

# My Home is my Castle! Or is it? Hospitalizations following Home Injury in Israel, 1997–2001

Fabienne Sikron MA, Adi Giveon BA, Limor Aharonson-Daniel PhD ITG\* and Kobi Peleg PhD

Israel National Center for Trauma and Emergency Medicine Research, Gertner Institute for Epidemiology and Health Policy Research, Sheba Medical Center, Tel Hashomer, Israel

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## Abstract

**Background:** Although the home is perceived to be a safe haven, it is a scene of numerous injuries.

**Objectives:** To characterize home injury in Israel, the victims, injury circumstances and outcomes, and to identify groups at high risk for injury in order to focus future interventions and thus effectively prevent these injuries and their associated hospitalizations.

**Methods:** We analyzed 5 year records (1997–2001) from the National Trauma Registry of all patients arriving at eight trauma centers following home injury and admitted to hospital, transferred to another medical center, or died in the emergency department.

**Results:** The study group included 26,921 patients, constituting 34% of all unintentional hospitalized trauma patients. Twenty-seven percent were children (0–4 years) and 37% were elderly ( $\geq 65$  years), the two age groups whose home injury accounted for most of the trauma injuries. Among children more boys (59%) than girls (41%) were injured, but the opposite was true for the elderly (30% males and 70% females). The share of females among the home-injured increased with age. Falls caused 79% of all home injuries (97% among the elderly) and burns 9%, increasing to 18% among children (0–4 years). Among non-Jewish home-injured patients, infants predominated (50% compared to 20% among Jews). Moderate to critical injuries amounted for 42%, with 38% of the home-injured and 60% of the elderly requiring surgery. The clinical and economic consequences of home injuries differed according to the type of injury, with burns carrying the heaviest toll of prolonged intensive care and hospital stay. Overall, hospital stay averaged 6.2 days per patient (median 3 days).

**Conclusions:** Falls among the elderly, burns among children, and a high prevalence of hospitalization among non-Jewish children define groups at high risk for home injuries. Prevention programs should be based on these findings and should focus on the more vulnerable groups.

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For Editorial see page 364

Although the home is perceived to be a safe haven, it is the scene of numerous injuries. In Israel, home and leisure injury result in approximately 350,000 visits to emergency departments, 25,000 hospitalizations, and 750 deaths every year [1]. According to the Israel National Trauma Registry, injuries at home account for about one-third of trauma patients hospitalized, a proportion identical to that in the United Kingdom [2,3]. In the United States, trauma at home is responsible for 33,000 fatalities annually, with an incidence of

12 per 100,000 inhabitants [4]. The mortality rate for home and leisure injury in Israel was 12 per 100,000 inhabitants [1]. Indeed, home injuries are a major contributor to trauma, similar in magnitude to motor vehicle accidents, the other major cause of trauma.

In a study conducted in two Israeli community-based clinics in the 1980s, most children who sustained trauma were injured at home or around it [5]. In a survey conducted in Israeli high schools, 21% of students reported that their most severe injury occurred at home [6]. Similarly, the elderly in a Swedish population suffered more injuries at home than anywhere else [7].

Analysis of the causes of home injuries suggest that most of them can be prevented, often by simple intervention such as enforcing safety standards when building a new house, distributing leaflets with a home-safety checklist, installing stairway gates and handrails, and reducing the temperature of tap water. Nevertheless, many types of accident occur repeatedly and frequently [8]. Therefore, the objectives of the present study were to characterize home injury in Israel, its victims, circumstances and outcomes. The aim was to identify groups at high risk for injury in order to focus future interventions, thus effectively preventing these injuries and the hospitalizations associated with them.

## Materials and Methods

Data were obtained from the Israel National Trauma Registry, based on patient records from January 1997 to December 2001 that originated from eight trauma centers, including all six level I trauma centers in Israel and two regional trauma centers.

Included were all patients who arrived at these trauma centers following unintentional home injury and were admitted to hospital, transferred to another hospital, or died in the emergency department. Not included were patients receiving treatment only in the emergency room who were not hospitalized, and patients dead on arrival. Also excluded were injuries following suffocation, poisoning or drowning, since they are not defined as trauma. Home was defined as the residence (including vacation homes) and its adjacent garden or backyard; institutions such as nursing homes or prisons were excluded (2% of all the injured).

Demographic information, data on the causes of injury, emergency room and in-hospital care, and outcome were obtained from the Registry's records, and were analyzed by SAS statistical software [9]. Frequency distributions were used for categorical variables and the chi-square test was applied for comparison of categorical data. Non-parametric tests were used for the comparison of continuous variables that did not distribute normally

\* The Israel Trauma Group (ITG) is a study group comprising the heads of trauma units of all hospitals that belong to the Israel Trauma Registry (ITR): Drs. R. Alficci, E. Ish Tov, Y. Hiss, J. Jeroukhimov, Y. Klein, Y. Kluger, M. Michaelson, A. Rivkind, D. Simon, G. Shaked, M. Stein.

(Kruskal-Wallis test). A statistical test result was considered to be statistically significant where the *P* value was smaller than 0.05. A multivariate analysis for predicting length of stay was carried out using logistic regression.

### Results

Of the 79,547 unintentional trauma casualties included in the National Registry between 1997 and 2001, 26,921 (34%) were injured at home. This proportion was invariant over the study period [Figure 1]. Home is the most frequent place of injury occurrence for hospitalized patients included in the registry, together with roads (28%).

Of those injured at home, the larger proportions were infants and toddlers (aged 0 to 4 years) or the elderly ( $\geq 65$  years) [Table 1]. In these two age groups home injury accounted for most of their trauma injuries (62% and 57%, respectively). The overall proportion of females was 52%. Figure 2 shows an excess of females among the elderly (70%), while among children 41% were females (chi-square  $P < 0.001$ ). Among non-Jewish home-injured patients, infants predominated (50% compared to 20% among Jews). In the general population, the proportion of infants is 16% among non-Jews and

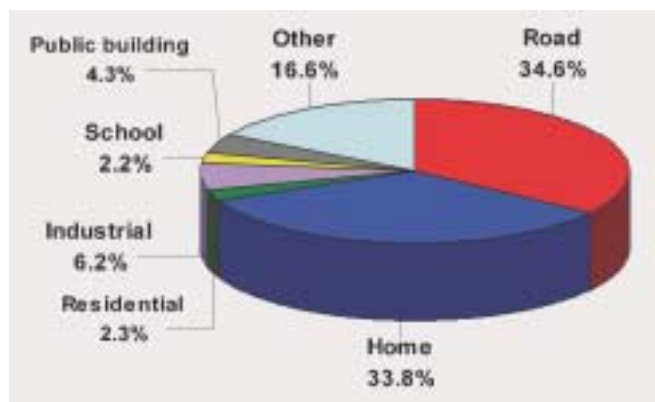


Figure 1. Place of occurrence (percentage)

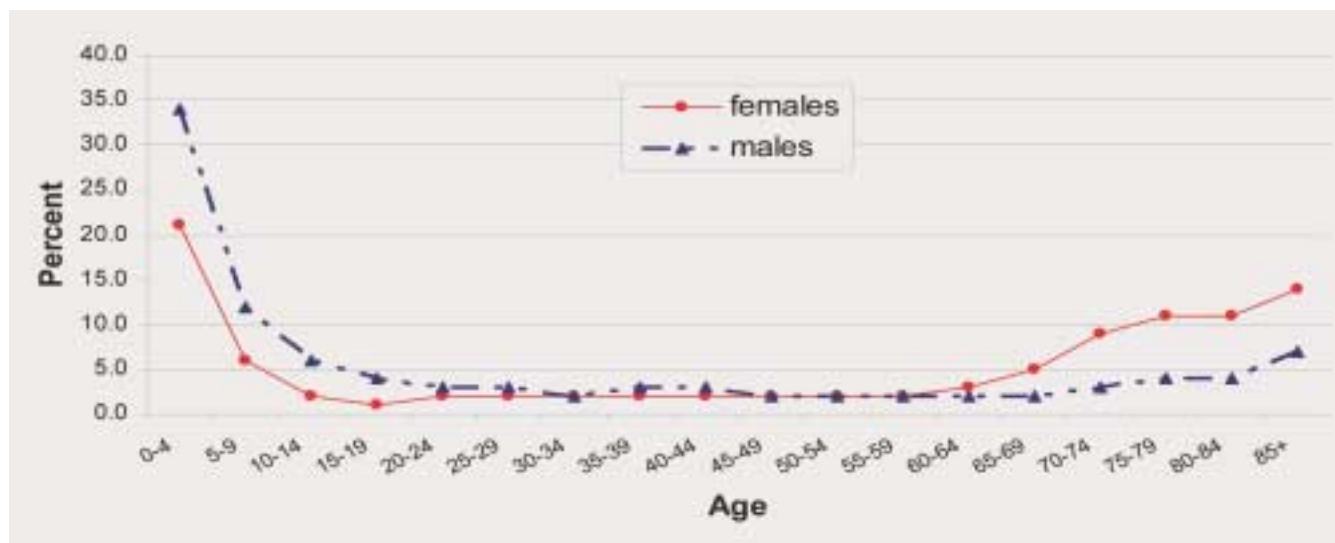


Figure 2. Distribution of home injury by gender and age (%)

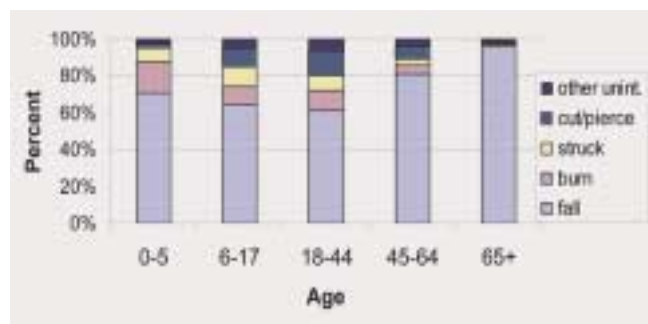


Figure 3. Relative contribution of different mechanisms to home injury in different age groups (%)

9% among Jews [10]. All age groups, except the elderly, were more prone to home accidents on weekends. School-age children are injured more frequently from March to August, a period that includes the spring and summer vacations. The elderly were injured more during the winter.

The distribution of different mechanisms by age group was found to be significantly different ( $P < 0.001$ ), as presented in Figure 3, showing that burns are more frequent among children. Seventy-nine percent of all home injuries were caused by falls [Table 1]. Among the elderly, falls accounted for 97% of all home injuries. Injuries from falls were more common among women (85% vs. 72% in men, chi-square  $P < 0.001$ ). Females were more likely to fall on ground level, such as by slipping, compared to men who fell from elevated surfaces such as ladders. Falls from heights occurred more frequently among non-Jews, 48% as compared to 31% among Jews (chi-square  $P < 0.001$ ). This discrepancy was even larger in children (0–14 years of age). Burns accounted for 9% of home injuries, with the majority of victims being children under age 4 (57%). Burns were more prevalent among non-Jews (14% vs. 7% among Jews; chi-square  $P < 0.001$ ). In terms of body region injured, injuries to the extremities were the most prevalent, with more than half of the elderly suffering injuries to the femoral neck. Overall, 29% had head

injuries, this percentage almost doubling in children aged 4 or younger, 57%.

Severity of injury was low (Injury Severity Score, ISS  $\leq$  8) in 58% of the injured [Table 1]. Age was not found to be a factor affecting the severity of the injuries. Surgery was necessary in 38% of patients

**Table 1.** Injury characteristics of study population

	n=26,921 100%*
<b>Gender</b>	
Male	47.7%
Female	52.2%
<b>Age (yrs)</b>	
0–4	27.5%
5–64	35.8%
65+	36.5%
<b>Population group</b>	
Jews	76.0%
Non-Jews	23.6%
<b>Mechanism</b>	
Falls	78.8%
Burns	8.6%
Other	12.5%
<b>ISS</b>	
Low (ISS $\leq$ 8)	57.9%
Moderate (9 $\leq$ ISS $\leq$ 14)	34.9%
Severe (16 $\leq$ ISS $\leq$ 24)	4.4%
Critical (ISS $\leq$ 25)	2.0%
<b>Surgery</b>	
Done	37.7%
Not done	62.3%
<b>Intensive care unit</b>	
Used	4.6%
Not used	95.4%
<b>Hospital stay</b>	
<3 days	41.7%
3–6 days	25.2%
7+ days	32.3%
<b>Outcome</b>	
Died	2.1%
Home	71.3%
Other**	25.7%

\* Percentages totaling less than 100% are due to up to 1% of unknown values.

\*\* Rehabilitation, institution, etc.

**Table 2.** Distribution of severity, resource utilization and outcome measures, by injury mechanism

	Overall*	Falls	Burns	Other	P value for chi-square
N	26,921	21,213	2,302	3,155	
Ambulance	40.8%	45.4%	25.9%	20.8%	<0.0001
Severity (ISS $\geq$ 16)	6.4%	6.3%	11.4%	3.4%	<0.0001
Surgically treated	37.7%	40.6%	11.5%	37.9%	<0.0001
Intensive care	4.6%	4.1%	9.8%	4.2%	<0.0001
Length of stay $\geq$ 3 days	57.5%	57.9%	75.6%	42.3%	<0.0001
Mortality	2.1%	2.3%	3.0%	0.4%	<0.0001

\* Including 251 home-injured of unknown causes.

[Table 1]. This percentage increased with age, reaching 60% in the elderly (>65 years), which was possibly due to the large proportion of fractures to the femoral neck, where 81% required surgery. Approximately 5% of the injured required intensive care [Table 1], totaling 1,788 intensive care days per year with a median of 2 days (interquartile range 1–7 days) per patient. The percentage of the injured requiring intensive care increases with the ISS score.

The clinical and resource utilization consequences of home injuries differed according to the type of injury, as detailed in Table 2. Burns, more than other type of injury, resulted in a higher proportion of severe injuries (ISS  $\geq$  16), and consequently in prolonged intensive care and overall hospital stay [Table 2], which increase the financial burden. Yet, a large part of the fall victims required surgery. The overall median length of hospital stay was 3 days (interquartile range 1–8 days)

A logistic regression was performed using length of hospitalization (0–2 days versus 3+ days) as the dependent variable, with gender, age (by units of 10 years), race (Jews vs. non-Jews), and injury mechanism (burn, fall, and others) as independent (predicting) variables. The analysis showed longer hospital stays for older patients (odds ratio for age 1.526, 95% confidence interval 1.509–1.543), non-Jews (OR 1.822, 95% CI 1.7–2.0), and patients with burn injuries (OR 7.0, 95% CI 6.2–7.9) or other mechanism injury (OR 1.173, 95% CI 1.079–1.276). Gender did not affect length of stay in this model. Hospital stay increased with the ISS score, a median of 2 days for ISS < 9 (interquartile range 1–4 days) and a median of 10 days for ISS > 24 (interquartile range 4–24 days; Kruskal-Wallis test,  $P < 0.01$ ).

The inpatient death rate was 2.1% [Table 1], with 80% of deaths occurring in patients older than 64 years. Among the survivors aged 65+, approximately 39% of the Jewish patients and 12% of the non-Jewish patients were sent to a rehabilitation institution or nursing care. Injuries to the femoral neck contributed many referrals to such institutions.

## Discussion

The objectives of this study were to delineate the epidemiology of home injury in Israel. Our finding that home injuries account for about one-third of accident-caused hospital admissions reflects the magnitude of home injuries and the damage they afflict on the public's well-being. This is especially true because our data account only for hospital-admitted patients, and because the Israel Trauma Registry data are biased towards tertiary trauma centers and more severe injuries, thus missing the majority of less severe home-related injury. Other investigators reported that only 8% of home injuries required overnight hospitalization [11]. Furthermore, the exclusion of nursing homes also skewed the data, because, among other things, it was found that institutionalized elderly are subject to four times the risk of fractures than those living in private homes [12].

It is not surprising that a large proportion of home injuries occurs in the vulnerable extreme age groups and that the predominance of falls and the resulting injuries to the extremities

OR = odds ratio

CI = confidence interval

occur in the elderly. This concurs with the observations of others regarding accidents managed in community general practices [13], in infants [14], in children [15] and in the geriatric population [16].

A prolonged hospitalization following falls in the elderly was also reported by others [17]. Therefore, fall-prevention programs directed at this population were implemented in many communities and have proven in many cases to be successful in injury prevention [18,19]. Group-based exercise was the most potent single intervention tested, and further reduction was achieved by the addition of home-hazard management or reduced vision management programs [20]. Some evidence on cost-effectiveness of home injury prevention programs was given, such as home assessment and modification to reduce falls in the elderly [21], or home visits, including the provision of discount coupons and instructions regarding safety measures to prevent childhood injury [22]. Those programs compared between-intervention group and a control group and showed a significant saving in the total cost of care for injuries. Burns appear to occur frequently among small children, especially among non-Jews. Prevention strategies should be conducted in this population, such as teaching burn-related home-safety practices. This strategy appeared to be effective in increasing the number of scald burn prevention measures implemented by parents who received instruction by public health nurses [23].

Injuries at home have far-reaching consequences – personally in terms of disability and pain, socially in terms of the family and social interaction of the injured, and economically in terms of lost work and the expenses of medical care with long hospital stay and costly surgery and procedures. Most home injuries are preventable, and increased awareness of the dangers with improved safety at home could reduce their number and severity. While injuries related to occupation or motor vehicles are treated by organizations that also assume responsibility for preventive measures, home injuries receive less attention and little is done by the public and authorities to prevent them, despite their scope and widespread effect.

Large national studies, such as the present one, can indeed provide policy makers and medical professionals with an objective yardstick for the allocation of resources and efforts to reduce trauma caused by home injuries, and induce a stronger official and voluntary involvement in their prevention.

## Conclusions

This analysis demonstrated patterns of circumstances and profiles of people who sustain injuries at home. Groups at high risk for home injuries are the elderly (falls), children (burns) and non-Jewish children (falls and burns). Prevention programs should therefore be based on these findings and should focus on the vulnerable groups and the type of injury.

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**Correspondence:** Dr. K. Peleg, Gertner Center, Sheba Medical Center, Tel Hashomer 52621, Israel.  
Phone: (972-3) 530-3926  
Fax: (972-3) 535-3393  
email: [kobip@gertner.health.gov.il](mailto:kobip@gertner.health.gov.il)