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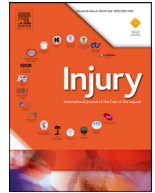
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Tip-over injuries among children: Data from an urban emergency department of Karachi, Pakistan

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ABSTRACT

Introduction: Most unintentional injuries among children occur in the home environment. Tip-overs, defined as incidents where heavy objects fall on children due to some type of interaction, are one of the reasons for injuries inside the home. This study aims to determine injury patterns and outcomes for child injuries resulting from tip-overs in the home environment as reported in the emergency department.

Methods: We performed a retrospective chart review of pediatric (under 18 years) tip-overs injuries occurred in years 2010 to 2015 at the Aga Khan University Hospital. Furthermore, parents of injured children participated in phone interviews to provide information about the injury scene. File review and telephonic interviews were conducted in the year 2015 and 2016.

Results: A total of 75 children visited the emergency department with tip-over injuries, out of which 55 (73%) were boys. The majority of incidents (75.5%) happened inside the home, and the most common places were the living room and bedroom (32% and 21% respectively). More than half (53%) of the children were not under adult supervision at the time of the incident and less than half (47%) of the household took safety measures after the incident. Tip-over injuries were common among 3-year-old children with decreasing frequency as children grew older. The most common causes of tip-overs were TV/TV trolley (32%), followed by furniture (28%), and wall and roof (23%). The most common sites of injuries were head ($n = 33$, 44%) and extremities ($n = 33$, 44%). A majority of the cases ($n = 66$, 88%) were admitted to the hospital from the emergency department, under care of both general ($n = 51$, 68%) and critical care units ($n = 15$, 20%). More than a quarter ($n = 27$, 36%) required at least one surgical procedure during their hospital stay. The median length of hospital stay was one day (interquartile range, IQR 1–5 days). There were two cases of mortality (3%).

Conclusion: Most tip-over injuries among children were caused by TV, furniture, and TV trolleys. These injuries can be prevented with public education around home safety measures, such as mounting them on the wall.

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Introduction

Injury is a major cause of in-house childhood deaths, especially in younger children [1]. Globally, children spend a significant portion of their time inside the home, exposing them to various injury hazards [2]. Every year more than 875,000 children under the age of 18 die because of injuries [3,4], most of which are unintentional and can be prevented and controlled [3–6]. In low-to-middle-income countries (LMICs), the mortality risk for children as a result of injuries is threefold that of children in high-income

countries (HICs) [4,7]. According to a World Health Organization (WHO) report, Pakistan has one of the highest rates of unintentional injuries in the pediatric age group [8].

In the United States (US) alone, over 25,000 children are treated in emergency departments (EDs) every year for tip-over injuries caused by furniture, televisions (TVs), or appliances. In addition, from 2000 to 2019, there were over 500 tip-over-related fatalities reported [9]. In recent decades the number of furniture tip-over injuries among children and adolescents grew by more than 40% [10,11]. Studies have revealed that most injuries take place when children try to climb or run to reach or grab devices such as a trolley (with wheels attached to poles), dresser or bookcase. Such actions can lead to objects falling and striking injuries [3,12]. Tip-over injuries can be severe and even fatal [1,7,13]. A retrospective

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study from two pediatric emergency departments in Sydney, one of Australia's largest cities, reported more than 100 childhood deaths between 2000 and 2003 from heavy furniture falling on children [13]. Amongst this heavy furniture, TV sets are listed as the third leading hidden hazard for children inside the house [1]. According to a recent study of emergency room records in the US, the number of kids injured by a TV falling on them grew 125 percent between 1990 and 2011 [14].

Although there are some epidemiological data on tip-over injuries, an updated epidemiologic injury trend is needed following global safety initiatives, such as the ASTM International Voluntary Safety Standard for Clothing Storage Units (ASTM F2057) [15], and changes in TV technology, making them lighter in weight, and shifting from heavy cathode ray tubes (CRTs) to digital flat-screens. These kind of epidemiological studies are significant both for high and low-income countries to identify the gap in consumer safety measures, to protect children from avoidable injuries, and to influence legislative policies in promoting injury prevention initiatives. This study aims to describe the pattern of injuries and associated factors caused by tip-over incidents among children in Karachi, Pakistan.

Methods

This cross-sectional study was conducted in the Aga Khan University Hospital (AKUH) in Karachi, Pakistan and included patients visiting the pediatric ED with the complaint of tip-over injury. The Aga Khan University Hospital is a private not-for-profit teaching hospital in Karachi, Pakistan established in 1985. The organization has gold-seal accreditations from the prestigious Joint Commission International and College of American Pathologists (JCIA). It is considered one of the best specialty based hospitals in Asia and internationally providing clinical services and outstanding academic research outputs. Patient Welfare and Zakat programs (Islamic charity) offer financial assistance to patients who are unable to pay and are found to meet the eligible criteria. The AKUH pediatric ED (within the larger general ED) provides 24/7, 365 days-a-year care to children from birth to 18 years of age, and it caters to over 17,000 patients annually. It holds 13 beds with three beds in the resuscitation bay.

This study was conducted in two phases. In the first phase, the medical record review, data was collected retrospectively from the medical record files of all pediatric patients up to 18 years of age who visited the ED with furniture or other object tip-over injuries. Five years of medical record files, from January 2010 to December 2015, were reviewed. We have done file review from 9 - 02-2015 to 24-09-2016 for years 2010 to 2015.

We retrieved ICD-CM codes from the medical record room of AKUH for all cases with an admission or discharge diagnosis of "fallen object injury." Patient demographics, including age, sex, presenting complaint, nature of injury, diagnosis, treatment, outcome, and duration of hospital stay were collected. We also recorded telephone numbers for the telephonic follow-up.

In the second phase of the study, we conducted a telephonic survey from 20 - 04-2015 to 22-05-2016. The median duration from injury to telephonic interviews was 22.2 months (interquartile range, IQR 10 - 40) with minimum duration was 3 months and maximum was 61 months. Verbal consent was obtained prior to all telephone interviews from parents or caregivers of the children. In this phase, we collected information on injury scene; type, size and placement of furniture, TV/TV trolley or other falling object; and factors that may inform prevention efforts. Interviews were conducted in Urdu and took around 10 min to complete.

Research assistants were trained for both phases by the principal investigator (PI).

Table 1
Sociodemographic characteristics of children and respondents.

Description	Frequency and percentages (n = 75)
Sex*	
Male	55 (73%)
Female	20 (27%)
Age of Child*	
1 year or less	8 (11%)
1-4 years	26 (35%)
>4years	41 (55%)
Mother's occupation**	
Housewife	50 (94%)
Employed outside the home	3 (6%)
Responders to telephonic interview**	
Father	30 (57%)
Mother	10 (19%)
Others (grandparents, aunts, uncles)	13 (22%)
Supervision at time of incident**	
Yes	25 (47%)
No	28 (53%)
Took safety measures after the incident**	
Yes	25 (47%)
No	26 (49%)
Not reported	2 (4%)
Child's activity at time of incident**	
Playing	22 (29%)
Other activities	53 (71%)

* n = 75, data collected by medical chart review.

** n = 53, data collected by telephone interviews (22 were lost to follow up).

Statistical analysis

All data from the questionnaire were encoded and entered in Epi-Info, version 3.5.3, and then analyzed by SPSS 19 statistical software (IBM, IL, USA). A p-value of ≤ 0.05 was considered statistically significant. The PI and co-investigators each randomly checked 10% of data entries for accuracy. Median and interquartile range (IQR) are reported for continuous variables; frequency and percentages are presented for categorical variables.

Results

A total of 75 children were enrolled in the study, of whom 55 (73%) were boys and 20 (27%) were girls. The median age of victims was 4.5 years old (interquartile range, IQR 2-10 years) with most of the children over age 4 (n = 41, 55%). We conducted a total of 53 phone interviews. In the remaining 22 cases, the phone was switched off, the contact number had been changed, or they did not respond. Most interviewees were the child's father (n = 30, 57%), followed by grandparents, aunts, and uncles (n = 13, 22%). Only 10 mothers participated (19%). (See Table 1.)

Phone interviews provided important details on several topics. Almost all mothers of injured children were housewives (n = 50, 94%) with only three (6%) working women. At the time of the incident, 25 (47%) children were under supervision, and 28 (53%) were not under supervision. More than a quarter of children were playing at the time of the incident (n = 22, 29%). In the remaining cases, children were involved in a variety of activities, including but not limited to sleeping, sitting, lying down, praying, and wandering around.

The most common falling object was a TV/TV trolley (n = 17, 32%). The second most common falling objects were furniture items (n = 15, 28%), followed by falling walls or roofs that were under construction (n = 12, 23%). Construction objects (screwdrivers, hammers, pipes), kitchen items, decorative items (flowerpots), and other unstable and loose items around the home caused tip-over injuries in nine cases (n = 9, 17%). Many of these incidents happened inside the home (n = 40, 75.5%). The living room was

OBJECTS FALLEN BY AGE CATEGORY

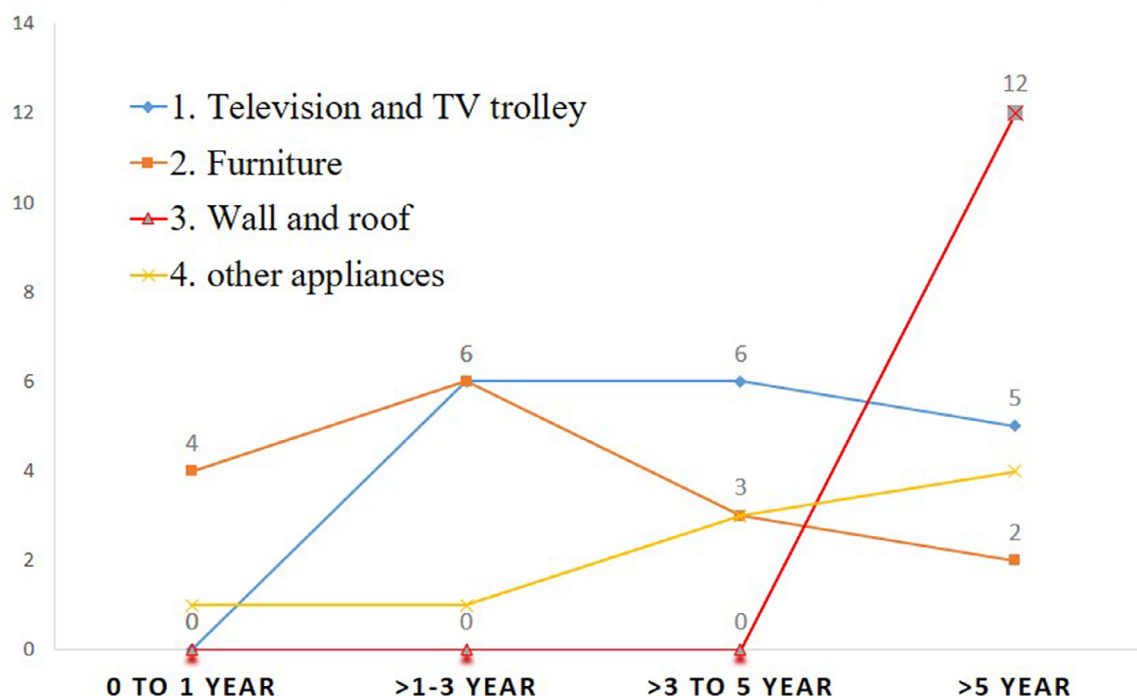


Fig. 1. In this figure we have portrayed the frequency of objects causing tip-over injuries among children by age category. Note: Figure 1 should be printed in black and white, color print is not required.

Table 2
Fallen object and home area characteristics.

Description	Frequency and percentages (n = 53)
Fallen object category**	
TV/ TV trolley	17 (32%)
Furniture	15 (28%)
Wall and roof	12 (23%)
Other objects†	9 (17%)
Location of incident**	
Home	40 (75.5%)
Outside house	13 (24.5%)
Home area of incident**	
Living room	17 (32%)
Bedroom	11 (21%)
Kitchen	3 (6%)
Dining hall	2 (3%)
Others	20 (38%)

*n = 75, data collected by medical chart review.

** n = 53, data collected by telephone interviews (22 lost to follow up).

† Includes a wide range of construction objects (screwdrivers, hammers, pipes), kitchen items, decorative items (flowerpots), and other unstable and loose items around the home.

the most common area where these incidents occurred (n = 17, 32%), followed by the bedroom/sleeping area (n = 11, 21%). The kitchen (n = 3, 6%) and dining hall (n = 2, 3%) were the least common area where tip-over injuries happened. (See Table 2.)

Fig. 1 portrays the frequency of objects causing tip-over injuries among children by age category. TV/TV trolley tip-over injuries were common among children ages three and up, but the frequency decreases as children grew older. Injuries from falling walls or roofs were more common among ages five and up with almost none among younger children. Furniture items caused injuries among children less than five years old and became less common as they grew older.

Table 3
Injury characteristics of tip-over incidents.

Description	Frequency & percentages (n = 75)
Body part injured*	
Head/face	33 (44%)
Extremities	33 (44%)
Thorax	6 (8%)
Abdomen	3 (4%)
Nature of injury*	
Bruise/contusion	21 (28%)
Laceration/abrasion	19 (25%)
Brain trauma	19 (25%)
Cut/wound	13 (17%)
Fracture	13 (17%)
Systemic organ injury	6 (8%)
Strain/sprain or dislocation	6 (8%)
First aid given at home**	
Yes	1 (2%)
No	52 (98%)

* n = 75, data collected by medical chart review.

** n = 53, data collected by telephone interviews (22 lost to follow up).

Head/face and extremities (both arms and legs) were the most common body parts injured (n = 33, 44% and n = 33, 44% respectively). Thorax (n = 6, 8%) and abdominal (n = 3, 4%) injuries occurred less often. Around a quarter of participants had bruises/contusions (n = 21, 28%), lacerations/abrasions (n = 19, 25%), or brain trauma (n = 19, 25%) after tip-over injuries. Fractures and cuts/wounds were each reported among 13 children (17%). Systemic organ injury, and strain/sprain/dislocation were the least common reported injuries (n = 6, 8% each). Only one injured child (2%) received first aid at home, while all others (n = 52, 98%) were not given first aid. (See Table 3.)

The median length of hospital stay was one days (interquartile range, IQR 1–5) with a minimum stay of one day and a maxi-

Table 4
Injury characteristics of tip-over incidents.

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Systemic organ injury	6 (8%)
Strain/sprain or dislocation	6 (8%)
First aid given at home**	
Yes	1 (2%)
No	52 (98%)

* n = 75, data collected by medical chart review.

** n = 53, data collected by telephone interviews (22 lost to follow up).

mum stay of 56 days. Twenty-seven patients (36%) underwent a surgical procedure. More than a quarter (n = 27, 32%) of cases were admitted for observation and conservative clinical management, and nearly a quarter (n = 19, 23%) underwent at least one episode of wound debridement procedure as part of their management course. Orthopedic and thoracic procedures were done in 10 cases (12%) each, and vascular repair and abdominal surgeries were performed in five cases (6%) each. Neurosurgery was the least common procedure in this sample of tip-over injuries (n = 4, 5%). After emergency management, a majority of cases (n = 51, 68%) were admitted to general care units; and 20% (n = 15) were admitted to critical care units, including pediatric and neonatal intensive care units. Out of 75 cases, only five (7%) were discharged from the ED, and four (5%) left the hospital against medical advice (LAMA). (See Table 4.)

Discussion

We found that many children who suffered tip-over injuries due to falling objects were younger than five years and were boys. The most frequent falling objects causing tip-over injuries were TVs, TV trolleys and other furniture. About half of these incidents took place unsupervised within the living room where children spend most of the time playing and exploring unstable household items. More than a quarter of these children required some form of surgical intervention after the incident, and most of them were admitted to the hospital in either general or critical care units.

Factors causing these observed injuries can be associated with the behavioral and physical characteristics of children younger than 5 years old. These children tend to move while watching TV, try to touch the TV screen and try to retrieve the remote. Moreover, they spend a lot of time at home, surrounded by furniture and TV sets. They are curious, and they frequently fail to perceive danger. For instance, they use drawers as stairs to climb a cupboard or pull themselves up on furniture to reach an attractive object. Sometimes parents keep the remote on top of the TV, which can become a danger for children if they try to retrieve it, increasing the risk for TV tip-over. This experience often happens when children are left unattended and has contributed to the recent increase in head injury incidents sustained from TV tip-overs [16,17]. Another attribute of these children is the lack of physical and cognitive capacity to react quickly enough to avoid injury if a tip-over occurs, or to free themselves if stuck under a falling object.

Several other studies have shown that children younger than five are more likely to get injured from toppling TVs [7,8,12,18-20].

We observed a similar trend in our study. They are more likely to receive head/neck injuries due to their short stature, whereas older children are more likely to sustain injuries to the lower extremities. In our study, the majority of younger children had head/face injuries; similar findings are reported in other studies [5,9,14,16,19-23]. In addition, we noticed that brain trauma and contusion were the most common injuries. Other studies have also reported overall higher rates of these injuries among younger kids compared to older kids [9,10,24-26] because younger children spend more time in the house and are exposed to hazardous household items for longer time periods. They may consider the TV/TV trolley as toys to play with or items to climb over, and as such might pull them over [12]. However, most toddlers in this study did not engage in such behavior. This outcome may be due to recall bias of interviewees, but alternatively, it may point out the inherent instability of the objects. Previous studies have shown that furniture or trolleys with or without wheels caused almost half of head and other injuries within the home environment [21,27].

This study has significance in highlighting injuries caused by a lack of product safety regulations in LMIC settings as governments do not have passive safety regulations regarding protecting children from tip-over injuries; it can serve as an advocacy tool to promote child injury prevention [28]. Some recommended interventions include: 1) regulate product safety by making it mandatory to include tip-over restraints in all furniture along with clear installation instructions; 2) products must have permanent warning labels; and 3) require mandatory product stability tests as per evidence of international guidelines. Although, internationally, there are known preventive measures and safety policies such as the ASTM F2057-19, Standard Safety Specification for Clothing Storage Units (CSUs), and product regulations [15], ambiguities exist in the effectiveness of these measures [25]. Furthermore, a statement from the US Consumer Product Safety Commission dictates that "the Commission preliminarily believes that the ASTM standards do not adequately reduce the risk of injury associated with clothing storage units tip-overs [29]. Furthermore, parents should take preventive measures, such as not placing the TV on furniture that is not designed to hold a TV. These appliances should be placed on appropriate furniture and should be anchored to the wall along with the supporting furniture to stabilize the product. Most importantly, toys, colorful objects and other attractive materials should not be placed on top of the TV as children may become curious to climb and pull them down, causing tip-over incidents.

Limitations

This study has a few limitations. First, the actual number of furniture and TV tip-over injuries are likely underreported because this study includes only cases managed at the ED. Injuries that were treated outside EDs and those who did not seek medical care are not included. As a retrospective study, we could not eliminate recall bias, particularly as information collected during the interviews depended largely on what the interviewee remembered. This was a single center study, and the socioeconomic profile of patients presenting to one of the best private hospitals of Pakistan is not representative of the entire city. Future studies should focus on identifying a nationally representative sample of tip-over injuries. Another limitation of the study is that we have collected more than half of the telephonic interviews from the fathers of the injured children, while 75% of the incidents happened at home and mothers would have been the ideal responders as most of them were housewives. In Pakistani culture, women usually do not have access and permission to answer public calls. This may have resulted in some recall bias. Efforts have been made to get injury information from the primary caregiver of the injured child to reduce this bias.

Conclusion

In conclusion, this study suggests that there are many injury hazards to children within the household, including items that are generally overlooked. These hazards can be identified with context relevant tools, and safety and injury precautions can be taken accordingly—household items that put a child's well-being at risk should be identified and labeled as hazardous. The public can be educated on identifying hazards and taking appropriate cost-effective prevention measures through simple mass media campaigns. In addition, furniture-related injuries are a neglected public health area and are not considered a major problem in our households. TVs and large furniture items can be stabilized and secured to reduce the risk of tip-over injuries among children through simple cost-effective maintenance measures.

Ethical approval and consent to participate

Ethical Approval was taken from Aga Khan University, Karachi, Pakistan. (ERC#103–2014). Informed written consent was obtained before data collection.

Declaration of Competing Interests

The authors declare that they have no competing interests.

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Data availability statement

Deidentified participant data is available upon reasonable request from Corresponding Author.

Supplementary materials

Supplementary material associated with this article can be found, in the online version, at doi:[10.1016/j.injury.2022.11.069](https://doi.org/10.1016/j.injury.2022.11.069).

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