Falling in the Netherlands: prevention, care, and follow-up of fall-related injury
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Chapter 1

Staircase Falls; high risk groups and injury characteristics in 464 patients


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Abstract

Background
Few data are available about the epidemiology and injury characteristics in staircase falls. The available literature mainly concerns children and autopsy studies.

Objective
This study aimed to describe the epidemiology and injury characteristics of staircase falls, and to identify high risk groups for these falls.

Methods
All patients who reported to an Academic Emergency Department in 2005 after a staircase fall were selected in the Dutch Injury Surveillance System. These data were linked to the hospital trauma registry database.

Results
Four hundred and sixty-four patients (42% male, $p=0.001$), with a median age of 35 years were included. Children under five suffered significantly more head injuries. Male patients showed significantly more thoracic injuries than female patients. Spinal column fractures were only seen in patients over 25 years of age. Older patients tended to accumulate more rib fractures and lower extremity fractures and were admitted more frequently than the younger patients. Sixty-one patients (13%) required admission. Two patients, both with severe Traumatic Brain Injury (TBI), died. National data on staircase falls were comparable with our hospital data. However, in comparison to the national population data, senior citizens in this study had an incidence that was markedly higher than in the younger patients.

Conclusion
Injuries due to staircase falls occur in all age groups, however, children under five years are relatively overrepresented with higher rates of head injury. Senior citizens showed a markedly higher incidence than younger patients. Most injuries occur to the distal extremities and are relatively mild.
Introduction

Data about the epidemiology, pattern, and severity of injury in staircase falls are only scarcely available.\(^1\)\(^4\)\(^6\)-\(^8\)\(^10\)\(^11\)\(^16\) This may be in part due to the fact that people with minor injury or on the other end of the spectrum, fatal injury do not report to the Emergency Department (ED). The available literature shows that children under five years old are particularly at risk.\(^6\)\(^10\)\(^11\) In addition, the risk of falling seems to increase with age, becoming a problem in senior citizens.\(^1\) An important risk factor among senior citizens seems to be decreased self-confidence while taking the stairs.\(^7\)\(^8\) Alcohol has also been described as a risk factor in staircase falls.\(^4\) It has been suggested that chronic alcohol abuse (with associated liver disease) may predispose to increased bleeding after (brain) injury.\(^16\) However, these findings are partly contradicted by a study that found a significantly lower mortality rate in alcohol intoxicated patients.\(^3\)

In Amsterdam, many houses are no more than four stories high and were constructed during the first half of the 20\(^{th}\) century. Many are not equipped with elevators and staircases can be steep and cluttered. It can be hypothesized that this results in more staircase fall-related ED visits. In the Netherlands, comparative data on staircase falls at local and national level are currently not available to extrapolate the possible similarities and dissimilarities in these data based on architecture.

Moreover, no hard data is available on the true incidence of staircase fall-related ED visits per age group. Such data would be important for guiding future prevention programs.

Objective

The aim of this study was to describe the epidemiology and injury pattern among patients with staircase falls reporting to the ED of a hospital and to compare these data with those available at the national level. In doing so, we attempted to gain further insight into the problem of staircase falls thereby helping to create a guide for future prevention programs.

Ethics approval

The Institutional Research Board approved of this study.
Methods

Study design
This was a retrospective cohort study that was supplemented by a comparison to the national data.

Hospital setting
This study was executed in a tertiary university teaching hospital that serves as one of two Level-1 Trauma Centers in a region with approximately 2.8 million inhabitants. Annually, 32,000 patients visit the ED. The trauma team is alerted approximately 600 times each year for (potentially) severely injured patients. Of these, 150 to 200 patients are indeed severely injured (Injury Severity Score >15). Annually, approximately 1250 trauma patients are admitted to the hospital.

Injury surveillance
For the purpose of this study, two injury databases were combined. The first database was the Dutch Injury Surveillance System (LIS, Dutch: Letsel Informatie Systeem). The LIS is managed by the Consumer Safety Institute (CSI, Dutch: Stichting Consument en Veiligheid). The LIS database was started in 1983 and currently records all injury related ED visits in fourteen hospitals in the Netherlands, in both urban and rural areas. These data are extrapolated to the whole of the Netherlands using a set of mathematical models. Further analysis of these LIS models has shown them to be representative for all ED’s in the Netherlands. Our hospital is one of the fourteen hospitals that participate in the LIS.

The second database that was used was the hospital Trauma Registry. This is a permanent registration of all trauma patients (with or without trauma team activation) who are admitted to the Level-1 Trauma Center. The Trauma Registry database contains detailed data on the prehospital phase, resuscitation, vital signs, type and severity of injury, treatment and outcome of patients (Major Trauma Outcome Study (MTOS)+ dataset).

Data extraction
Patients who visited the ED in our hospital because of a staircase fall in 2005 were selected in the LIS. The LIS data were linked to the Trauma Registry database by means of the unique A&E number that was recorded in both databases. The trauma mechanism was manually confirmed (MRvO and PBvH) in the medical records of all selected patients. Several relevant variables (e.g. height of the fall, alcohol intoxication, and suspicion of child abuse) were not
recorded in either database. These data were retrieved from the medical records. The height of the fall was recorded in number of steps. When the fall height was reported in meters, the number of meters was divided by 0.21 meter (average rise of a step) to calculate the number of steps. According to International Standards, Traumatic Brain Injury (TBI) was defined as a non-degenerative, non-congenital insult to the brain by an external mechanical force, possibly leading to permanent or temporary impairments of cognitive, physical, and psychosocial functions with an associated diminished or altered state of consciousness.\textsuperscript{13}

**National data**
The 2005 national data on staircase falls were calculated for us by the LIS. The national data were compared to the local data on staircase falls. In order to calculate the incidence of staircase fall-related A&E visits, the national LIS data were divided by the total number of inhabitants in the Netherlands in 2005. These data were adopted from the Statistics Netherlands (Dutch: Centraal Bureau voor de Statistiek; CBS) website.\textsuperscript{14}

**Statistical analysis**
Data were analysed using SPSS version 14.0.2. The main outcome measure was description of age and sex distribution of those presenting to the ED with staircase falls injury and their injury patterns. The length of stay in the ED and in hospital and its correlation with age, sex, and injury pattern is also reported. Comparison of our study data was done with the national data to understand the differences in the distribution. Statistical significance was assessed using the Chi\textsuperscript{2}, Fisher’s exact, and Mann-Whitney U tests as appropriate. Correlations were assessed using the Pearson and Spearman correlations as appropriate. In order to compensate for multiple testing, differences were considered to be significantly different when the p-value was less than 0.01.

**Results**

**Patients**
In 2005, 30,991 patients visited our ED. Of these 30,991; 464 patients (1.5%) reported a staircase fall. There were 193 men and 271 women (p=0.001). The median age was 35 years (range, 0-91 years) and did not differ between men and women. Children under 5 years constituted the largest patient group (n=60, 12.9%). The number of patients who reported to the ED decreased markedly after 60 years (Figure 1).
Most patients (n=373; 80%) were self-referred and 71 patients (15%) were brought in by ambulance. Other patients were referred by their family physician (n=8), another hospital (n=1), or the Radiology Department (n=11). Patients who were brought in by ambulance were significantly older than the other patients (median 51 years versus 33 years; p<0.001). Furthermore, these patients had sustained significantly more TBI (p<0.001), spinal fractures (p<0.001), and lower extremity fractures (p=0.006).

The height of the fall was reported in 142 patients (31%), and ranged from 1 to 25 steps (median, 4 steps). Most of these patients (67%), however, fell from six steps or less. The blood alcohol level was tested in 15 patients (3%), eleven of whom showed detectable blood alcohol levels which ranged from 1.31 to 3.31 mg/ml.

Two patients died; one was an 87 year old woman and the other was a 36 year old man. Both patients suffered severe TBI form their fall. The height of the fall by these patients, however, remained unknown.

Table 1. Distribution of injuries over the two sexes.

<table>
<thead>
<tr>
<th>Injury</th>
<th>Women n (%)</th>
<th>Men n (%)</th>
<th>Total n (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Facial injury</td>
<td>28 (10.3)</td>
<td>9 (4.7)*</td>
<td>37</td>
</tr>
<tr>
<td>facial fracture</td>
<td>1 (0.4)</td>
<td>1 (0.5)</td>
<td>2</td>
</tr>
<tr>
<td>Cranial fracture (vault or skull base)</td>
<td>4 (1.5)</td>
<td>1 (0.5)</td>
<td>5</td>
</tr>
<tr>
<td>TBI</td>
<td>15 (5.5)</td>
<td>11 (5.7)</td>
<td>26</td>
</tr>
<tr>
<td>mild</td>
<td>10 (3.7)</td>
<td>9 (4.7)</td>
<td>19</td>
</tr>
<tr>
<td>moderate</td>
<td>1 (0.4)</td>
<td>0 (0)</td>
<td>1</td>
</tr>
<tr>
<td>severe</td>
<td>4 (1.5)</td>
<td>2 (1.0)</td>
<td>6</td>
</tr>
<tr>
<td>Neck injury</td>
<td>1 (0.4)</td>
<td>2 (1.0)</td>
<td>3</td>
</tr>
<tr>
<td>Upper extremity fracture</td>
<td>33 (12.2)</td>
<td>27 (14.0)</td>
<td>60</td>
</tr>
<tr>
<td>wrist fracture</td>
<td>9 (3.3)</td>
<td>7 (3.6)</td>
<td>16</td>
</tr>
<tr>
<td>carpal or metacarpal fracture</td>
<td>8 (3.0)</td>
<td>5 (2.6)</td>
<td>13</td>
</tr>
<tr>
<td>Thoracic injury</td>
<td>12 (4.4)</td>
<td>22 (11.4)**</td>
<td>34</td>
</tr>
<tr>
<td>rib fracture</td>
<td>5 (1.8)</td>
<td>10 (5.2)</td>
<td>15</td>
</tr>
<tr>
<td>Abdominal injury</td>
<td>2 (0.7)</td>
<td>0 (0)</td>
<td>2</td>
</tr>
<tr>
<td>Spinal column fracture</td>
<td>3 (1.1)</td>
<td>6 (3.1)</td>
<td>7</td>
</tr>
<tr>
<td>cervical fracture</td>
<td>2 (0.7)</td>
<td>2 (1.0)</td>
<td>2</td>
</tr>
<tr>
<td>thoracic fracture</td>
<td>1 (0.4)</td>
<td>3 (1.6)</td>
<td>4</td>
</tr>
<tr>
<td>lumbar fracture</td>
<td>0 (0)</td>
<td>1 (0.5)</td>
<td>1</td>
</tr>
<tr>
<td>Lower extremity fracture</td>
<td>33 (12.2)</td>
<td>11 (5.7)***</td>
<td>44</td>
</tr>
<tr>
<td>ankle fracture (tibia or fibula)</td>
<td>9 (3.3)</td>
<td>4 (2.1)</td>
<td>13</td>
</tr>
<tr>
<td>tarsal or metatarsal fracture</td>
<td>13 (4.8)</td>
<td>4 (2.1)</td>
<td>17</td>
</tr>
</tbody>
</table>

Table legend: TBI: Traumatic Brain Injury; Strong trend at P=0.026; ** Significant at P=0.005; *** Strong trend at P=0.019.
**Fall-related injury**

The distribution of injuries is shown in Table 1. Six patients sustained multiple facial injuries. All five with skull fractures also sustained TBI. There was a strong trend towards more facial injuries in women. The most common fractures were fractures to the upper extremities (n=60; 13%). Wrist and hand fractures were the most common upper extremity fractures (n=29; 48%). Male patients showed significantly more thoracic injury than female patients. There was a strong trend towards more lower extremity fractures in women. Most lower extremity fractures were located in the ankle or foot (n=30; 68%). Table 2 shows the distribution of injuries over the different age groups. This table shows that spinal column fractures were only seen in patients over 25 years of age (p=0.009; SCC: 0.122). It further shows that rib fractures (p=0.003; SCC: 0.139) and lower extremity fractures (p<0.001; SCC: 0.209) were significantly more common in older patients than in younger patients. Advancing age was significantly associated with rib fractures.

**Table 2. Distribution of injuries over the different age groups.**

<table>
<thead>
<tr>
<th>Age Group</th>
<th>&lt;5 years</th>
<th>5-14 years</th>
<th>15-24 years</th>
<th>25-44 years</th>
<th>45-64 years</th>
<th>65+ years</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Facial injury</td>
<td>n (%)</td>
<td>n (%)</td>
<td>n (%)</td>
<td>n (%)</td>
<td>n (%)</td>
<td>n (%)</td>
<td>n (%)</td>
</tr>
<tr>
<td>Facial fracture</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>1</td>
<td>0.9</td>
</tr>
<tr>
<td>Cranial fracture (vault or skull base)</td>
<td>1</td>
<td>1.7</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>1</td>
<td>0.8</td>
</tr>
<tr>
<td>TBI</td>
<td>n (%)</td>
<td>n (%)</td>
<td>n (%)</td>
<td>n (%)</td>
<td>n (%)</td>
<td>n (%)</td>
<td>n (%)</td>
</tr>
<tr>
<td>Mild</td>
<td>6</td>
<td>10.0</td>
<td>1</td>
<td>2.8</td>
<td>-</td>
<td>-</td>
<td>3.0</td>
</tr>
<tr>
<td>Moderate</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Severe</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Neck injury</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>1</td>
<td>0.9</td>
</tr>
<tr>
<td>Upper extremity fracture</td>
<td>8</td>
<td>13.3</td>
<td>6</td>
<td>16.7</td>
<td>2</td>
<td>2.9</td>
<td>3.0</td>
</tr>
<tr>
<td>Wrist fracture</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>1</td>
<td>0.8</td>
<td>10.9</td>
</tr>
<tr>
<td>Carpal or metacarpal fracture</td>
<td>-</td>
<td>-</td>
<td>2</td>
<td>5.6</td>
<td>1</td>
<td>1.4</td>
<td>10.0</td>
</tr>
<tr>
<td>Thoracic injury</td>
<td>1</td>
<td>1.7</td>
<td>2</td>
<td>5.6</td>
<td>7</td>
<td>10.0</td>
<td>3.8</td>
</tr>
<tr>
<td>Rib fracture</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>1</td>
<td>1.4</td>
<td>3.0</td>
</tr>
<tr>
<td>Abdominal injury</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>2</td>
<td>1.5</td>
<td>10.9</td>
</tr>
<tr>
<td>Spinal column fracture</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>1.0</td>
</tr>
<tr>
<td>Cervical fracture</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>1</td>
<td>0.8</td>
<td>2.8</td>
</tr>
<tr>
<td>Thoracic fracture</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>1</td>
<td>0.8</td>
<td>10.9</td>
</tr>
<tr>
<td>Lumbar fracture</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>1.0</td>
</tr>
<tr>
<td>Lower extremity fracture</td>
<td>-</td>
<td>-</td>
<td>3</td>
<td>8.3</td>
<td>2</td>
<td>2.9</td>
<td>2.0</td>
</tr>
<tr>
<td>Ankle fracture (tibia or fibula)</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>2</td>
<td>1.5</td>
<td>10.7</td>
</tr>
<tr>
<td>Talar or metatarsal fracture</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>1</td>
<td>2.8</td>
<td>1</td>
<td>1.4</td>
</tr>
</tbody>
</table>

**Table legend:** TBI: Traumatic Brain Injury.
### A&E stay
The median length of stay at the ED was 90 minutes (IQR, 56 - 149 minutes). The variables that correlated significantly with the length of ED stay are listed in Table 3.

### Table 3. Variables that correlated with the length of stay at the Emergency Department and/or length of hospital stay.

<table>
<thead>
<tr>
<th>Variable</th>
<th>Patients</th>
<th>ED stay</th>
<th>Hospital stay</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>n</td>
<td>min (med)</td>
<td>IQR</td>
</tr>
<tr>
<td>age &lt; 5 years</td>
<td>60</td>
<td>75* 53-107</td>
<td>0.006</td>
</tr>
<tr>
<td>5 – 14 years</td>
<td>36</td>
<td>97 53-150</td>
<td>0.973</td>
</tr>
<tr>
<td>15 – 24 years</td>
<td>70</td>
<td>75* 47-108</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>25 – 44 years</td>
<td>133</td>
<td>95 56-155</td>
<td>0.088</td>
</tr>
<tr>
<td>45 – 64 years</td>
<td>112</td>
<td>120 70-201</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>65+ years</td>
<td>53</td>
<td>148 75-214</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>CGS</td>
<td>464</td>
<td>0.274</td>
<td>&lt;0.051</td>
</tr>
<tr>
<td>TBI</td>
<td>26</td>
<td>153 88-181</td>
<td>0.004</td>
</tr>
<tr>
<td>cervical spine fracture</td>
<td>4</td>
<td>285 224-320</td>
<td>0.002</td>
</tr>
<tr>
<td>wrist fracture (radius or ulna)</td>
<td>16</td>
<td>174 131-249</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>carpal or metacarpal fracture</td>
<td>13</td>
<td>194 152-259</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>lower leg fracture (tibia or fibula)</td>
<td>7</td>
<td>171 101-225</td>
<td>0.101</td>
</tr>
<tr>
<td>ankle fracture (tibia or fibula)</td>
<td>13</td>
<td>158 121-236</td>
<td>0.001</td>
</tr>
</tbody>
</table>

*Table legend: ED: Emergency Department; min: minutes; med: median; IQR: Inter quartile range; SCC: Spearman correlation coefficient; GCS: Glasgow Coma Scale; TBI: Traumatic Brain Injury; * Stay shorter than rest of cohort; ** Lower GCS means longer stay.*

### Hospital and Intensive Care Unit (ICU) admission
Sixty-one patients (13%) required admission for further observation or (operative) treatment. There were 26 female and 35 male patients with a median age of 54 years (IQR, 37 - 65 years); no patients between 12 and 35 years required admission. The median length of stay in the hospital was three days (range 1 to 58 days). Table 3 shows that older patients (45+) required longer A&E and hospital stay than the younger patients did. Furthermore, patients with TBI and cervical fractures required both a longer ED stay and hospital stay. In addition, both the ED stay and the hospital stay in patients with ankle fractures was longer that in the other patients. Seven patients required admission to the ICU for a median period of four days (range, 1 to 12 days). Advancing age (p=0.007; Spearman Correlation Coefficient (SCC): 0.132), TBI (p<0.001; SCC: 0.615), and rib fractures (p<0.001; SCC: 0.183) correlated with the length of ICU stay.
Child abuse
Of the 109 children (i.e. less than 18 years old), 77 children (71%) were evaluated for child abuse. In 3 children (4%), the suspicion of child abuse was raised. In one of these cases the attending pediatrician was notified to further evaluate the case.

Children under five years old
As shown in Figure 1, 13% of the patients with fall-related injury were under five years of age and 62% of them were girls. Injuries to the head were significantly more common in this group (p<0.001; SCC: 0.312). However, most of these children (76%) sustained superficial head injuries. None of the children suffered abdominal injury. They suffered significantly less injury to the lower extremities (p<0.001; SCC: -0.283) than older patients.

Figure 1. The staircase fall-related Emergency Department visits per 4-year age group (as a percentage of the total number of staircase fall-related Emergency Department visits) as reported in LIS and in the local cohort.

National staircase falls
In 2005, approximately 31,000 patients with staircase fall-related injuries presented to the ED’s in the Netherlands. Similar to the local cohort, children
under five years constituted the largest patient group. Furthermore, the age
distribution in the local cohort was the same as on the national level (Figure
1). The incidence of ED visits was markedly higher in senior citizens then in
the younger patients. Moreover, people over 80 years old had a 20% higher
chance of a staircase fall-related ED visit than people between 20 and 40
years old (Figure 2).

**Figure 2.** The incidence (per 100,000 inhabitants) of staircase fall-related Emergency
Department visits per 20-year age group.

The location of the falls is shown in Figure 3. Falls most often occur at home.
However, in the local cohort most patients did not report the location of the
fall.

The top 10 injuries were the same in the local cohort as in on the national
level (Figure 4). However, within the top 10 there were differences between
the local cohort and the national level. Wrist, thoracic, and facial injuries
were relatively more prevalent in the local cohort whereas foot and brain
injuries as well as injuries to the hairy cranium were more prevalent on the
national level.
Figure 3. The reported location of staircase falls in the Netherlands versus the local cohort.

Figure 4. The 10 most frequent injuries in the Netherlands versus the local cohort.
Discussion

This study shows that injury from staircase falls occurs in all age groups, however, young children and senior citizens are particularly at risk. Furthermore, it shows that most injuries occur in the distal extremities and are relatively mild; however, severe TBI and death do occur. Although many people report to the ED due to injury they sustained in a staircase fall, the real number of staircase falls is likely to be much higher. This is because patients with minor or no injuries as well as patients with fatal injuries have not been evaluated in this study. The present cohort shows an age distribution that is similar to that that has been reported in patients who have fallen from great height. The gender distribution, however, is similar to reports from older patients who have sustained a low fall. Therefore, this study population seems to be a mixture of low-energy falls and falls from height. Some articles have described the role of (chronic) alcohol abuse in staircase falls. The blood alcohol level in this series, however, was determined in very a limited number of patients. Blood alcohol examination is not a standard test in our hospital for this situation. The blood alcohol level in the eleven patients in whom it was tested ranged from 2.6 to 6.6 times the maximum legally allowed for participation in traffic in the Netherlands (i.e. 0.5 mg/ml). Women seemed to be more at risk of sustaining facial injury or lower extremity injury. Of all fractures, the distal upper extremity fractures were the most common ones. This may not be surprising since the hands may be used to break the fall. Other studies also report that the majority of fractures involve the distal extremities, however, the exact location is not always reported in detail. Contrary to our expectations, advancing age did not correlate with an increased risk of extremity fractures. Abdominal injuries were rare and relatively mild. This is in concordance with other articles on fatal staircase falls and staircase falls in children. Both patients who died after admission suffered TBI. This may be in line with studies on fatal staircase falls that also report a high incidence of severe head injury in those patients who die. Strikingly, distal extremity fractures, unlike many more severe injuries, correlated strongly with the length of stay at the ED. The number of severely injured patients, however, was low which may have weaken the correlation. Another notable fact was that no patients between 12 and 35 years old were admitted, having sustained generally less severe injuries. However, the available data did not reveal a clue as to why these patients sustained less severe injuries and did not require hospital admission.
Abusive parents may use a staircase fall as a false cover for the origin of their child’s injuries.\textsuperscript{9,15} Determination of abuse, however, remains difficult for the hospital staff. This is underlined by the fact of the 77 evaluated cases, raised was suspicion in only one. Abdominal injuries in children are often associated with child abuse.\textsuperscript{9,10,15,16} However, no children in this study sustained abdominal injury.

In concordance with previous reports in literature, there was a distinct group of children of less than five years old. Furthermore, the frequency of staircase falls and head injury (both superficial and TBI) resembled other studies.\textsuperscript{2,5,6,10,11} This study, however, was the first to describe all age groups and thereby highlighted the problem in young children in comparison to all age groups. Several factors may contribute to this high number of young children. First, in small children the head constitutes a larger part of the body than in older patients causing them to fall head first. Second, young children lack sufficient coordination and strength to protect their head with their arms. Third, parents may be inclined to bring their child to the ED after head injury as a precaution. Because of the high incidence of this group in staircase falls, future prevention programs should focus on these young children and raising awareness in parents of the possible danger related to their age.

The top 10 of injuries in the local cohort was comparable to the national top 10 of staircase fall related injuries. This was somewhat unexpected because the hospital serves as a Level 1 Trauma Center facility. However, two explanations can be put forth. The first is that, in addition to being a Level 1 Trauma Center, the ED also has a local function like any other hospital. The second explanation is that the number of severely injures patients who required the highest level (Level 1) of Trauma care was relatively low.

The proportion of senior citizens with staircase fall-related injury gradually decreased after 65 years. However, comparison with the Netherlands population data revealed that staircase falls in senior citizens are indeed a problem. This is endorsed by other reports.\textsuperscript{1} Although the cause of the fall was not further delineated, it seems likely that fear of falling as well as declining functional ability play an important roles.\textsuperscript{7} Taking into account the severity of their injuries, the case should be made that in addition to young children, future prevention programs should also focus on senior citizens.

This study has several limitations. It is based on data collected in a single hospital and comprises only A&E and hospital patients. Therefore, two groups of people were not included in this study. The first group consists of those people who sustained minimal injuries in their fall and were able to treat themselves, or visited their General Practitioner. The second group consists of people who died at the scene. In the Netherlands, the mortal
remains of these people are brought directly to the mortuary, and not to the hospital. In addition, the study suffers from all the known disadvantages of (retrospective) database analyses.
Based on the experiences from this study, the authors recommend recording the circumstances of the incident in more detail in order to aid future prevention programs. Factors that need more detailed recording include blood alcohol levels, medications, height and cause of the fall (including reasons for use of the stairs and time of the day) as well as underlying medical conditions. It would be certainly interesting and in our opinion valuable to record the type of staircase and surface material of the steps (e.g. wood, carpet or vinyl).

Conclusion

Based on this study it can be concluded that injury from staircase falls occurs in all age groups, however, the group of children under five years is relatively over-represented with high rates of head injury. The incidence was markedly higher in senior citizens. Overall, most injuries occur to the distal extremities and are relatively mild.
Future prevention programs should focus primarily on young children and senior citizens.
References

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