

In-Depth Analysis of Nonfatal Injuries from TVs Falling off Furniture

March 2017
(Revision 1)



U.S. CONSUMER PRODUCT SAFETY COMMISSION
5 Research Place
Rockville, MD 20850

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Revision 1 Changes

March 14, 2017 – Corrections to Table 16 and column 1 titles.

U.S. CONSUMER PRODUCT SAFETY COMMISSION
Directorate for Engineering Sciences



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FROM TVs FALLING OFF FURNITURE

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Arthur Lee
Division of Electrical Engineering
Directorate for Engineering Sciences

Adam Lee, Intern
Division of Mechanical Engineering
Directorate for Engineering Sciences

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EXECUTIVE SUMMARY

U.S. Consumer Product Safety Commission (CPSC) staff estimates that annually there are 11,800 television-related (or TV + furniture) emergency department (ED)-treated injuries involving TVs falling.¹ In addition, from 2000 to 2015, CPSC staff has reports of 315 fatalities associated with falling TVs and TV + furniture falling. The majority of the injuries and fatalities with TVs and furniture falling involved children.

To understand better the circumstances that lead to a falling TV incident, CPSC staff reviewed 296 reports of nonfatal injury incidents from 2005 to 2015. The review was limited to incidents in which TVs were placed on furniture, such as chests, bureaus, and dressers (CBDs).

Among the known 296 nonfatal incidents (284, 12 unknowns), the majority (83.5 percent, 237/284) resulted in the TV falling when a child climbed on the furniture on which the TV was sitting. In about 12 percent (35/284) of the known 296 incidents, the TVs fell when someone opened one or more drawers of a CBD. The open drawers caused the furniture to tip forward, causing the TV to fall from the furniture. In all but one incident report, it appears that the TVs were not secured to the furniture or wall at the time of the incidents. The information reviewed did not provide any insight on why consumers did not install anti-tipping devices for the furniture and/or the TVs.

Removing TVs from furniture, such as CBDs, and instead, using an appropriate TV stand with anti-tipping devices, can significantly reduce the number of falling TVs. The analyzed dataset showed that 60.4 percent (134/222) of the known incidents were caused by children attempting to interact with the TV or other media equipment, such as DVD players and gaming systems that was on the furniture. The danger of unanchored furniture that can tip over still exists, because 39.6 percent (88/222) of the incidents occurred when a child was not attempting to interact with the TV, but their actions caused the furniture to tip over.

More than 90 percent of the known incidents (90.9 percent, 261/287) involved cathode ray tube (CRT)-type TVs. CRT TVs are typically heavier in the front than in the rear (and thus, CRT TVs have the potential to shift the center of gravity of the furniture) because of the large display tube. Additionally, the falling patterns of CRT TVs are more predictable than flat-screen TVs and may result in greater numbers of similar injuries. The height of the TV above the floor may determine how the TV strikes the child. A TV that is higher from the floor and above the child has the potential of causing a head injury; whereas, a TV that is lower and closer to the floor may cause mid- or lower-body injuries. Other factors also determine the severity of the injury, such as how the child falls, where the child was standing, the TV's slide rate, type and size of the TV, surrounding furniture or objects, and the difference between the height of the child and the TV's height.

¹ Suchy A. (2016) Product Instability or Tip-Over Injuries and Fatalities Associated with Televisions, Furniture, and Appliances: 2016 Report, U.S. Consumer Product Safety Commission, Bethesda, MD.

Of the 237 incidents involving a child climbing, half (50.0 percent, 63/126) of the known heights of the climbers were 3 percentile or less in height for their age group. Most of the known incidents (79.4 percent, 100/126) involved children shorter than the height of the furniture. Some 20.6 percent (26/126) of incidents involved children 6 inches to less than 12 inches shorter than the top of the furniture; 31.7 percent (40/126) involved children 12 inches to less than 24 inches shorter than the height of the furniture; and 15.9 percent (20/126) involved children 24 inches to less than 36 inches shorter than the height of the furniture. Ninety percent (159/176) of the known weight of the climbers weighed 50 lbs. or less. Most of the climbers (45.5 percent, 80/176) weighed 30 lbs. to less than 40 lbs.

Consumers and stakeholders can visit www.AnchorIt.gov for lifesaving information about the simple steps that parents and caregivers should take to prevent the hidden home hazard of television and furniture tip-overs.

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1.0 INTRODUCTION

CPSC staff annually reports injuries and fatalities related to furniture or appliances tipping over.¹ More than one-third of these injuries involved TVs falling. TVs toppled off furniture for various reasons, depending on factors such as the stability of the furniture or the size of the TV base in relation to the furniture base. The majority of the nonfatal incidents involving falling TVs were caused by clothing-storage furniture, such as CBDs, tipping forward. To gain insight into the circumstances surrounding TVs falling due to furniture tip-over, CPSC's engineering staff reviewed 369 nonfatal reports from 2005 to 2015.

The most common action that led to furniture tipping forward involved children who tried to pull out the drawers of the CBD and used the drawers as steps. Children climbing on furniture will increase the weight on the open drawers; without anti-tip hardware for the TV and the furniture, the furniture may tip, and thus, cause the TV to slide forward. These events frequently took place when a child was left unsupervised; therefore, there may not have been witnesses to these incidents.

2.0 INCIDENT DATA

CPSC staff estimates that between 2013 and 2015, there were 11,800 injuries related to TVs falling. About 60 percent of these injuries (4,500 injuries) occurred to children younger than 5 years old, with the majority of the injured (2,900 injuries) being children between 2 to 3 years of age.¹

3.1 Dataset - Injuries from Falling TVs

The dataset used in the analysis for this report involved nonfatal injury incidents from TVs and clothing-storage furniture. The incident dataset timeframe was January 1, 2005 to December 31, 2015, and reported a total of 369 nonfatal incidents. One incident involved a TV on a table (TV/table), and 72 incidents involved only furniture (furn), and these incidents were filtered from the dataset. The filtered dataset that involved a TV and a CBD (TV/furn) totaled 296 incidents. One of the 296 incidents involved a TV on a bookcase that was adjacent to a CBD. Because the incident involved a child climbing the CBD to access the TV, the incident was included in the 296 count. The analysis is based on the 296 incidents. The analysis does not provide national statistical representation.

Table 1. Nonfatal injury dataset from January 1, 2005 to December 31, 2015

Incident Categories	Count	Percent of total
Total "furn"	72	19.51%
Total "TV/furn"	296	80.22%
Total "TV/table"	1	1.39%
Total Count	369	

The 296 incidents were from three different report types (incidents, IDIs, phone interviews), with the breakdown as shown in Table 2. The incident reports were culled from news reports or consumer incidents reported to CPSC. News reports typically contained minimal information on the products and the events surrounding the incident. The IDI reports were from investigations conducted by CPSC field staff that may have originated from a news or consumer report. These reports are conducted by CPSC investigators via phone or in-person interviews, as well as a collection of police and injury reports. The reports typically contain detailed information on the products and events surrounding the incident, but the completeness of the reports depends on the information that the field investigator was able to collect. In some instances, the family or parents of the victim did not want to communicate with the CPSC field investigator; therefore, minimal information was collected on the incident. The third type of report comes from phone interviews. This involved CPSC staff conducting a phone interview with an individual who was familiar with the incident. The phone interview was structured from a specific list of questions about the incident, including details on the products involved in the incident and the victim’s height, age, and weight. Nearly 95 percent of the reports were phone interviews, which provided sufficient details on the nonfatal incidents for this analysis.

Table 2. Report types in the dataset

Type of Report	Count	Percent of Total
Incident report	8	2.7%
Phone Interview	280	94.6%
IDI (In-Depth-Investigation)	8	2.7%
Dataset total	296	

Almost all (96 percent, 283/296) of the 296 incidents occurred in a bedroom. Table 3 shows the location of the tip-over incident. Two of the bedroom incidents occurred in the parents’ bedrooms, while the remainder of the bedroom incidents occurred in the victims’ or siblings’ bedrooms. Three incidents occurred in a hotel/motel.

One of the hotel/motel incidents occurred when the victim’s weight was applied to the bottom drawer of the dresser, which caused the dresser to tip forward. The victim fell to the floor, but the open bottom drawer stopped the dresser from falling completely onto the victim’s head. The victim’s leg was pinned under the dresser. The TV that was on top of the dresser slid off when it tipped forward, causing the TV to land on the victim’s arm. (Reference 21)

The second hotel/motel incident involved a flat-screen TV that was inadequately bolted to the hotel's dresser. The victim opened the second drawer when the top drawer rolled open at the same time. This caused the dresser to tip forward and led the TV to slide towards the victim. The TV and dresser tipped over on top of victim, which caused the victim’s feet to be pinned under the dresser. The TV also pinned the victim’s right arm. (Reference 29)

The third hotel/motel incident involved a 46-year-old victim who was putting away clothes in the dresser. The victim was reaching into the open drawer to retrieve clothing

when the drawer pulled out completely, causing the dresser to tip forward. The TV on top of the dresser slid off and impacted the victim’s face. (Reference 84)

Table 3. Incident location for the dataset

Location of Incident	Count	Percent of Total
Bedroom	283	95.6%
Living Room	3	1.0%
Hotel/Motel	3	1.0%
Playroom	1	0.3%
Unknown	6	2.0%
Dataset total	296	

About 88 percent (261/296) of the incidents involved CRT TVs. Table 4 shows the breakdown of the TV type involved in the incident – either a CRT (cathode ray tube) or flat screen. The CRT is an older type of TV that contains a large vacuum tube as the display. A CRT TV typically has the center of gravity closer to the front because of the weight of the CRT near the front of TV. Flat-screen TVs (flat) are a newer type of TVs that uses plasma, LED, or LCD displays, and they typically weigh less than CRT TVs of the same screen size. Typically, the type of TV that was involved in the incident was reported. Three percent of the reports did not identify the type of TV (unknown).

Table 4. Type of TV involved in the incident dataset

Type of TV	Count	Percent of total
CRT	261	88.2%
Flat screen	26	8.8%
Unknown	9	3.0%
Dataset total	296	

Most of the TVs (43.2 percent) involved in the incidents were acquired between 5 to 10 years before the incident. Table 5 shows how long before the incident the TV was acquired. The interviewee was given the choices listed in the table. There may be some uncertainty at the boundaries, such as 1, 5, and 10 years. Twenty-nine percent of the incidents involved TVs that were more than 10 years old. All flat-screen TVs, except for one, were less than 10 years old.

Table 5. Approximate age of the TVs involved in the incident dataset

TV acquired age (years)	Count	Percent of total
“Less than 1”	5	1.7%
“1 to 5 years”	40	13.5%
“5 to 10 years”	128	43.2%
“More than 10”	86	29.1%
“Unknown”	37	12.5%
Dataset total	296	

The sizes of the TVs involved in the incidents were typically “common” TV sizes. Figure 1 shows the distribution of TV screen sizes for the incidents. The TV size is measured diagonally across the TV display screen. The highest count TV sizes that were involved in the incidents were 19-inch and 20-inch, 26-inch and 27-inch, and 32-inch TVs. The 19-inch and 20-inch size TVs were 13.5 percent (40/296) and 8.8 percent (26/296), respectively. The 26-inch and 27-inch size TVs were 5.4 percent (16/296) and 14.2 percent (42/296), respectively. The 32-inch size TVs accounted for 14.9 percent (44/296). The other TV sizes worth noting that were involved in the incidents were 12-inch (6) and 13-inch (12), 36-inch (9) and 37-inch (8), and 42-inch (6) TVs. About 6 percent (19/296) of the reports did not identify the size of the TV.

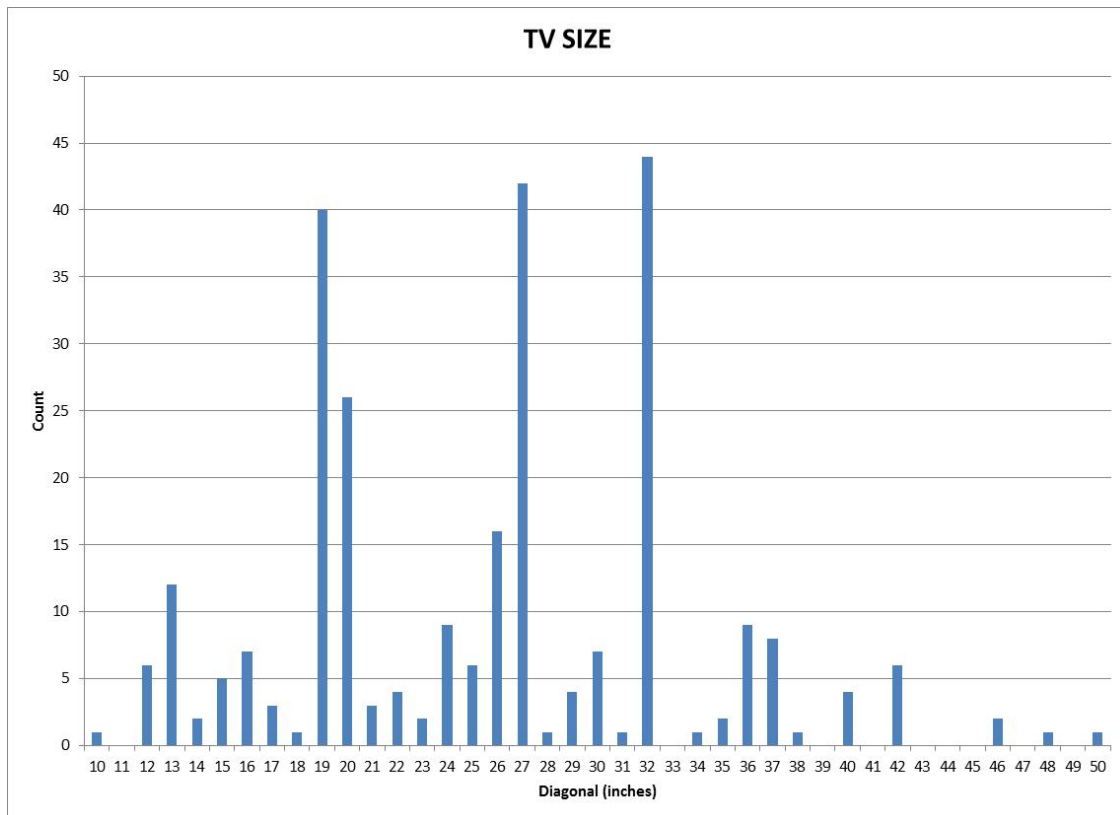


Figure 1. TV size involved in the incident dataset

Most of the incidents (about 75 percent) occurred in rooms with carpet. Table 6 shows the breakdown of flooring material for the dataset. Hardwood was the second most common flooring at 13.2 percent. Tile was the third most common flooring at 5.7 percent. Linoleum accounted for less than 1 percent (0.79 percent) of the incidents. About 5 percent of the reports did not identify the flooring type.

Table 6. Flooring type involved in the incident dataset

Flooring Type	Count	Percent of total
Carpet	223	75.3%
Tile	17	5.7%
Hardwood	39	13.2%
Linoleum	2	0.7%
Unknown	15	5.1%
Dataset total	296	

3.2 Victims' Age, Weight, and Height

The dataset contained the ages of all the victims. In many cases, the exact age, in months, of the victim was not given, but the integer ages were used, such “2-years-old,” 3-years-old” and “4-years-old.” This can be seen in Figure 2, which shows peaks in the count at 24, 36, and 48 months. A more accurate representation of the data is to display the age data by years, as seen in Table 7 and Figure 3, because the interviewee may not have stated the victim’s exact age by months, and therefore, likely reported the age of the victim as of his/her last birthday. The age range from 2 years old to less than 4 years old represents more than 55 percent (56.4 percent, 167/296) of the nonfatal injuries in the dataset. Children younger than 5 years old accounted for approximately 84 percent (83.8 percent, 248/296) of the nonfatal injuries in the dataset.

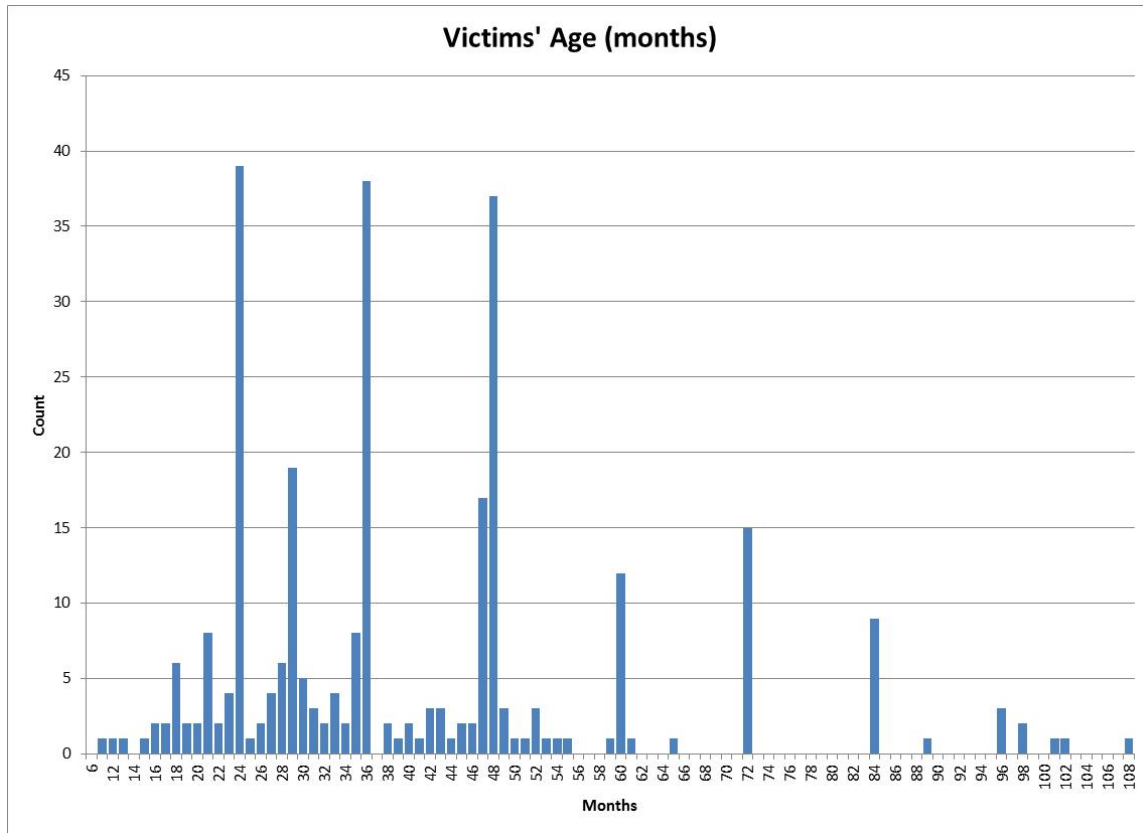


Figure 2. Age of the victims involved in the incident dataset

Table 7. Ages of the victims involved in the incident dataset

Years old of the victim	Count	Percent of total
less than 1	1	0.3%
1 to less than 2	31	10.5%
2 to less than 3	95	32.1%
3 to less than 4	72	24.3%
4 to less than 5	49	16.6%
5 to less than 6	14	4.7%
6 to less than 7	15	5.1%
7 to less than 8	10	3.4%
8 to less than 9	7	2.7%
9 to less than 10	1	0.3%
46	1	0.3%
Dataset total	296	

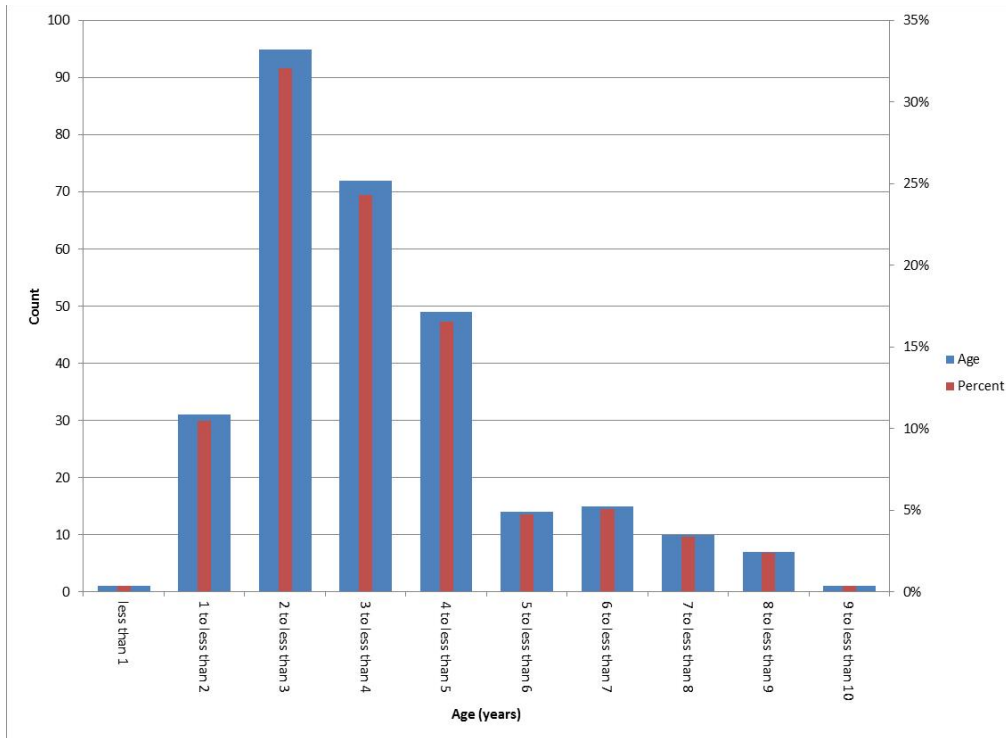


Figure 3. Age and percentages of the victims involved in the incident dataset

Table 8 shows the known weights of the victims, categorized by 10-pound increments. For about one-quarter of the incidents, the weight of the victim was unknown. The highest counts of nonfatal injuries in the dataset were victims who weighed between 30 lbs. to less than 40 lbs., which was 34.1 percent. Children less than 50 lbs. accounted for 65.9 percent (195/296) of the nonfatal injuries in the dataset. Nearly 70 percent (69.9 percent, 207/296) of the children less than 60 lbs. accounted for the nonfatal injuries in the dataset. There were no victims less than 20 lbs. The weight of the 46-year-old victim who was injured in the hotel/motel is unknown.

Table 8. Weight bins of the victims involved in the incident dataset

Weight (lbs.) of the victim	Count	Percent of total
20 to less than 30	50	16.9%
30 to less than 40	101	34.1%
40 to less than 50	44	14.9%
50 to less than 60	12	4.1%
60 to less than 70	14	4.7%
70 to less than 80	2	0.7%
80 to less than 90	0	0.0%
90 to less than 100	3	1.0%
Unknown	70	23.6%
Dataset total	296	

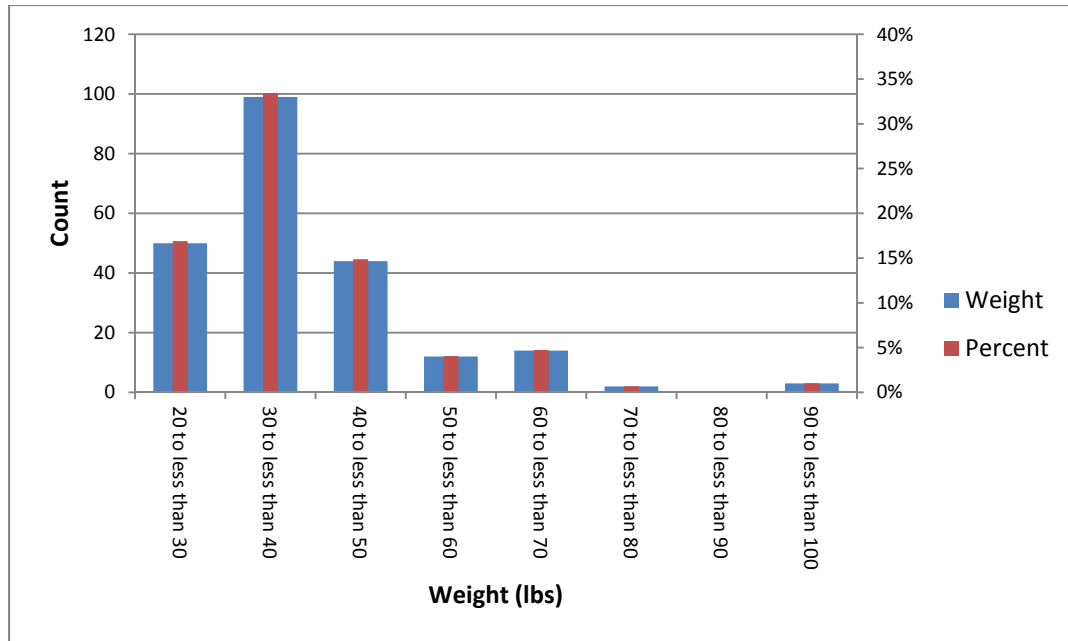


Figure 4. Weight and percentages (bins) of the victims involved in the incident dataset

Of the three characteristics that described the victim, the height had the most unknowns at 39.2 percent (116/296). Similar to the age category, in many cases, the exact height of the victim may not have been stated or known. Therefore, responses may have been rounded measurements, such as “2 feet” or “3 feet,” when, in fact, the victim’s height may have been inches taller or shorter. Table 9 lists the victim heights for the dataset. The rounded heights can be seen in Figure 5, which shows peaks in the count at 24 inches (2 feet), 30 inches (2-1/2 feet), 36 inches (3 feet), 42 inches (3-1/2 feet), and 48 inches (4 feet). A more accurate representation of the data is to display the weight in 1-foot bins, but there is still an uncertainty if the actual height is less than or greater than the incremental measurements. Changing the lower and upper points of 1-foot bins can change the plot of data, as shown in Figures 6 and 7. Moving the center of each bin in 1-foot increments, such as 18 inches to 30 inches with the center at 24 inches, reallocates the incident counts for each bin. The height range from 36 inches (3 feet) to less than 48 inches (4 feet) represents 32.1 percent (95/296) of the nonfatal injuries in the dataset. Children less than 48 inches or 4 feet account for 54.1 percent (160/296) of the nonfatal injuries in the dataset. Using only known children’s heights of incidents, children less than 48 inches or 4 feet account for 88.9 percent (160/180) of the nonfatal injuries in the dataset. There were no victims less than 12 inches. The height of the 46-year-old victim in a hotel/motel is unknown.

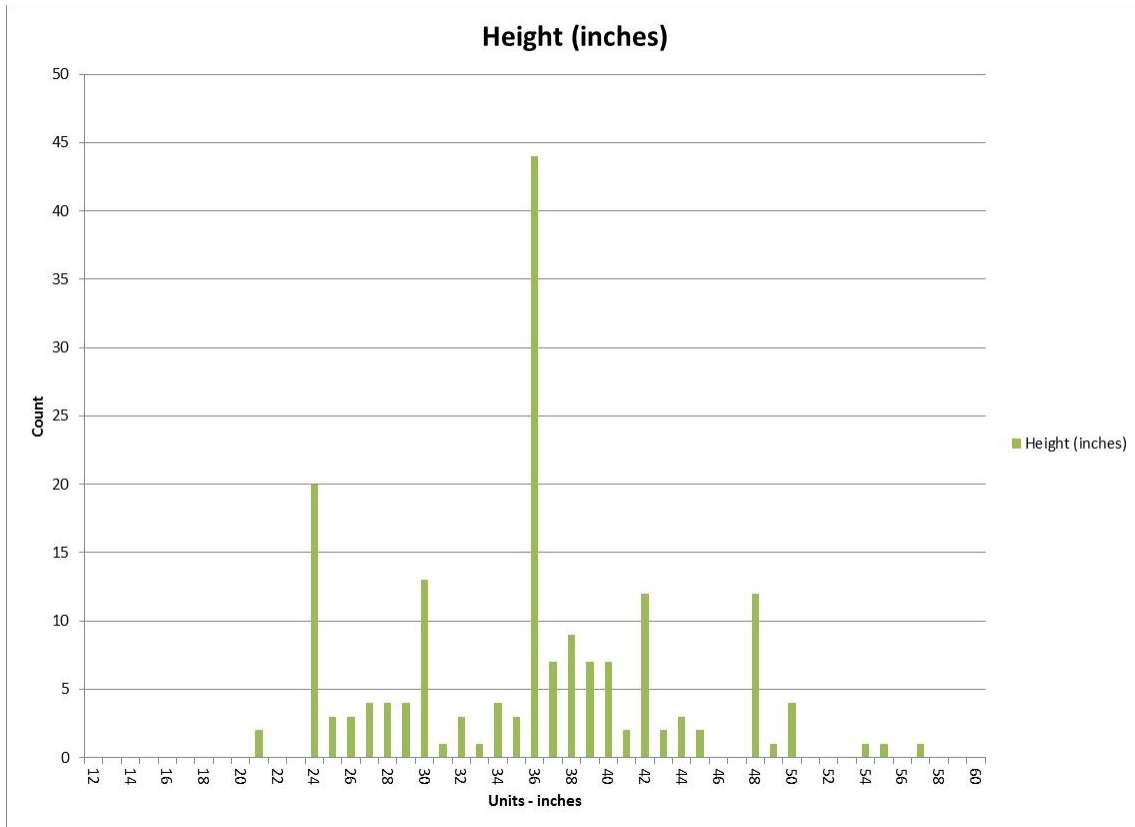


Figure 5. Height of the victims involved in the incident dataset

Table 9. Heights of the victims involved in the incident dataset

Height (inches) of the victim	Count	Percent of total
12 to less than 24	2	0.7%
24 to less than 36	63	21.3%
36 to less than 48	95	32.1%
48 to less than 60	20	6.8%
Unknown	116	39.2%
Dataset total	296	

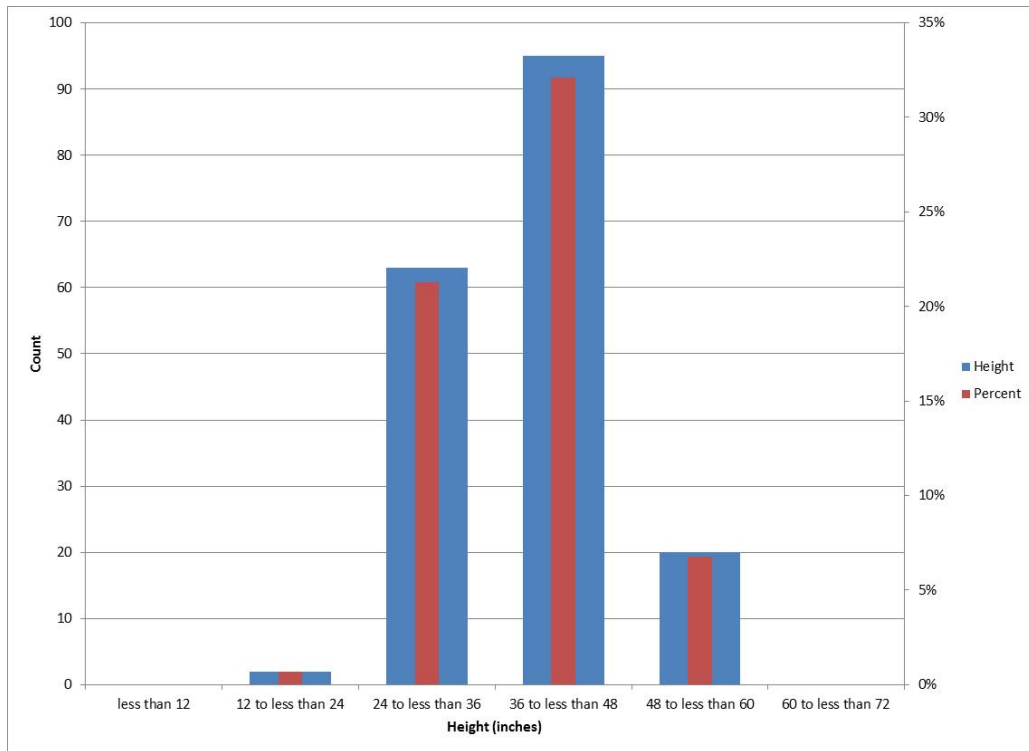


Figure 6. Height and percentages (bins at every 12 inches) of the victims involved in the incident dataset

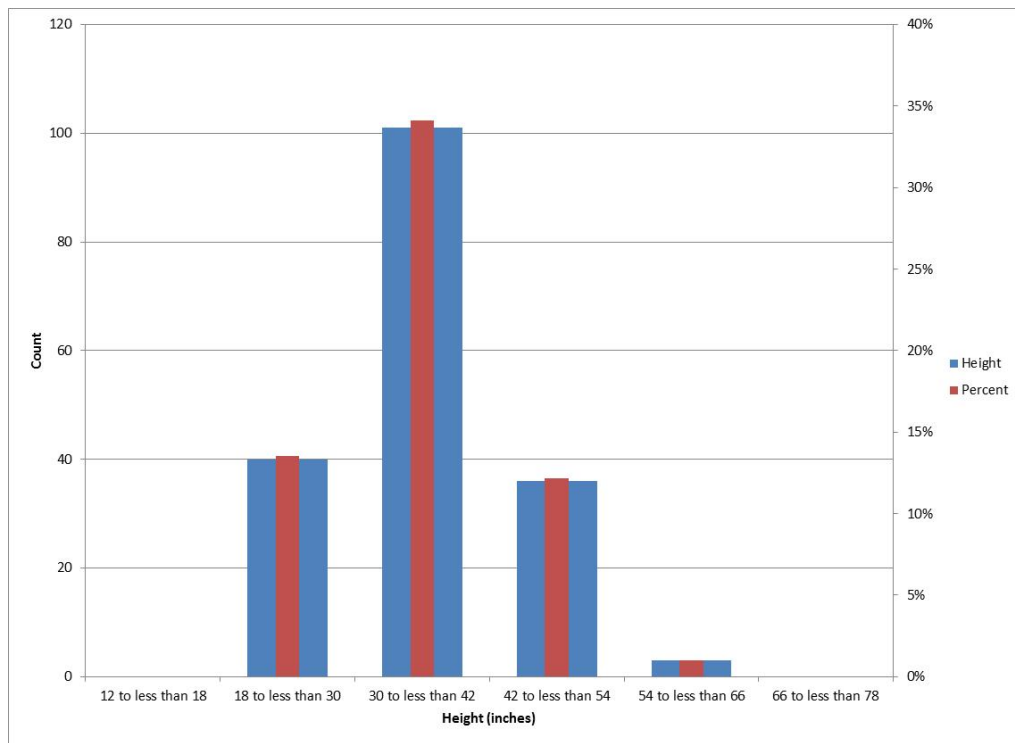


Figure 7. Height and percentages (bins centered at 12-inch increments) of the victims involved in the incident dataset

3.3 Scenario Events - Action, Interaction, Contact

The nonfatal incident reports contain narratives of the events leading up to the incidents. If the narrative contained the word “climb,” the incident would be categorized as “climbed.” If the narrative described the action that the drawers were opened and no mention of victim’s weight being applied to open drawers, then the incident was categorized as “open.” If the action described did not involve climbing or opening the drawers, but mentioned actions such as pulling on the drawer handles, kicking the furniture, pulling on the TV power cord, or squeezing behind the furniture and the wall, the incident was categorized as “adjacent.” If there was insufficient information to determine the action before the incident, the incident was categorized as “unknown.” In some cases, even though the parent or adult that was present did not witness the incident, they may have stated that the action of the child was climbing because they believed that was what the child was doing before the incident. In some of the incidents, the adult stated that the child has climbed before or a sibling witnessed the incident.

Eighty percent (237/296) of the incidents involved a child or multiple children climbing the furniture. Table 10 includes a breakdown of the actions leading to the incident. These incidents resulted in the TV falling. Most of the climbing incidents described the child pulling the drawers out of the CBD to be used as steps to get to the top. A child pulling out the drawer and getting into or sitting in the drawer was categorized as “climbing” because their weight was being applied to the open drawer. This only represented three of the climbing incidents. A child pulling the drawer and resting their feet on the drawer while watching TV was categorized as climbing because part of their weight was being applied to the drawer. This represented one of the climbing incidents. Almost 12 percent (35/296) of the incidents involved a child only opening the drawers of the furniture. These incidents resulted in the furniture tipping forward and the TV falling. The open drawer incidents involved the child opening the drawer to place or retrieve clothing or something else from the drawers. In some cases, it may have been only one drawer that was opened to cause tipping, and in other cases, the action involved opening more than one drawer. In some of the cases, the injured was not the person climbing on or opening the furniture, but instead, the person was a bystander.

Table 10. Action of incident in the dataset

Action to cause TV to fall	Count	Percent of total
Climbed	237	80.1%
Open drawer(s)	35	11.8%
Adjacent	12	4.1%
Unknown	12	4.1%
Dataset total	296	

There were 12 incidents that involved the TV falling, but not due to climbing or opening the drawers. These incidents were categorized as “adjacent.” Generalized scenarios of the incidents that did not involve climbing or opening the drawers are listed below:

- Standing on a chair while reaching for the TV
- Bumping into the TV and/or furniture
- Pulling on cords (TV/DVD/gaming)
- Tying a jump rope to the dresser
- Plugging in electronics behind furniture
- Rocking furniture.

Around 45 percent (134/296) of the nonfatal incidents involved someone attempting to interact with the TV, DVD, or VCR. A child interacting with the TV consists of the child attempting to reach for items like the TV, TV remote, gaming consoles, DVDs and other TV accessories. In some cases, the victim who was injured was not the person attempting to interact with the TV/DVD/VCR. Table 11 includes a breakdown of the interactions with the TV or an auxiliary device. Nearly 30 percent (88/296) of the incidents occurred with the child not trying to interact with the TV or an auxiliary device at the time of the incident. In one-fourth of the incidents, there was insufficient information to determine to determine their actions before the incident. These incidents were categorized as “unknown.”

Table 11. Interaction or attempted interaction with TV or media device in the incident dataset

Interaction or attempting to with TV	Count	Percent of total
Yes, interact with TV	134	45.3%
No, not attempting to interact with TV	88	29.7%
Unknown	74	25.0%
Dataset total	296	

Almost 90 percent (266/296) of the nonfatal incidents that resulted in the TV falling also struck a person. Table 12 includes a breakdown of whether the TV struck someone. In some of the cases, the victim that caused the TV to fall was not the person injured. If the information was unclear about whether the TV struck the child, the incident was categorized as “unknown.”

Table 12. TV struck a person in the incident dataset

TV struck victim	Count	Percent of total
Yes	266	89.9%
No	18	6.1%
Unknown	12	4.1%
Dataset total	296	

3.4 Severity of Nonfatal Injuries from Falling TVs

The severity of injury was categorized in three bins – “minor,” “moderate,” and “severe.” A “minor” injury included bruises, swelling, concussion, contusion, and laceration - no stitches. A “moderate” injury included fractures/broken bones (other than head) and stitches. If the interviewee responded to the injury as a fracture or broken bone, other than to the head, the injury was categorized as a “moderate” injury because fractures and broken bones are medically the same. A “severe” injury included a fractured skull, unconsciousness, coma (induced or not induced), brain damage or injury, and spinal damage or injury. The most severe injuries typically involved injuries to the head that may have resulted in either induced- or not induced-coma. If the incident did not contain any information on the level of injury, the incident was categorized as “unknown.” Table 13 includes the injury breakdown. The calculations are based on a total of 266 incidents, which were the number of incidents involving a falling TV that struck a person.

More than 61 percent (61.3 percent, 163/266) of the nonfatal injuries resulted in minor injuries when the falling TV struck the victim. About 14 percent (13.9 percent, 37/266) of the injuries were moderate and around 8 percent (8.3 percent, 22/296) were severe. In about 16 percent (15.8 percent, 42/266) of the incidents, the level of injury was unknown.

In one severe incident, a 4-year-old child left the bathroom to go to his room to get clothes from a dresser. A 27-inch or 32-inch CRT TV was on top of the dresser. As the child was getting clothes from the dresser, the dresser and TV fell onto the child. The mother discovered the child unconscious under the dresser and TV. The incident caused severe neck and head injuries, which included fractures to the skull. The incident resulted in a 2-week hospitalization with 1 week in the intensive care unit. The long-term effects of the injury included a speech impediment requiring speech therapy. (Reference 368)

In one moderate incident, a 4-year-old child was playing and climbing on a dresser when his weight caused the dresser and TV to fall. The TV landed on his shoulder and broke his collar bone. (Reference 97)

Table 13. Level of injury in the incident dataset

Injury severity from TV	Count	Percent of total
No injury	2	0.8%
Minor	163	61.3%
Moderate	37	13.9%
Severe	22	8.3%
Unknown	42	15.8%
Dataset total	266	

Nearly half (50.3 percent, 149/296) of the injuries were to the head. Table 14 lists the body part impacted. The face and head accounted for nearly two-thirds (67.2 percent, 199/296) of the injuries. Injuries to the face and head varied from bruising or laceration to

concussions and skull fractures. The next highest number of injuries, at 3 percent to 6 percent, was to the shoulder, torso, hand, leg and foot. About 5 percent (14/296) of the incidents did not note the location of the body part struck or injured. Figure 8 shows the percent of nonfatal injuries to the different body areas.

Table 14. Body part impacted

Table totals (296) includes all incidents of the dataset

Body part impacted or contacted by TV	Count	Percent of total	Body part impacted or contacted by TV	Count	Percent of total
Body – Head	149	50.3%	Body - Hand	9	3.0%
Body – Face	50	16.9%	Body - Hip	1	0.3%
Body - Shoulder	9	3.0%	Body - Leg	11	3.7%
Body – Torso	10	3.4%	Body - Ankle	1	0.3%
Body – Arm	5	1.7%	Body - Foot	16	5.4%
Body – Elbow	1	0.3%	Body - Unknown	14	4.7%
Body – Wrist	2	0.7%	Body – No contact	18	6.1%
			Dataset total	296	

Table total (264) includes only known incidents of the dataset. Unknowns and no contacts removed.

Body part impacted or contacted by TV	Count	Percent of total	Body part impacted or contacted by TV	Count	Percent of total
Body – Head	149	56.4%	Body - Hand	9	3.4%
Body – Face	50	18.9%	Body - Hip	1	0.4%
Body - Shoulder	9	3.4%	Body - Leg	11	4.2%
Body – Torso	10	3.8%	Body - Ankle	1	0.4%
Body – Arm	5	1.9%	Body - Foot	16	6.1%
Body – Elbow	1	0.4%			
Body – Wrist	2	0.8%			
			Dataset total	264	

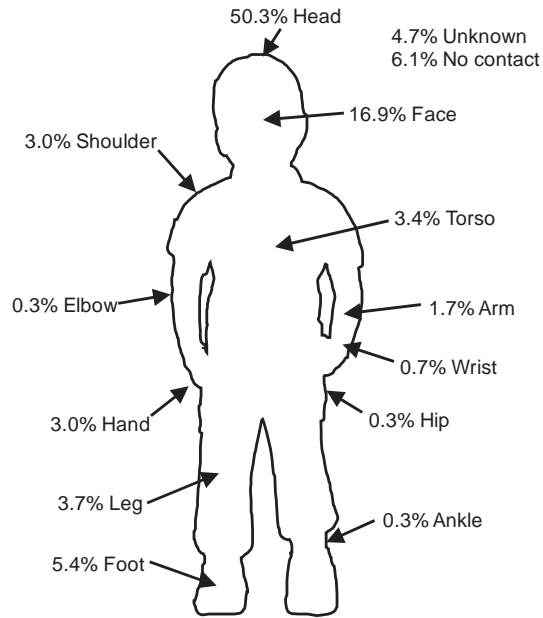


Figure 8. Locations of nonfatal injuries to the body

3.0 ANALYSIS OF CLIMBER CHARACTERISTICS AND TV HEIGHT

The 296-incident dataset was filtered to evaluate the relationship between the climber’s height and weight to the TV’s height from the floor (or furniture height). In the 296-incident dataset, there were 237 incidents classified as “climb.” Four incidents were removed from the dataset of 237 because the child was either sitting in the open drawer (3) or resting their feet on the open drawer (1). Of the 237 “climb” dataset, there were 13 incidents in which the height of the TV or furniture was unknown. All of the analysis in this section is based on a dataset of 220 remaining incidents, where a child was attempting to climb the furniture to reach an item, such as the TV, remote, DVD, or some other item, and the height of the TV/CBD was known. Notably, the climber was not always the person injured during the incident. In these cases, the climber who caused the TV to fall, caused the TV strike a bystander. If there were two climbers in the incident, the older climber was used in the analysis because they were typically the taller and heavier child and were more likely to be the contributing factor in the furniture tipping over. This dataset of 220 incidents is used to examine the climber during the incident, unless otherwise noted.

3.1 TV Height from the Floor

The most common (41.4 percent, 91/220) furniture height with a TV was 48 inches. Table 15 shows the breakdown of incidents relative to the height of the TV from the floor. The next most common heights were 36 inches at 15.5 percent (34/220) and 60 inches at 10.5 percent (23/220). These results are not surprising, given that these heights correspond to common CBD heights.

Table 15. Count of TV height on the furniture

TV height from floor (inches)	Count	Percent of total	TV height from floor (inches)	Count	Percent of total
12	1	0.5%	50	1	0.5%
24	11	5.0%	52	1	0.5%
27	1	0.5%	54	5	2.3%
30	10	4.5%	55	1	0.5%
32	2	0.9%	56	1	0.5%
34	2	0.9%	59	1	0.5%
36	34	15.5%	60	23	10.5%
40	15	6.8%	66	2	0.9%
42	10	4.5%	67	1	0.5%
43	1	0.5%	72	4	1.8%
48	91	41.4%	84	2	0.9%
			Dataset total	220	

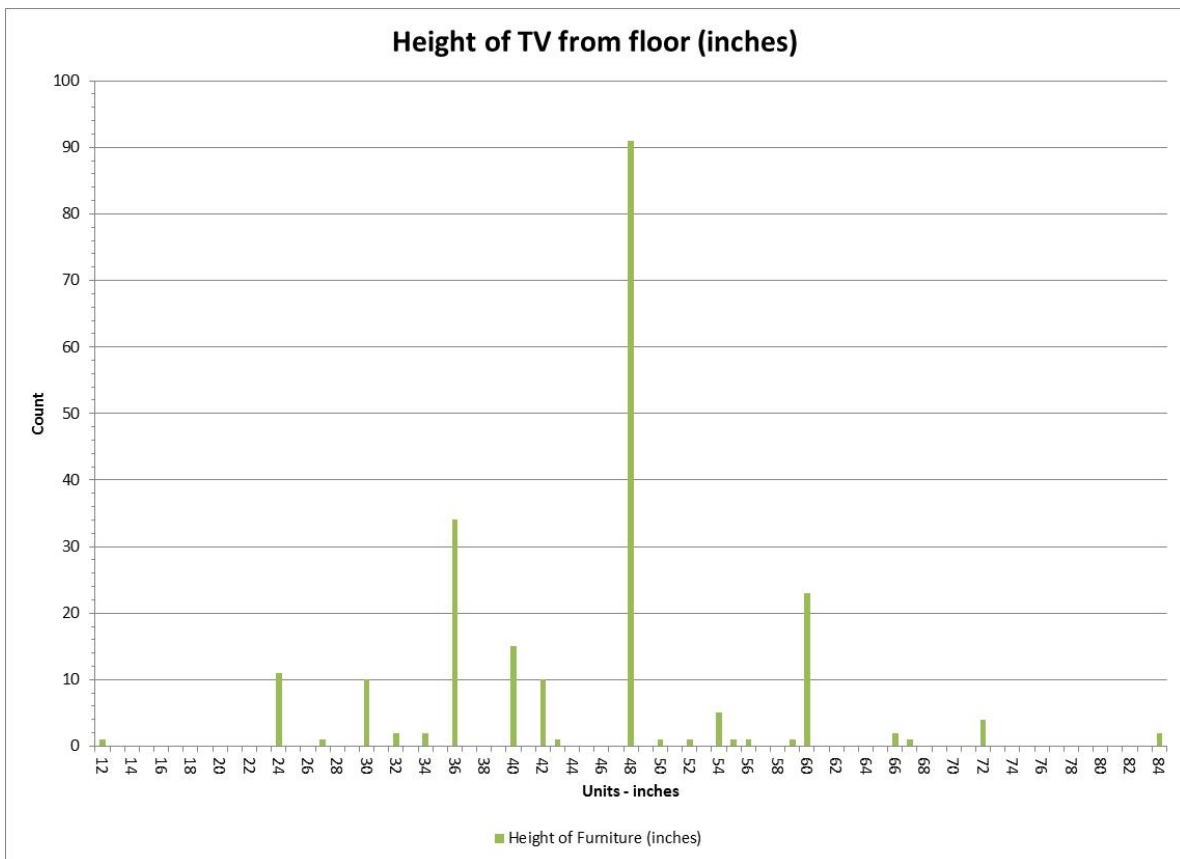


Figure 9. Counts of TV height from the floor or on the furniture in the incident dataset

3.2 Climber Weight

Of the 220 incidents in the dataset, 176 noted the weight of the climber. Ninety percent of the climbers (159/176) weighed 50 lbs. or less. Most of the climbers (80) weighed 30 lbs. to less than 40 lbs., as listed in Table 16. The minimum weight of a climber in the dataset was 21 lbs., and the maximum weight of a climber was 90 lbs.

Table 16. Count of climber weight

Weight of the climber	Count	Percent of total
<20 to less than 30	41	23.3%
30 to less than 40	80	45.5%
40 to less than 50	33	18.8%
50 to less than 60	9	5.1%
60 to less than 70	9	5.1%
70 to less than 80	2	1.1%
90 to less than 100	2	1.1%
Dataset total	176	
<=50	159	90.3%
>50	17	9.7%

3.3 Climber Height

Of the 220 incidents in the dataset, 126 contained both the height and age of the climber. The other 94 incidents were missing the height of the child. Using year 2000 growth charts from the Centers for Disease Control and Prevention (CDC),² the climbing child's percentile can be determined by using the height and age of the child for the 126 known climber incidents. Fifty percent of the climbers (126) had a height percentile that was 3 or less, as listed in Table 17. About 75 percent (74.6 percent, 94/126) of the climbers had a height percentile less than or equal to 50. About 12 percent (15/126) of the climbers were tall for their age, at greater than 97 percentile.

Table 17. Count of climber height percentile

Height percentile of the climber	Count	Percent of total
3 and less	63	50.0%
>3 and <=25	20	15.9%
>25 and <=50	11	8.7%
>50 and <=75	4	3.2%

² Kuczumski RJ, Ogden CL, Guo SS, et al. 2000 CDC growth charts for the United States: Methods and development. National Center for Health Statistics. Vital Health Stat 11(246). 2002

Height percentile of the climber	Count	Percent of total
>75 and <=97	13	10.3%
97 and greater	15	11.9%
Dataset total	126	
<=50	94	74.6%
>50	32	25.4%
Average percentile of dataset 30.7		

Because the dataset of 126 incidents noted the height of the TV from the floor and the height the child, the difference between TV height and child height can be determined as shown in Table 18. The largest difference between climbers taller than the TV height was 25 inches. The largest difference between climbers shorter than the TV height was 63 inches. The highest count differences between the climber's heights and TV heights were climbers shorter than the TV heights at 6 inches to 36 inches.

Table 18. Number of differences of climber height vs. TV heights

Negative (TV height is less than child's height), Zero (TV height is within two inches of the child's height), Positive (TV height is greater than child's height)	Difference between TV height to child's height (inches)	Count	Percent of total
Negative	24 to less than 36	1	0.8%
Negative	12 to less than 24	6	4.8%
Negative	6 to less than 12	3	2.4%
Negative	1 to less than 6	10	7.9%
Zero	Within 2 inches	6	4.8%
Positive	1 to less than 6	9	7.1%
Positive	6 to less than 12	26	20.6%
Positive	12 to less than 24	40	31.7%
Positive	24 to less than 36	20	15.9%
Positive	36 to less than 48	3	2.4%
Positive	48 to less than 60	1	0.8%
Positive	60 to less than 64	1	0.8%
	Total	126	

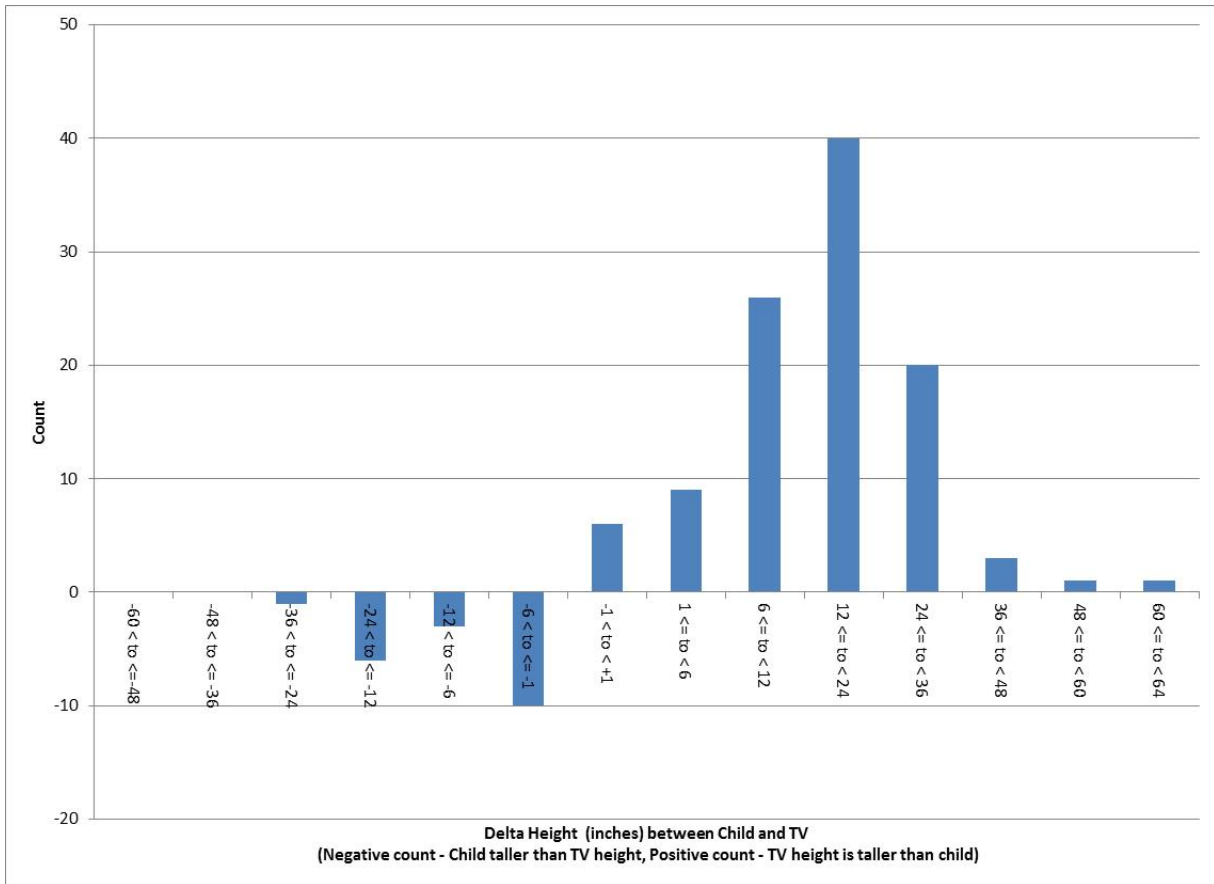
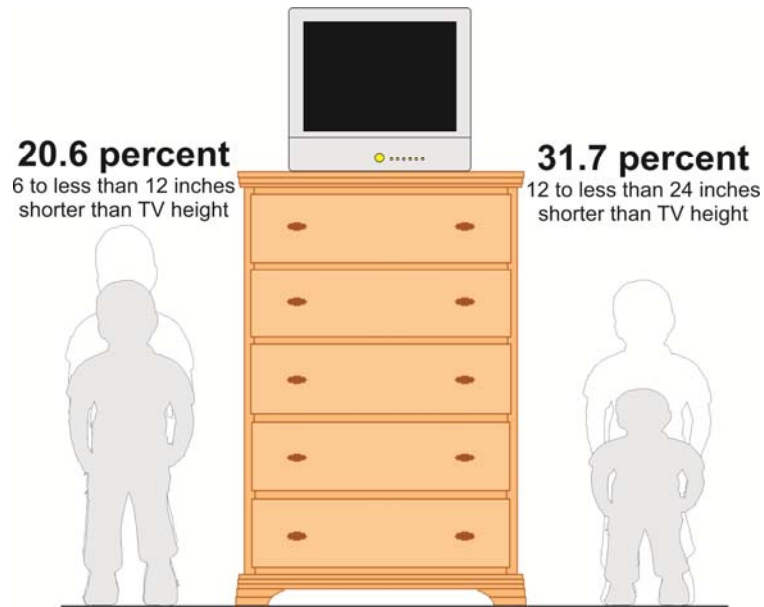


Figure 10. Difference in heights between climber and base of TV

About 20 percent (26/126) of the climbers were 6 inches to 12 inches shorter than the TV height. About 79 percent (100/126) of the climbers were 1 inch or more shorter than the TV height.³ Figure 11 shows an illustrated comparison between the child’s height and a fixed TV height. In Figure 11, the silhouette figures on the left show a child 6 inches to 12 shorter than the height of the TV at 48 inches on the CBD. This accounted for 20.6 percent (26/126) of the incidents. The silhouette figures on the right show a child 12 inches to 24 inches shorter than the height of the TV on the CBD, which accounted for 31.7 percent (40/126) of the incidents.

³ Results and analysis of climber heights in fatal incidents are in the Memorandum dated 10 August 2016 (Nesteruk, H. (2016). “Human Factors Assessment of Furniture Tipover Incidents.” Memorandum to John Massale, Furniture Tipover Project Manager.), U.S. Consumer Product Safety Commission, Bethesda, MD.



Children and dresser heights are to scale in the figure

Figure 11. Illustrated percentage injured comparison heights for the TV (48 inches) and children

4.0 ANALYSIS BETWEEN FALLING TVs AND CLIMBER

The height of the climber in relation to the TV height may play a role in the likelihood of a child attempting to interact with the furniture and the TV. Children of different heights may be the same age, and thus, they may have the same mental development, such as an understanding of how to turn the TV on or change channels. This would suggest that shorter children may attempt to climb to reach the TV or other equipment located on top of the furniture, while taller children at the same age may be able to reach the items on top of the furniture without climbing.

A child that is 2.5 years old at a 3 percentile height is almost 5 inches shorter than a child of the same age with a height of 95 percentile. Figure 12 shows the difference between heights for a 2.5-year-old male at 5, 50, and 95 percentiles. A 36-inch and 48-inch dresser also shows that, depending on the TV height on top of the furniture, the child may not be able to reach the TV. Figure 13 shows the same figure as Figure 12, except the child's height percentiles are represented for a 3.5-year-old.

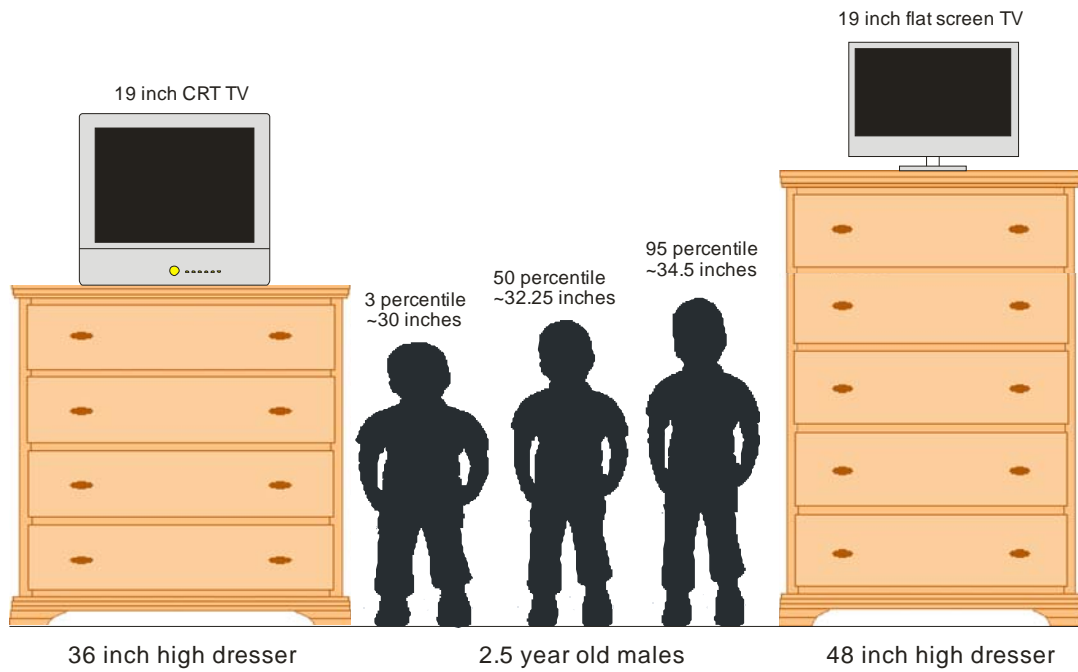


Figure 12. Illustrated height comparison for TVs and 2.5-year-old males

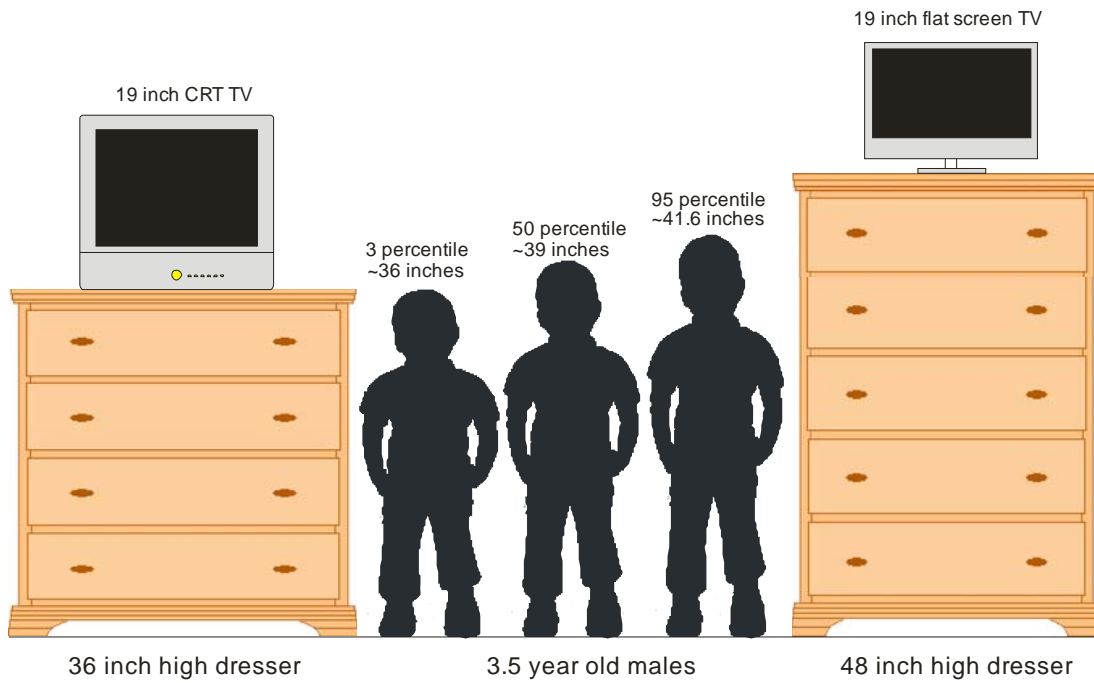


Figure 13. Height comparison for TVs and 3.5-year-old males

4.1 Climber and TV Heights Comparisons with Falling TVs

The 220 nonfatal incidents where a child was attempting to climb furniture to reach an item at the top of the dresser show that around 68 percent (68.6 percent, 151/220) of the incidents involved TVs that fell from a height of 36 inches to 48 inches. The sizes of the TVs involved in the incidents were typically “common” TV sizes. Two of the three highest counts for TV sizes that were involved in the incidents were 19-inch and 32-inch TVs. The 19-inch and 32-inch size TVs were 13.5 percent (40/296) and 14.9 percent (44/296), respectively.

To evaluate the fall pattern of TVs from two different dresser heights, CRT and flat-screen TVs were slid from a mock TV stand. Two different size TVs (19-inch and 32-inch) at two different heights (36-inches and 48-inches) were tested. The mock dresser was tipped until the TV fell from the dresser. The TVs would start to slide off the stand at approximately 13 to 14 degrees.

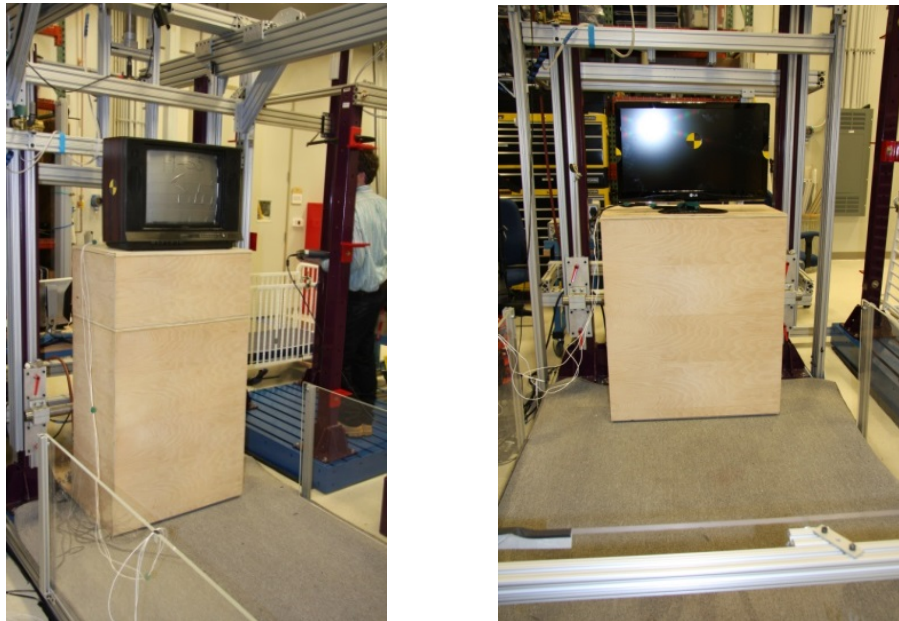
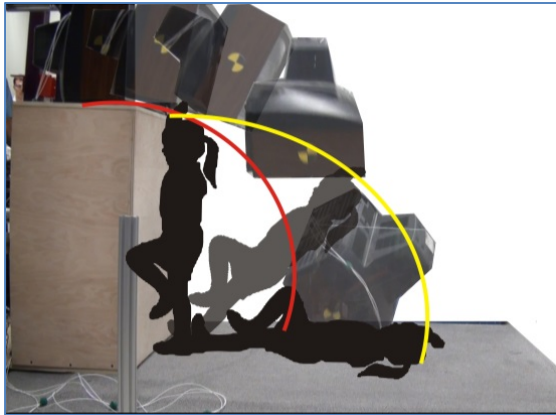


Figure 14. A CRT TV on a 48-inch stand and a flat-screen TV on a 36-inch stand

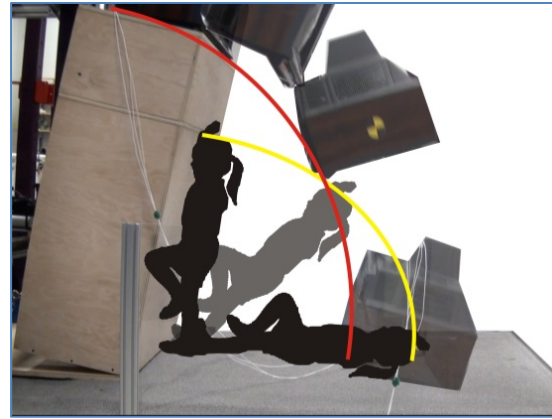
The analysis was conducted by capturing video frames from the testing and superimposing a child’s image to create a trajectory of the falling TV. A 36-inch (~3 percentile) tall 3.5-year-old child was superimposed in the figure for reference. The child’s image in the figures represents a child close to the dresser, as if they were interacting with the dresser. The child’s images, in Figures 15 and 16, show the child falling backwards by pivoting at the heel. The child’s images do not represent all scenarios when a child falls.

The images show that a CRT TVs’ falling trajectory is different, depending on the dresser height and the distance of the child from the dresser. The images show that when the TV falls from 48 inches, it would most likely strike the 3.5-year-old (36 inches tall) child in the head, but if the TV fell from 36 inch height, the TV would most likely strike the child in the torso/head region. The trajectory and pattern for the CRT TV falling from the furniture was consistent. The CRTs fell off the dresser by first sliding from the surface. When the angle of

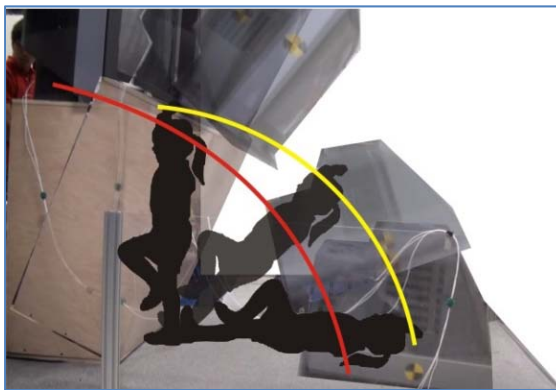
the surface on which the TV was sitting was great enough to allow the TV to slide, the TV would fall with the CRT pointing downward in a sweeping motion. This created a large surface area for striking the child, which has the potential to be fatal as seen in other incident reports.



19-inch CRT TV at 36-inch height



19-inch CRT TV at 48-inch height



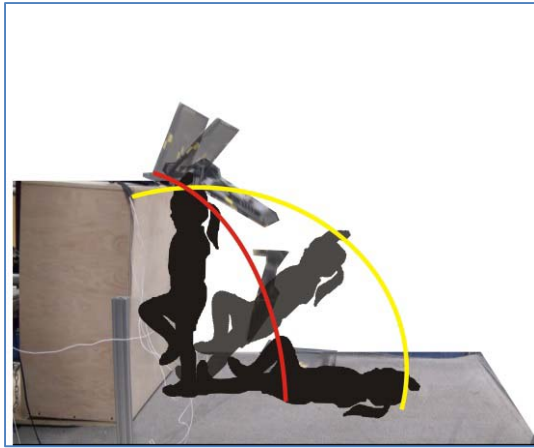
32-inch CRT at 36-inch height



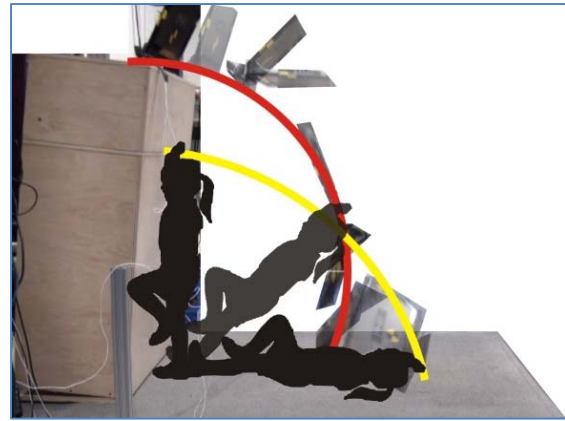
32-inch CRT at 48-inch height

Figure 15. CRT TVs and 36-inch tall child

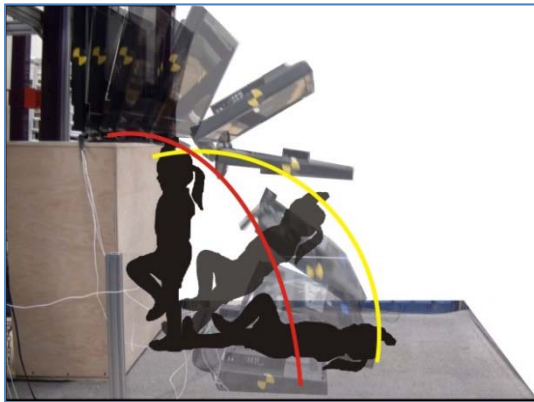
The flat-screen TVs fell very differently than the CRT TVs. Additionally, the way the flat-screen TVs fell depended on the height from which the TV fell. At the 36-inch height, both the 32-inch and 19-inch flat-screen TVs would most likely strike the child around the torso area. The TV on a higher platform, such as 48 inches high, causes the falling flat-screen TV more likely to strike to the child in the head. The pattern the flat-screen TV fell was random regardless of TV size and height. The TVs would fall in a tumbling motion. The flat-screen TVs' unrepeatable falling pattern may be caused by the size of the TV's base and centered mass. Reviewing the high-speed video shows that the flat-screen TV rotates during its descent, thus, creating a more unpredictable falling pattern and thus, an unpredictable pattern of injury.



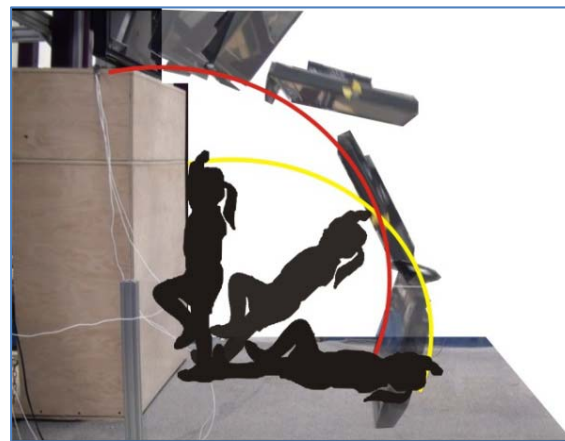
19-inch flat-screen TV at 36-inch height



19-inch flat-screen TV at 48-inch height



19-inch flat-screen TV at 36-inch height



19-inch flat-screen TV at 48-inch height

Figure 16. Flat-screen TVs and 36-inch tall child

5.0 CONCLUSIONS

The majority of the reported incidents occurred when the child was climbing in an apparent attempt to interact with the TV. In all but one of the incident reports reviewed, it appears that the TVs were not secured to the furniture or wall at the time of the incidents.

Based on CPSC staff's analysis of 296 nonfatal incidents involving falling TVs, the following recommendations and/or observations can be drawn:

- Removing TVs from furniture, such as CBDs, can significantly reduce the number of falling TVs, and thus, injuries. The data show that children were climbing the furniture to reach and interact with the TV or other media equipment, such as DVD players and gaming systems. It can be surmised that if the TVs were not on top of the CBD type furniture, the incident may not have occurred or would have reduced the likelihood for the child wanting to climb the furniture. There is still the danger of unstable furniture that can tip over and strike the child, regardless of a TV being present, which is shown in CPSC report for furniture tip-overs.¹
- Around 91 percent of the incidents (90.9 percent, 261/287, 9 unknowns) with the TV type known involved CRT TVs. CRT TVs are typically front-heavy because of the large display tube. The falling pattern of CRT TVs is more consistent or repeatable than flat-screen TVs. How the TV strikes a child may depend upon the initial height of the TV and the child's height. A falling TV has the highest potential of causing a head injury than any other body part, as seen in the dataset. The severity of the injury may depend on many variables, such as how the child falls, where the child was standing, TV slide rate, type and size of the TVs, surrounding furniture, and the presence of other people. Removing CRTs from homes may significantly reduce the number and severity of injuries from falling TVs.
- Fifty percent of the climbers (63/126) in the incidents had a height percentile that was 3 or less. About 75 percent of the climbers (94/126) had a height percentile less than or equal to 50. About 79 percent of the incidents involved children (100/126) who were shorter (by 1 inch or more) than the height of the TV or the furniture. About 68 percent of the climbers (86/126) were 6 inches to 36 inches shorter than the TV height. From the data, it is reasonable to believe for children that are shorter than the reach to the TV and the top of the CBD may motivate children to climb, thus, placing a child at a higher risk of injury from falling TVs and furniture that is not secured.
- Ninety percent of the climbers (159/176) weighed 50 lbs. or less. Most of the climbers (45.5 percent, 80/176) weighed 30 lbs. to less than 40 lbs. The minimum weight of a climber in the dataset was 21 lbs. and the maximum weight of a climber was 90 lbs. Additional testing may need to be conducted to further evaluate and understand the relationship between static and dynamic forces during a tipping scenario.