: To describe the housing characteristics and types of injuries among children who fell from windows treated in a Chicago pediatric trauma center.

Methods: Children treated in a pediatric trauma center for injuries related to window falls between 1995 and 2002 were identified retrospectively. We reviewed family demographics, the circumstances of the fall, and types of injuries. Site visits were performed to determine the height and type of building and type of window where the fall took place.

Results: The authors reviewed 90 cases; 55 were male. The median age was 2 years. Ninety eight percent of falls were reported to be from the third floor or lower. Site visits (n = 77) showed that 96% of the buildings were four storeys or lower. The median length of hospital stay was two days (range 0–24 days). The most common injuries were head trauma and extremity fractures. Three patients died, and an additional three patients were discharged to rehabilitation centers.

Conclusions: Some window falls result in serious injury. In Chicago, most falls were from modest heights (2nd/3rd floor windows) in buildings of four or fewer storeys, rather than from "high rises". Strategies to prevent window falls should be directed to the owners and occupants of this type of housing.

METHODS

Children treated in a level I pediatric trauma center for injuries related to window falls between 1995 and 2002 were identified retrospectively using the ICD9 external cause of injury code (E882) for fall from a building. Cases were included if they met the following criteria: (1) the fall occurred from a window and (2) the fall was unintentional. Information collected from the records included patient demographics, circumstances (floor of fall, landing surface), anatomic areas injured, Glasgow Coma Score (GCS) on arrival to the emergency department, number of inpatient hospital days, and inhospital death or patient disposition. Social worker notes that reconstructed, in text form, the circumstances leading to the fall were reviewed to gather specific information about the supervision of the child, if there was furniture near the window, and if it had a screen.

The second phase of the study included site visits to the location of the fall to describe the type of building, the total number of floors in the building, and the type of window the child fell through. Building types were designated as houses (one or two family), townhouses, or multiple unit dwellings. Building height was described as the number of floors. Window type was described as single hung, double hung, sliding, or casement. Some of the buildings in Chicago include “garden” units in which one to four floors is below grade. Windows in garden units were considered first level; windows in the floor above were designated second level. We estimated the height of the fall by measuring the vertical height of a brick, or siding panel, and counting vertically to the reported window.

Abbreviations: GCS, Glasgow Coma Score.
RESULTS

Demographics

Ninety children were treated for injuries resulting from window falls during the seven year study period. Fifty five were males. The age range was 9 months to 16 years with a median of 2 years (mean age 3 years 2 months). Ninety percent were 5 years old or younger. Five of the 12 children 6 years old or older were developmentally delayed. Forty nine percent of families self identified as Hispanic, 36% as other/unknown, 8% white, and 7% black. Seventy four percent were males. The age range was 9 months to 16 years with a median of 2 years (mean age 3 years 2 months). Ninety four percent were enrolled in Illinois Medicaid, 20% had HMO/PPO or other insurance, and 6% had no insurance.

Circumstances of falls record review

Eighty eight children (98%) fell from a window in the third floor or lower (table 1). Presence or absence of a screen was documented in 56 cases. Of these, 31 (55%) reported the presence of a screen. In five cases the window had some other type of covering (mosquito netting, plastic, glass). None reported having a window safety guard. The fall surface was described as concrete in almost half the cases (49%).

In 23% a bed or couch was present near the window at the time of the fall. A parent reported being in the same house/apartment as the child in 53% of the falls, 13% had an adult that was not the primary caretaker in the house, 2% had a minor supervising (older sibling, relative), 1% had no supervision, 31% unknown/not documented.

More than half of window falls were during the summer, with 53 falls occurring between June and August. Forty eight percent of the falls occurred between the hours of noon and 6pm, 34% between 6pm and midnight, 16% between 6am and noon, and 2% between midnight and 6am.

Site visits

We completed 77 site visits, representing 85% of the window falls in this study. Falls that occurred in buildings outside of the city of Chicago (n = 7) and those where the address was incorrect (n = 6) were not included. Seventy four buildings (96%) had four or fewer storeys. There were three falls from windows in high rise buildings: these buildings were 26, 10, and seven storeys and the falls occurred from the second, fifth, and third floors respectively. Fifty seven (74%) falls were through windows in multi-unit dwelling buildings, 19 (25%) occurred in homes, and one (1%) was through a townhouse window. Seventy two (95%) of the windows were single or double hung, two windows (3%) were sliding windows, and two windows (3%) were casement windows; in one building the windows were being renovated.

Figure 1 shows the reported floor of the fall and the distance of the fall estimated during the site visit. The estimated distances of falls reported as through first floor windows ranged from 2.5 feet to 11.5 feet. Falls reported as second floor falls ranged from 6.25 feet to 25 feet, and those reported as third floor falls ranged from 16.6 feet to 40.25 feet in distance. The median height of fall was 17 feet.

Outcome

Significant anatomic injuries are shown in table 2. Head trauma was the most common injury (48%), followed by skeletal injuries (23%). Thirteen percent had injuries to the chest or pelvis. Abdominal injuries accounted for only 3% of injuries. Twenty nine patients (32%) had minor injuries and are not included in the table. The GCS in the emergency department ranged from 3 to 15. Nineteen had a GCS ≤13 and five had GCS ≤8. Among the 19 children with a GCS ≤13, seven (37%) had falls shorter than, or equal to 17 feet (missing data, n = 1). Among the 56 children with GCS of 14–15, 31 had falls less than 17 feet and 25 had falls greater than 17 feet (missing data, n = 10). Among the five children with GCS ≤8, one had a fall shorter than 17 feet. The length of hospital stay ranged from 0 to 24 days; the median length of stay was two days. Eighty four children were discharged to home and three were discharged to rehabilitation facilities. Three children died, each from head trauma. Their reported height and estimated fall distances were first floor (10.25 feet), second floor (17.75 feet), and third floor (38 feet). The ages of the children who died were 9 months, one and a half years, and 2 years.

<table>
<thead>
<tr>
<th>Injury type</th>
<th>Specific injury</th>
<th>Injuries [n]</th>
</tr>
</thead>
<tbody>
<tr>
<td>Head [n = 43]</td>
<td>Skull fracture</td>
<td>30</td>
</tr>
<tr>
<td></td>
<td>Intracranial contusion</td>
<td>21</td>
</tr>
<tr>
<td>Chest/pelvis [n = 12]</td>
<td>Intracranial hemorrhage</td>
<td>2</td>
</tr>
<tr>
<td></td>
<td>Hemorrhage/pneumothorax</td>
<td>2</td>
</tr>
<tr>
<td></td>
<td>Rib fracture</td>
<td>5</td>
</tr>
<tr>
<td></td>
<td>Pelvic fracture</td>
<td>5</td>
</tr>
<tr>
<td>Abdomen [n = 3]</td>
<td>Liver laceration</td>
<td>2</td>
</tr>
<tr>
<td></td>
<td>Splenic rupture</td>
<td>1</td>
</tr>
<tr>
<td>Skeletal [n = 21]</td>
<td>Upper extremity</td>
<td>8</td>
</tr>
<tr>
<td></td>
<td>Lower extremity</td>
<td>14</td>
</tr>
</tbody>
</table>

*Several patients had multiple types of injury within a category.

Table 1  Circumstances of falls

<table>
<thead>
<tr>
<th>Floor of fall</th>
<th>n (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>11 (12)</td>
</tr>
<tr>
<td>2</td>
<td>53 (59)</td>
</tr>
<tr>
<td>3</td>
<td>24 (27)</td>
</tr>
<tr>
<td>4</td>
<td>1 (1)</td>
</tr>
<tr>
<td>5</td>
<td>1 (1)</td>
</tr>
<tr>
<td>Window covering</td>
<td></td>
</tr>
<tr>
<td>Screen</td>
<td>31 (34)</td>
</tr>
<tr>
<td>Open</td>
<td>18 (20)</td>
</tr>
<tr>
<td>Other covering</td>
<td>5 (6)</td>
</tr>
<tr>
<td>Unlocked by child</td>
<td>2 (2)</td>
</tr>
<tr>
<td>Not documented</td>
<td>34 (38)</td>
</tr>
<tr>
<td>Surface of fall</td>
<td></td>
</tr>
<tr>
<td>Concrete</td>
<td>44 (49)</td>
</tr>
<tr>
<td>Grass/dirt</td>
<td>22 (24)</td>
</tr>
<tr>
<td>Vegetation</td>
<td>5 (6)</td>
</tr>
<tr>
<td>Not documented</td>
<td>19 (21)</td>
</tr>
</tbody>
</table>

Figure 1  Relation between floor of window fall and the measured height of window.
reach of a young child. In Chicago, the building code requires window guards if the height of the window sill is less than 2 feet above the floor. We do not know how well this code is enforced and its potential effectiveness to prevent window falls. As the site visits were limited to the exterior of the building, we cannot report the distance between the sill and the floor inside. It may be that lower windows lacked guards, or that children fell from windows more than 2 feet from the floor. The data suggest that furniture placed near some of the windows was a contributing factor to the fall, allowing children access to the higher windows.

In Chicago, the reported floor of a fall is a poor indicator of the height of the fall. In these data, a fall reported from the second floor may represent a 6–25 foot fall. In part this variation is explained because windows in submerged “garden level” units are very near the ground (building codes allow habitable space in a residence to be up to half submerged) and windows the next level up, reported as “second floor”, were not very high. These data are unique in that the performance of the site visits allowed us to estimate the actual distance of the fall and compare that to the reported floor of fall.

Falls from windows in Chicago resulted in significant injuries. Head trauma was the most common injury (48%) followed by skeletal trauma (23%). The three children with fatal injuries fell from the heights of 10.25 feet, 17.75 feet, and 38 feet (all reported from the third floor or lower). This is in contrast to New York data that report 100% survival in children who fell three storeys or less, and a Dallas case series in which there were no deaths among 98 children who fell from four floors or lower.

Because this was in part a retrospective study, we were limited to the medical record for details of the injury event. Not all parents were asked if furniture was near windows, or if a screen was present, thus reported percentages may underrepresent these circumstances. The data are not population based, and represent the experience at a single pediatric trauma center in Chicago. However, these data suggest that in young children falls from relatively modest heights are associated with significant morbidity, and interventions to prevent them are warranted.

Although the hazard that window falls pose to children’s health has been recognized, additional work is needed to implement the recommended preventative strategies suggested by the American Academy of Pediatrics in a recent policy statement. Window falls prevention programmes, which include broad based public education, can be used to decrease incidence of pediatric window falls in urban centers. Successful interventions have been implemented by New York and Boston. This study identifies preschool children, particularly those living in poverty, as the at-risk population in Chicago. We have initiated local efforts including posters on the public transit system and community outreach programmes in several Hispanic neighborhoods near the hospital emphasizing the importance of limiting the height of the window opening to 4 inches to prevent falls. Printed materials discuss the use of sash stops to limit the height of an open window, and operable window guards to prevent falls from open windows. These materials also inform families how these products can be obtained.

As most falls occur in multi-unit properties, it is important that the prevention message also be targeted to building owners, managers, and their tenants with young children. In Chicago, property owners must inform prospective tenants about the potential of lead exposure at the time the rental lease is signed. A similar strategy to inform tenants about window fall risks at the time of property rental might also be successful in reaching a group at risk for window falls. Educational materials could also be distributed at single
family unit property transfers. This study demonstrates morbidity from window falls among preschool children in Chicago—ongoing efforts are needed to assess the effectiveness of interventions to reduce them.

ACKNOWLEDGEMENTS
We would like to acknowledge Sameer Gafoor, James P Harisiades, MPH, and Edward Zhovtis for their help in this project.

Key points
- In Chicago, most falls were from modest heights (2nd/3rd floor windows) in buildings of four or fewer storeys.
- Males aged 5 years old or younger accounted for the majority of those injured in window falls.
- Although most children in Chicago fall from lower floors, our data show a significant degree of morbidity and mortality from these falls. Head trauma was the most common injury (48%) followed by skeletal trauma (23%).
- In Chicago, the reported floor of a fall is a poor indicator of the height of the fall.
- Window falls prevention programmes, which include broad based public education, can be used to decrease the incidence of pediatric window falls in urban centers.

REFERENCES
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