

# Deaths Due to Home Accidents Between 2005 and 2012 in İzmir

## İzmir'de 2005-2012 Arası Ev Kazalarına Bağlı Ölümler

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**ABSTRACT Objective:** The aims of this study were to characterize home accident-related deaths in İzmir, and to make a projection for preventive measures inspired by the causes of home accident related deaths. **Material and Methods:** In this study we retrospectively reviewed autopsy reports of deaths due to home accidents for seven years (from January 01, 2005 to December 31, 2012) performed by the İzmir Morgue Department of the Council of Forensic Medicine of Turkey. **Results:** Out of 636 cases, 59.7% were males. The mean age of the victims was 48.6±27.7 years. Majority of the cases were older than 75 years of age, followed by children younger than 4 years of age. The living-room and hall were found to be the main risky parts of home in both sexes. Home accidents mostly occurred in winter (39.2%), especially in January (13.8%) and December (12.9%). Poisonings were the primary cause of death in home accidents (36.5%), in especially carbon monoxide poisonings (32.7%), followed by burns, scalds, or electrocutions (31.4%), blunt traumas (24%), and asphyxias (7.7%). **Conclusion:** In literature, there are many articles about home accident exposure of the living victims; however, articles on the cause of death in home accidents are very limited. Most of home accidents can be prevented and many people can survive if legal, educational, economical, and structural measures based on the risk factors are taken to prevent home accidents.

**Key Words:** Accidents, home; poisoning; cause of death; forensic medicine

**ÖZET Amaç:** Bu çalışmanın amacı, İzmir'de ev kazalarına bağlı ölümleri tanımlamak ve ev kazalarına bağlı ölümlerin nedenlerinden yola çıkarak önleyici tedbirler için bir projeksiyon yapmaktır. **Gereç ve Yöntemler:** Adli Tıp Kurumu İzmir Morg İhtisas Dairesi'nde yedi yıl içinde (1 Ocak 2005 ile 31 Aralık 2012 arasında) gerçekleştirilen ev kazalarına bağlı ölümlerin otopsi raporları geriye dönük olarak gözden geçirildi. **Bulgular:** 636 olgunun, %59,7'si erkekti. Mağdurların yaş ortalaması 48,6±27,7 yıl idi. Olguların çoğu, 75 yaş ve üstünde olup; bunu 4 yaş ve altındaki çocuklar izlemekteydi. Oturma odası ve salon, her iki cins için evin en riskli bölümleri olarak bulundu. Ev kazaları çoğunlukla kışın (%39,2) özellikle de Ocak (%13,8) ve Aralık (%12,9) aylarında meydana gelmişti. Zehirlenmeler (%36,5), özellikle karbon monoksit zehirlenmeleri (%32,7), ev kazalarında ölümlerin başlıca nedeni olup; bunu yanıklar, haşlanmalar veya elektrik çarpmaları (%31,4), künt travmalar (%24) ve asfiksiler (%7,7) izlemekteydi. **Sonuç:** Literatürde, yaşayan mağdurların maruz kaldıkları ev kazaları hakkında birçok makale bulunmasına karşın, ev kazalarına bağlı ölümler hakkındaki makale sayısı oldukça sınırlıdır. Ev kazalarının çoğu önlenebilir olup ev kazalarını önlemek için risk faktörleri esas alınarak, yasal, eğitsel, ekonomik ve yapısal önlemler alındığı takdirde, birçok kişi hayatını kaybetmeyecektir.

**Anahtar Kelimeler:** Kazalar, ev; zehirlenme; ölüm nedeni; adli tıp

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Accidents occurring in or around a dwelling are defined as "home accidents".<sup>1,2</sup> Home accidents began to attract the attention of health professionals in 1930s. The New York State Department of Health

entered the field of home accidents in 1942 with the establishment of a safety program in its Office of Public Health Education.<sup>3</sup> In 1949, Armstrong and Cole reported the results of two studies conducted in the United States and Canada between 1940-1941 and 1948-1949. They mentioned a study performed in the Cook County, Illinois, in 1935-1936.<sup>4</sup> A study conducted between 1932 and 1948 in New York City reported that among all accidents, home accidents were the primary cause of death and there was no reduction in the rate of home accident related deaths over 16 years while the death rates of other accidents were reduced.<sup>5</sup> According to vital statistics of the United States-1955, as reported by Haggerty, the rate of home accidents ranged from 51-56% for 10 to 14 years of age to 91-93% for children under 1 year of age.<sup>6</sup> Tibboni reported that approximately half of all accidental deaths in Philadelphia as of 1952 were due to home accidents.<sup>7</sup>

Despite years having passed since these first studies and all efforts to prevent home accidents, home accidents currently continue to be an important cause of death for young children and elderly and a major public health problem worldwide.<sup>8-11</sup> It was reported that, upper middle-income economies were at higher risk for fatal home injuries compared to high-income economies.<sup>12</sup> The ratio of home accidents to all accidents has been reported 41.4% in North Ireland, 23.4% in Attica, Greece, and 23.5% and 26% in the whole population and among the age group 0-19, respectively in Sweden.<sup>13-16</sup> According to 2 studies conducted in Ankara, the annual ratio of the home accidents to all accidents was 40%, and 37.9% of children aged 0 to 6 years had a history of a home accident.<sup>9,17</sup> It was reported that about one third of adult injuries in the United Kingdom occur at home.<sup>18</sup> In Aydın, 38.6% of elders had a type of home accident within the calendar year 2004.<sup>19</sup> It was reported that over 3 million people suffer home accidents annually in Italy, a figure that continues to rise.<sup>20</sup> The incidence of home accidents among all household was reported as 0.9% and 1.3% in Adana, 1.7% in India, 2.7% in Belgium, and 13.6 % in Kocaeli.<sup>21-25</sup> Gaillard and Herve ex-

plained that “household injuries were serious, with a prehospital mortality rate of nearly 5% and intensive care treatment in one-third of cases in Paris”.<sup>26</sup> It was also reported that 39% of children aged 0 to 9 years exposed to home accidents in Mexico were in a clinical condition severe enough to require medical treatment, and 51% were hospitalized.<sup>27</sup> Mantero et al. reported that more than one-third of all accidental deaths in Italy occurred at home.<sup>28</sup> Approximately 350,000 people admitted to emergency departments, and 25,000 hospitalizations and 750 deaths occur due to home or leisure time accidents each year in Israel.<sup>29</sup> In the United States, at least three million people seek medical advice for a home accident related injury each year.<sup>30</sup> The rate of non-fatal home accidents requiring medical treatment was reported 10.8% in Aksaray.<sup>31</sup> The mortality rate of home accidents among all autopsied cases in Istanbul, was 3% in whole population and 26% among those under the age of 18 years.<sup>32</sup> Farchi et al. reported a home accident related mortality rate found 31.1/100,000 in Rome, Italy.<sup>33</sup> In New Zealand, the rate of death from home injury was reported 13/100,000 per year between 1989 and 1998 among children under five years of age.<sup>34</sup>

In a study from Norway, Kopjar et al. reported that “the average per-injury cost of medical treatment was considerably higher for persons aged 65 years and older, than for persons less than 65 years (\$2,504 and \$341, respectively). The estimated average (indirect) cost of lost work time per injury in the 12-month period after injury was \$1,342 among people aged 25-64 years. The aggregate annual direct and indirect costs in the 12 months after injury were approximately \$3 million or \$1,300 per case.<sup>35</sup> Approximately 10% of all public health costs in Sweden and France were a result of home accidents.<sup>16,26</sup> It is estimated that the overall cost of home accidents is £78 million to £80 million per annum in North Ireland.<sup>13</sup>

The actual rate of home accidents cannot be accurately estimated because of an excess of unreported cases which resemble an underwater part of an iceberg.<sup>22</sup> A section indicating the location and cause of death are not included in death certificates

in Turkey, and thus it is impossible to ascertain the actual number of deaths due to home accidents. Deaths due to accidents at home rarely capture the media headlines and there is a sense of inevitability about them.<sup>30</sup>

In literature, there are many articles about home accident exposure of the living victims; however, articles on the cause of death in home accidents are very limited. The aims of this study were to characterize domestic, accident-related deaths in Izmir, and to make a projection for preventive measures inspired by the causes of home accident related deaths.

## MATERIAL AND METHODS

In this study, autopsy reports of deaths due to home accidents for seven years (from January 01, 2005 to December 31, 2012) performed by the Izmir Morgue Department of the Council of Forensic Medicine was retrospectively reviewed. Next, the incident scene investigation data and information obtained from eyewitnesses were reviewed for additional information to what was recorded in the autopsy reports. The population of Izmir was 4.005.459 as of 2012 according to Turkish Population Statistics. Of Izmir population, 24.7% were equal to or younger than 18 years and 9.1% were equal to or older than 65 years.

Deaths due to home accidents were classified into six main groups according to the system modified by Asirdizer et al.:<sup>32</sup>

1. Poisonings by solid/liquid and gaseous compounds;
2. Burns, scalds, or electrocutions;
3. Blunt traumas;
4. Asphyxias;
5. Firearm wounds;
6. Stab and perforating tool wounds.

As the second step, the cause of accidents, types of fatalities according to age groups and gender, high-risk areas at home, as well as household items and activities leading to accidents were investigated.

As the third step, risk coefficients (RC) by age group and gender were calculated using the data on the death figures classified by age groups for Izmir population obtained from web pages of the Turkish Statistical Institute (TURKSTAT) of the Republic of Turkey. For the calculation of RCs, the following formula was used:

$$\text{RC} = \frac{\text{Number of deaths (for seven years) due to home accidents in each age group}}{\text{Total number of deaths (for seven years) occurred in Izmir in each age group}} \times 100$$

Deaths at home due to homicidal or suicidal origin as well as fatalities not identified as accidental were investigated in the group; natural deaths (cancer, heart attack, etc.) were not included in the study. However, deaths by drug or alcohol overdose identified as unintentional, were included in the home accident group.

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Chi-square test, McNemar paired test, and Fisher's exact test were used for the statistical analyses. A "P" value less than 0.05 was considered statistically significant.

## RESULTS

Total number of deaths related to home accidents was 636 and their ratio among all deaths autopsied in the Izmir Morgue Department of the Council of Forensic Medicine decreased at the period between 2006 and 2012 (4.3% in 2005 vs 3.5% in 2012) ( $p < 0.001$ ). The highest death rate was seen in 2006 (6.1%) (Figure 1). In this study, the annual death rate due to home injury was 3/100,000 in Izmir between 1995 and 2012.

Of 636 deaths related to home accidents, 380 (59.7%) cases were male and 256 (40.3%) were female ( $p < 0.001$ ). The mean age of all victims was  $48.6 \pm 27.7$  years (median: 51; range: 0-101 years). The mean ages of the male and female victims were  $46.6 \pm 26.4$  years (median: 50; range: 0-96 years) and  $51.6 \pm 29.3$  years (median: 56; range: 0-101 years), respectively. Most of the cases who deceased due

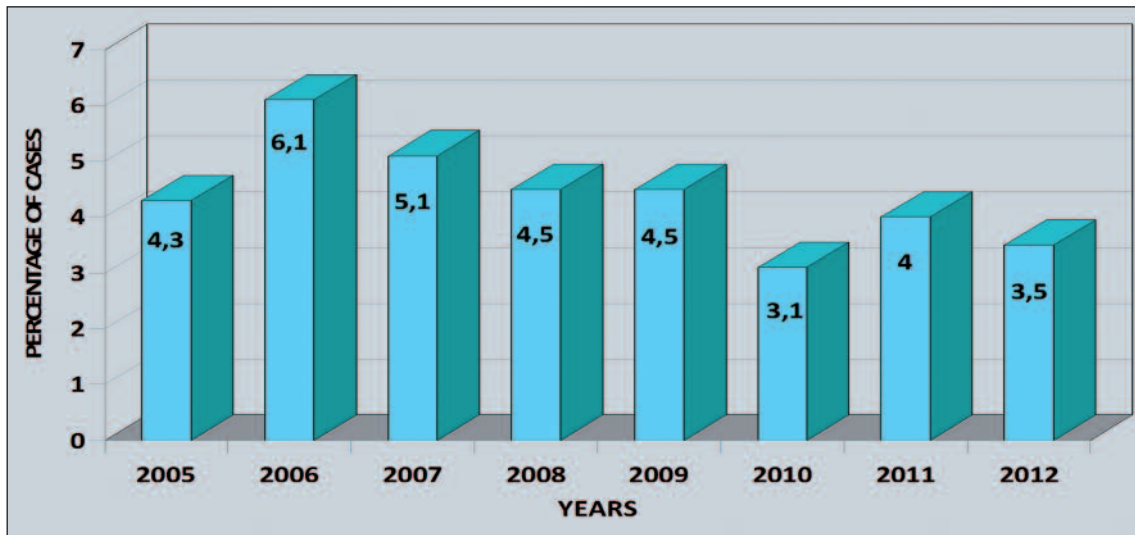


FIGURE 1: Distribution of cases according to years.

to home accidents (n=158, 24.8%) were older than 75 years, followed by children younger than 4 years (n=66, 10.4%) ( $p<0.001$  for both genders). RC was highest for persons aged 5-9 years (RC=5.00), for males among persons aged 5-9 years (RC=6.69), and for females among persons aged 15-19 years (RC=5.11) ( $p<0.001$ ) (Table 1).

The majority of deaths due to home accidents occurred in the accident scene (n=564, 88.7%), followed by deaths in the hospitals (n=65; 10.2%), and in the ambulances (n=7; 1.1%) ( $p<0.001$ ). When home accidents were classified according to the part of the house and gender, the following data were obtained (Table 2): living rooms and halls

TABLE 1: Distribution of cases according to gender and age groups.

Age Groups (years)	Male			Female			Total		
	n	%	RC*	n	%	RC*	n	%	RC*
≤4	42	11.1	1.45	24	9.4	0.96	66	10.4	1.22
5-9	16	4.2	6.69	7	2.7	3.17	23	3.6	5.00
10-14	7	1.8	2.47	6	2.3	2.99	13	2.0	2.69
15-19	10	2.6	1.68	15	5.9	5.11	25	3.9	2.82
20-24	11	2.9	1.40	8	3.1	2.33	19	3.0	1.68
25-29	16	4.2	1.73	10	3.9	2.23	26	4.1	1.89
30-34	16	4.2	1.43	14	5.5	2.35	30	4.7	1.75
35-39	21	5.5	1.56	10	3.9	1.27	31	4.9	1.45
40-44	21	5.5	1.06	8	3.1	0.75	29	4.6	0.95
45-49	25	6.6	0.71	10	3.9	0.57	35	5.5	0.66
50-54	37	9.7	0.65	12	4.7	0.48	49	7.7	0.59
55-59	25	6.6	0.32	9	3.5	0.25	34	5.3	0.30
60-64	19	5.0	0.20	10	3.9	0.21	29	4.6	0.20
65-69	22	5.8	0.21	11	4.3	0.18	33	5.2	0.20
70-74	21	5.5	0.17	15	5.9	0.16	36	5.7	0.17
75-75+	71	18.8	0.18	87	34.0	0.19	158	24.8	0.18
Total	380	100.0	0.39	256	100.0	0.32	636	100.0	0.35

\*: RC: risk coefficients.

**TABLE 2:** Distribution of cases according to gender and of home accident scenes.

Home Accident Scenes	Males		Females		Total	
	n=380	%	n=256	%	n=636	%
Living Rooms	182	47.8	124	48.4	306	48.1
Roofs & Terraces & Gardens	52	13.7	20	7.8	72	11.3
Bathrooms	31	8.2	36	14.1	67	10.5
Corridors & Stairs & Larders	39	10.3	19	7.4	58	9.1
Balconies	35	9.2	15	5.9	50	7.9
Bedrooms	29	7.6	21	8.2	50	7.9
Kitchens	12	3.1	21	8.2	33	5.2

were found to be the primary areas with particular risk (n=306; 48.1%) (p<0.001) for both genders; followed by roofs & terraces & gardens (13.7%), corridors & stairs & larders (10.3%) and balconies (9.2%) for males (p<0.001) whereas bathrooms (14.1%), bedrooms (8.2%) and kitchens (8.2%) followed living rooms and halls in females (p<0.05).

It was found that most of home related accidents occurred in winter (n=249; 39.2%) (p<0.001), especially in January (n=88; 13.8%) and December (n=82; 12.9%) (p<0.001) (Table 3). In summer time, the death rate decreased to the lowest level (n=103; 16.2%). The majority of home accident related injuries occurred between midday and 05.59 p.m. (n=182; 28.6%), followed by the period between 06.00 a.m. and midday (n=174; 27.4%), and the period between 06.00 a.m. and midnight (n=163; 25.6%). The fewest injuries occurred between midnight and 05:59 a.m. (n=117; 18.4%) (p<0.005).

In this study, poisonings by solid/liquid and gaseous compounds were found to be the primary cause of death in home related accidents (n=232; 36.5%). They were followed by burns, scalds, or

electrocutions (n=200; 31.4%), blunt traumas (n=153; 24%), and asphyxias (n=49; 7.7%) (p<0.001) (Table 4). Firearms (0.2%) and sharp objects (0.2%) were causes of deaths each in of two cases.

#### POISONINGS BY SOLID/LIQUID AND GASEOUS COMPOUNDS

Among 232 cases of intoxication, carbon monoxide was involved in 208 (89.7%) (p<0.001) (Table 4). It is the leading cause of all home accidents, accounting for 32.7% of all cases. The majority of those who suffered from carbon monoxide poisoning inhaled smoke from coal stoves (n=127; 61.1%) (p<0.001). The source of carbon monoxide was gas water heaters in bathrooms, kitchens, and larders in 43 (20.7%) cases. Other sources were fires (n=20, 9.6%), catalytic gas stoves (n=10, 4.8%) and gas stoves (n=4, 1.9%), and oil lamps (n=1, 0.5%). All poisonings were due to improper usage of the devices or carelessness. In 3 (1.4%) cases who were hospitalized due to domestic carbon monoxide poisoning and died later no information was available with respect to the carbon monoxide source. Carbon monoxide poisoning by inhalation of smoke

**TABLE 3:** Classification of home accidents according to months.

Months of Home Accidents	n	%	%	Months of Home Accidents	n	%	%
December	82	12,9	39,2	June	34	5,3	16,2
January	88	13,8		July	36	5,7	
February	79	12,4		August	33	5,2	
March	62	9,8	23,9	September	28	4,4	20,7
April	48	7,6		October	46	7,2	
May	42	6,6		November	58	9,1	



**TABLE 4:** Classification of home accidents according to causes of deaths.

Cause of Deaths	n	%
Poisonings by Solid/Liquid and Gaseous Compounds	232	36.5
Carbon monoxide poisoning	208	89.7
Drug poisoning	8	3.4
Pesticide poisoning	8	3.4
Alcohol poisoning	5	2.2
Poisoning with corrosive chemicals	3	1.3
Burns, scalds, or electrocutions	200	31.4
Large flame burns	143	71.5
Electrocutions	34	17.0
Local flame burns	14	7.0
Scalds	5	2.5
Mixed burns	4	2.0
Falls and blunt traumas	153	24.0
Falls	146	94.8
Other blunt traumas	8	5.2
Drowning and other asphyxias	49	7.7
Food, stomach content, or foreign body aspiration	27	55.1
Drowning	17	34.7
Other asphyxias	5	10.2
Firearm wounds	1	0.2
Accidental gunshot wound	1	100.0
Stab and perforating tool wounds	1	0.2
Tetanus due to rusty nail injury	1	100.0

from coal stoves led to the deaths of 4 persons in one residence. Furthermore, there was more than one victim in 5 houses.

Five (62.5%) of eight cases who were unintentionally exposed to excessive alcohol or overdose of medical drugs died. All of them were children under the age of 10. Three (37.5%) cases injected overdose heroin. All of them were males aged 18 to 61.

Eight cases deceased due to accidental pesticide poisoning due to ingestion of several pesticides including organophosphates (n=4; 50%), endosulphanes (n=3; 37.5%) and methomyl (n=1; 12.5%) stored in different bottles. Four of them were under the age of 12 years and four cases were adults.

Four cases consumed counterfeit spirits including methyl alcohol; one case consumed excessive ethyl alcohol.

Three cases were poisoned with cleaning detergents containing corrosive chemicals. Two of them were under the age of 7 years and one case was at the age of 80 years.

### BURNS, SCALDS, OR ELECTROCUTIONS

More than the half of deaths related to “burns, scalds, or electrocutions” occurred due to flame burns during fires (n=143; 71.5%) (p>0.001) (Table 4). Additionally, there were accompanying smoke inhalation in 61.5% (n=88). In this study, causes of fires could not be ascertained because firefighter reports were missing among other incident scene investigation reports.

Majority of the electrocutions (n=22; 64.7%) occurred in the indoor areas of houses. Other places include (n=12; 35.3%) garden, roof, and barn (p>0.05): Sixteen (47.1%) accidents occurred due to electric leakage from electrical appliances, unprotected wall sockets, and bare wires, 6 (17.6%) accidents while repairing something on the rooftop, 6 (17.6%) accidents while repairing electrical appliances and machines at home, 5 (14.8%) accidents while gardening, and 1 (2.9%) accident while milking cattle in the barn.

Seven (50%) of deaths related to local flame burns occurred during fires. Four (28.6%) cases were burned by flames of paint thinner poured into a burning stove while 3 (21.4%) cases, including one patient with epilepsy having fallen on the stove.

Five cases were scalded with hot liquids like tea, water, and coffee which were poured off from tables, benches, and stoves.

Four cases with mixed burns were injured by explosion of liquefied petroleum gas (LPG).

### BLUNT TRAUMAS

A vast majority of cases with “blunt traumas” were secondary to falls (n=146; 94.8%) (p<0.001). Falls were “from balconies and terraces” in 60 (41.1%) cases, “off the stairs” in 35 (24%) cases, “on the ground slipping or stumbling” in 19 (13%) cases, “off rooftops” in 13 (8.9%) cases, “out windows” in 12 (8.2%) cases, “down elevator shafts”

in 3 (2%) cases, “down a well” in 1 (0.7%) case, “off a crib” in 1 (0.7%) case, “off a chair” in 1 (0.7%) case, and “off a tree in the garden” in one case (0.7%).

Three of other blunt trauma cases stayed underneath and struck by heavy objects, namely a coat stand, a television, and a wardrobe. Heavy objects, namely a cooker, a chandelier, and a stepladder topple on three cases. One case was trapped under rubble during excavation of a canal in the garden while one case was trapped under a collapsed roof.

### ASPHYXIAS

More than the half (n=27; 55.1%) of deaths related to asphyxias occurred with aspiration of food, stomach content, or foreign bodies (p>0.005). Seventeen (63%) cases aspirated some food, 6 (22.2%) cases aspirated a foreign body, and 4 (14.8%) cases aspirated stomach content. Seventeen of people having aspirated were children under the age of 9 years. Two of 10 adults were mentally retarded. Two adults were above the age of 65 years. Three adults were drunk. In two adults who aspirated food and one adult who aspirated stomach content, the etiopathogenesis of aspiration could not be determined.

Drowning (n=17; 34.7%) was the second most common cause of asphyxias. Eleven (64.8%) cases were drowned in the garden pool of the house. Four (23.5%) children under the age of five drowned in the tubs or water bucket in the bathroom. Two children (11.7%) who aged 4 and 8 years were drowned in the water wells in the garden.

Two children who aged 1 and 2 years were accidentally strangled with swing rope and electrical cable, respectively. Two children who aged 3 and 5 got their neck compressed between balcony railings. A 42-year-old man deceased from anaphylaxis and asphyxia as a result of epiglottic edema due to bee sting.

### FIREARM WOUNDS

A 5-year-old boy was accidentally shot by a gun while an adult was cleaning the gun.

### STABBINGS AND SHARP OBJECT WOUNDS

A 64-year-old woman was injured by sinking the nail in the hencoop in the garden. After eight days she deceased from tetanus. No additional deaths were observed due to stabbing in this series.

### DISCUSSION

This study showed that annually 3 of every 100,000 people deceased due to home accidents and an average of 4.4 % of all medico-legal deaths in Izmir was related to home accidents each year between 2005 and 2012. Although their ratio among medico-legal deaths decreased in the period between 2006 and 2012, it was higher than the rate (3%) reported by a study performed in Istanbul between 2006 and 2012.<sup>32</sup>

In previous studies, no dominance of males or females has been reported with respect to injuries or deaths in home accidents. A female dominance over men with a ratio of 52% to 75,9% has been reported in some studies whereas some other studies have reported a male dominance over women, with a ratio of 53.3% to 66%.<sup>1,8,13,17,21,22,25-28,32,34,36,37</sup> In the present study, 62.2% (n=258) of the victims were males.

Children, elderly, and the disabled constitute the most important risk groups for home accidents.<sup>1</sup> It was reported that children between the age of 0 and 6 are often exposed to domestic accidents because they are not developed enough to avoid danger and protect themselves from accidents. They need the help of an adult for creation of a safe environment for them and to be protected from accidents. The risk of exposure to home accidents increases in the elderly because they spend a large proportion of their time at home.<sup>2,10</sup> In the present study, in the evaluation of numerical and proportional values, 24.8% of deaths related to home accidents occurred at an age of 75 years or above, 10.4% at an age of 4 years or below. Nonetheless, evaluation of RC values provided information that 5-9 year age subgroup in a broader age group of 5-19 years is at particular risk in terms of home accidents. It has also been reported that children younger than 18 years are under the increased risk of home accidents.<sup>32,38</sup>

Farchi et al. reported that 0.1% of injured persons died before hospitalization, 8.1% were hospitalized, and 92.8% were medically treated at home; the mortality rate was 4.7% among hospitalized patients.<sup>33</sup> In the present study, the vast majority of deaths occurred before the arrival of the injured person to hospital (n=571, 89.8%). This result showed that home accidents in Turkey are serious ones which should not be ignored. We think that the difference between the mortality rates before or during hospitalization was brought about by several factors including the type of accident (such as the high rate of carbon monoxide poisoning in our series), cultural and socio-economic factors, the extent and effectiveness of the security measures at home, the level of first aid knowledge of the household, and the extent and effectiveness of ambulance services. In general, home accidents were accepted lethal accidents. It was reported that home accidents were the second most common cause of death of injured children and adolescents in Paris, second after traffic accidents.<sup>26</sup>

When the relationship between home accidents and the part of home was investigated, it was clear that that living rooms were primary accident scene (n=306; 48.1%), a finding that was in accordance with most of the previous study results (30.2% to 70.6%), with the exceptions of the kitchen (22.2%) in one study and the bedroom (39.6%) in one other.<sup>1,8,11,22,25,31,32,39</sup> The roofs & terraces & gardens (13.7%), corridors & stairs & ladders (10.3%), and balconies (9.2%) were the secondary risky parts in males, whereas the bathrooms (14.1%), bedrooms (8.2%), and kitchens (8.2%) were the secondary risky parts in females. This difference may be explained by different roles of men and women at home.

The relationship between home accidents and the time of accidents has been rarely studied before. In the present study, it seems that most of home related accidents occurred in winter (n=249; 39.2%), especially in January (n=88; 13.8%) and December (n=82; 12.9%). This result was in line with high rates of death due to carbon monoxide poisoning caused by coal stoves in the study group. Winter and autumn was also defined as risky sea-

sons in three separate studies made in Manisa and Kocaeli whereas summer and spring were the most risky seasons in two other studies conducted in Adana.<sup>10,21,22,25,38</sup> This was possibly because Adana region has a Mediterranean climate in which winters are tepid and summers are extremely hot; thus, use of coal-burn stove is not common in this region. In agreement with the previous studies, there was a correlation between the timing of home accidents (56% between 06:00 a.m. and 5.59 p.m.) and time interval when people are active.<sup>22,25,38</sup>

Most of deaths due to home accidents occurred due to poisonings by solid/liquid and gaseous compounds (n=232; 36.5%), followed by burns, scalds, or electrocutions (n=200; 31.4%), blunt traumas (n=153; 24%), and asphyxias (n=49; 7.7%). In the literature, primary causes of accidents in the surviving victims have been reported as falls (31.9% to 78.8%), incisions (34.4%), and burns (39.1%).<sup>1,9-13,17,19,21-23,25-27,29,30,31,35-38</sup> In the limited number of articles about cause of death due to home accidents, primary causes of deaths was defined as "poisoning with solid, liquid or gaseous compounds" (43%), and falls (67%).<sup>32,36</sup> The reason for this difference can be explained by an excess of carbon monoxide poisoning in the present series and more fatality of carbon monoxide poisoning than most other home accidents.

Eighty-nine point seven percent of 208 cases of intoxication involved carbon monoxide poisoning. Carbon monoxide poisoning has shown a decrease trend in developed countries owing to appropriate measures and technological facilities whereas it is still a major cause of home accidents in developing countries.<sup>32</sup> Poisoning from conventional coal stoves was more frequent (61.1%), followed by gas appliances (27.4%). However, coal stoves were used in the province of Izmir, whereas gas appliances were used in the center of Izmir. Additionally 9.6% of victims died due to inhalation of fire smoke. Several factors including insufficiency of natural gas transportation system in the province, improper use and installation of coal and gas appliances, lack of smoke detectors, and lack of ventilation systems in houses were determined as risk factors for carbon-monoxide intoxications by



this study. Other poisonings included 5 overdoses of medical drugs, 3 overdoses of narcotic drugs, 8 pesticide poisonings, 4 methyl alcohol intoxications, 1 ethyl alcohol intoxication, and 3 poisonings with corrosive chemicals. Improper storage of medical drugs, pesticides, cleaning detergents containing corrosive chemicals, counterfeit spirits, and misuse of alcohol and narcotics were accepted as risk factors for other poisonings. However, it was reported that, a considerable portion of home accidents due to intoxication can be prevented by improving storage conditions of dangerous chemicals (solvents, detergents, pesticides) and storing medical drugs in the locked cabinets.<sup>2,32</sup>

One hundred and fifty people were killed in fires. In the majority of homes in Turkey, smoke detectors, fire extinguishers and fire extinguishing systems are not available, whereas only 27% of families in the United States do not have smoke detectors in their homes.<sup>40</sup> Carelessness, ignorance, and disease were other causes of deaths due to burns. Additionally 22 victims died due to electrocutions. Several factors including improper use and installation of electrical appliances and machines, improper maintenance of electrical devices, unprotected wall sockets, the exposed, bare wires, repair of electrical appliances by unauthorized personnel were accepted as risk factors for electrocutions in this study.

Among 153 people killed by blunt trauma, a vast majority (94.8%) were killed as a result of falls. This rate was reported as 88.1% in the home accidents involving children and adolescents.<sup>32</sup> Indeed, falls were reported as the primary cause of home accidents in many studies.<sup>1,9-11,13,17,19,21-23,26,27,29-31,35-38</sup> In this study, loosely fixed household appliances, construction errors, and excavations without adequate security measures were found to be other risk factors for blunt traumas.

For 27 cases of aspiration, 17 cases of drowning, and 5 cases of other asphyxias the risk factors were defined as small parts of toys and granular foods such as bean which can be easily ingested by young children unless they are attended by an adult, unprotected pools and wells, water collec-

tions in the tubs and buckets in the bathrooms, exposed swing ropes and electrical cables, and balcony railings. These factors were also reported in previous studies.<sup>2,9,32</sup> In a study made in 16 European countries, accidental drowning and submersion was reported as primary cause of home accident-related deaths.<sup>12</sup>

A 5-year-old boy in our study was accidentally killed by an adult while he was cleaning a gun. Many families possessing firearms were not aware of the risk of these weapons unless they were stored properly and kept out of the reach of children.<sup>32</sup>

A 64-year-old woman in our study died due to tetanus at 8<sup>th</sup> day following an injury with a nail in the hencoop in the garden. She would have been still alive if she had been regularly vaccinated.

Several measures were recommended in literature to prevent home accidents. These are: (1) identification of risk factors and potential hazards according to the psychological and motor development phases of the household; (2) providing educational activities for household, caregivers and servants serving in the house; (3) specification of home safety measures in laws and regulations; (4) designing and building of homes in accordance with security regulations; (5) production of home appliances and devices in accordance with the safety regulations; (6) inclusion of specific safety instructions for home appliances and devices; (7) proper labeling and storage of chemicals; (8) establishment of a home safety inspection system; (9) regular monitoring of home security by inspectors and (10) providing financial support for families to take adequate indoor security measures.<sup>2,32,38</sup>

## CONCLUSION

In this article, carbon monoxide poisonings were found to be the leading cause of all home accidents, accounting for 32.7% of all cases, unlike a lot of information in the literature. Living rooms and halls were primary risky areas for elders and children, in especially. Risk factors were determined for deaths due to home accidents unlike many previous studies evaluating the survivor victims.

In reality, home accidents which are an important public health problem in developing countries, rarely draws attention of medical scientists, public authorities and media because of these accidents are isolated incidents which occur behind closed doors. The determination of actual number of home accidents is possible with a detailed scene investigation. In this stage, the forensic nurse examiners can play a major role for death investigation to examine the scene of death, the circumstances of death, interview witnesses, family or caretakers and review the medical history from a forensic medical perspective as opposed to police who have no medical education. Thus, the research data that is missing in a vast number of cases can be well documented and organized for

the systems of death investigation. This method is used from 1970s in the United States of America and from 1993 in United Kingdom medical examiner's and coroners systems where forensic nurse examiners assist forensic pathologists in this manner.<sup>41</sup>

Most of home accidents can be prevented and many people can survive if legal, educational, economical, and structural measures based on the risk factors are taken to prevent home accidents.

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