



U.S. CONSUMER PRODUCT SAFETY COMMISSION
5 RESEARCH PLACE
ROCKVILLE, MD 20850

Kristen Talcott, PhD, Division of Human Factors
Hope Nesteruk, Division of Mechanical and Combustion Engineering

KTalcott@cpsc.gov
HNesteruk@cpsc.gov

August 24, 2018

TRANSMITTED VIA EMAIL

Philip Carlisle
Age/Weight Task Group Chair for ASTM F15.42
100 Barr Harbor Dr.
West Conshohocken, PA 19428-2959

Re: Questions raised by Age/Weight Task Group regarding available data

Dear Mr. Carlisle:

At the meeting of the age/weight task group on April 24, 2018, and at the meeting on May 4, 2018, ASTM subcommittee members asked several questions regarding the correlations among victim age, weight, and height. CPSC staff prepared the attached analysis based on the questions raised by ASTM members. The analysis has not been reviewed or approved by the Commission, and therefore may not necessarily reflect the views of the Commission.

The following pages contain analysis based on child (< 18 years) clothing storage furniture tipover fatalities reported to CPSC staff from 1/1/2000 to 12/31/2015.¹ This is the dataset that was discussed at the April and May meetings with the F15.42 subcommittee. We hope that the task group will find the information useful as they continue to discuss how age and child weight relate to furniture stability. We will update these analyses after the next dataset is available.

Sincerely,

Two handwritten signatures are present. The first signature, on the left, is a stylized, cursive signature that appears to be "KT". The second signature, on the right, is a more legible cursive signature that appears to be "HN".

Kristen Talcott, PhD and Hope E J. Nesteruk

cc: Patricia Edwards, CPSC Voluntary Standards Coordinator
Rick Rosati, Chair, ASTM F15.42 subcommittee

¹ The reports are drawn from the 2016 Tip Over Report focusing on clothing storage units (*i.e.*, involving "arm," "cbd," "shelf," "ward," or "portable closet.") The search identified 159 child fatalities.

Child (< 18 years) Clothing Storage Furniture Tipover Fatalities Reported to CPSC Staff: 1/1/2000 - 12/31/2015²

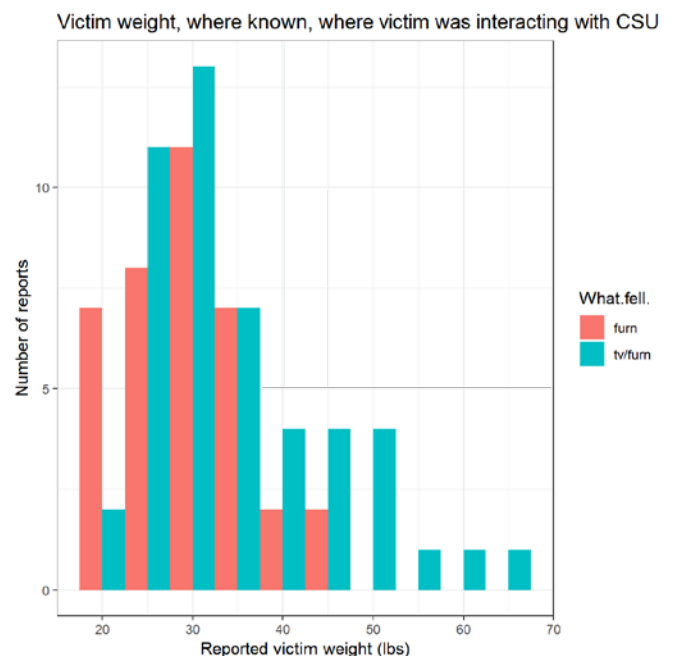
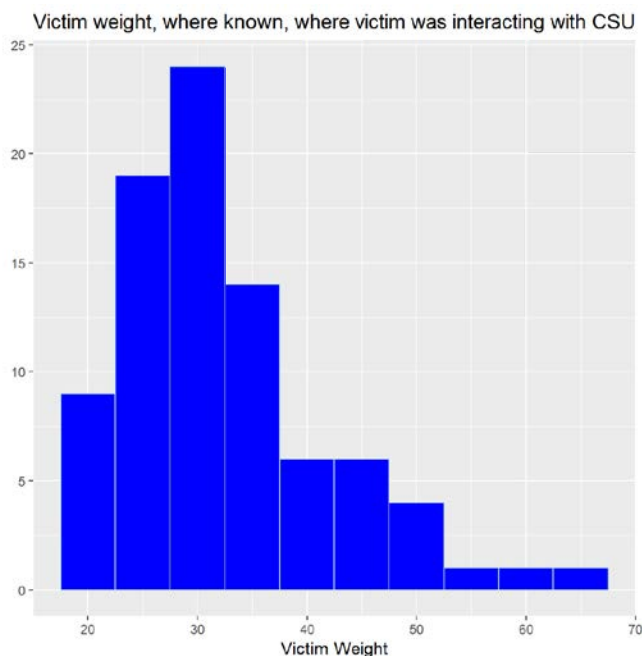
Data Summary

Of the 159 fatality reports:

- **88** (55%) reports included a **height for the CSU**;
- **87** (54%) reports included a **height for the victim**;
- **85** (53%) reports included a **weight for the victim**;
- Only **60** (37%) cases reported all three; and
- **Weight of the CSU** was unknown for almost all IDIs; therefore, no analysis is available.

Question raised: What are the weights of children interacting with CSUs that tipped over, resulting in injuries or fatalities?

Answer: For injuries, the weight of the child is not readily ascertainable. NEISS reports do not contain much information about the victim. Nonfatal incident reports rarely contain a child's weight, and those that do often do not report a weight with an accuracy level sufficient for analysis (*e.g.*, the report states "about 40 pounds"). Fatality IDIs often contain autopsy reports, which report an exact height and weight. The two histograms below show a count of reports where the victim weight could be obtained. In 74 (46.5%) of the 159 cases, the report did not contain the weight of the child who had interacted with the CSU. In 11 of the 74 cases, the victim was not the one who had interacted with the CSU. The histograms represent what is known for the 148 incidents where the victim interacted with the CSU; not shown are 63 cases where victim weight is unknown.



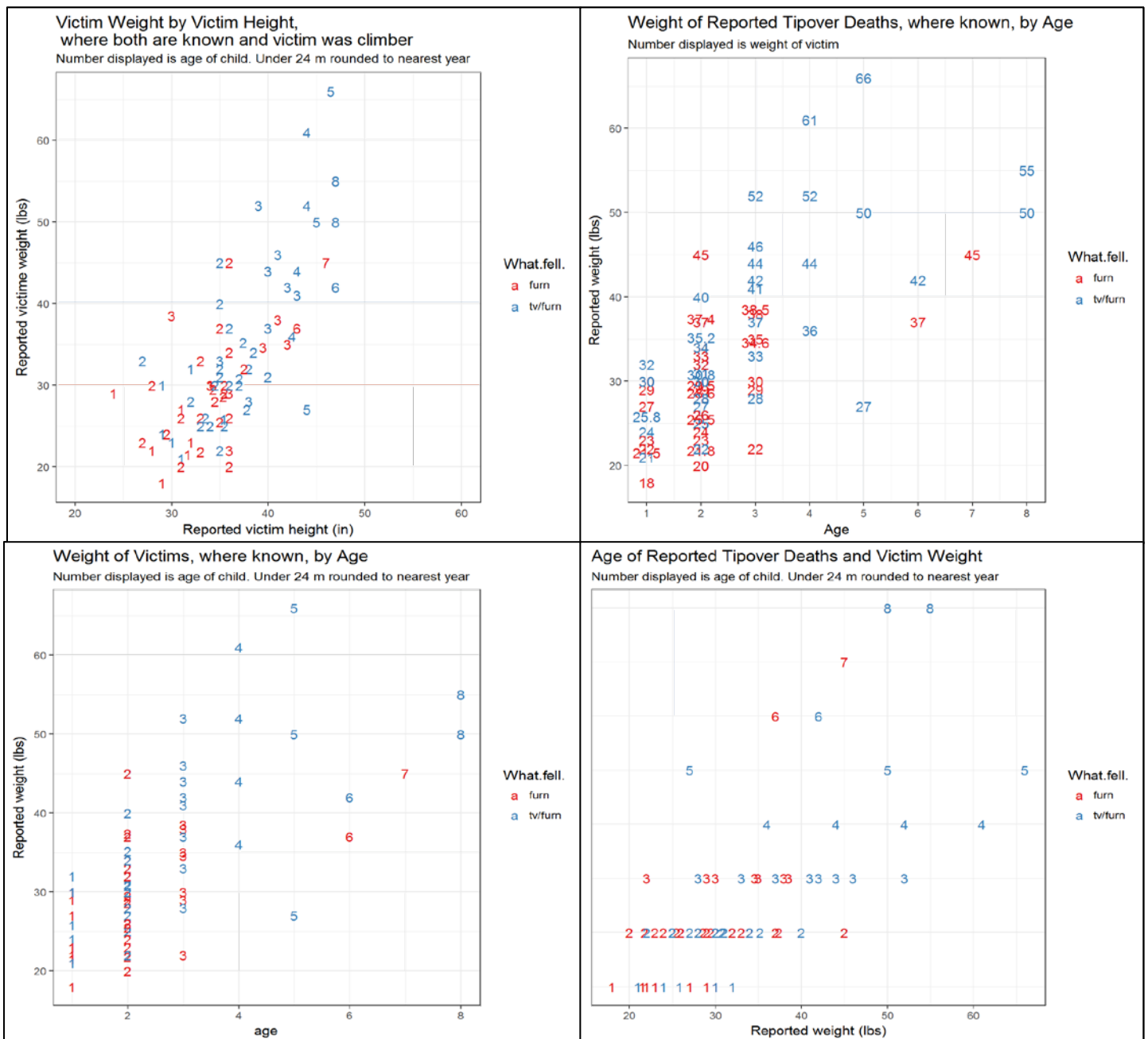
² The reports are drawn from the 2016 Tip Over Report focusing on clothing storage units (*i.e.*, involving "arm," "cbd," "shelf," "ward," or "portable closet.") The search identified 159 child fatalities.

Question raised: Do the heavier victims tend to be taller and older?

Answer:

- a) In the 85 cases where weight was known, victim weight was moderately correlated with age in years ($R^2 = 0.44$), meaning less than half the variance in weight is related to age.
- b) In the 83 cases where both height and weight were known, there was a moderate correlation between victim weight and victim height ($R^2 = 0.50$), with half of variance in victim weight related to victim height.
- c) Taken together, about half (adjusted $R^2 = 0.52$) of the variance in weight is related to the combination of height and age.

The charts below show several ways to look at the age and weight of fatal victims.

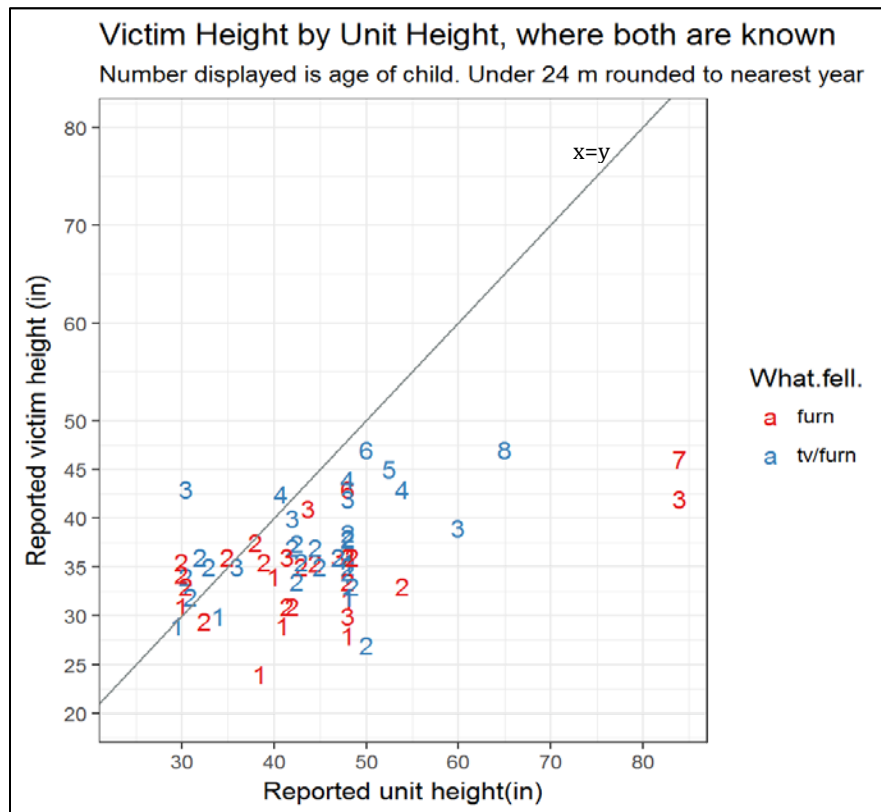


Question raised: Does the height of the victim show any relationship to the CSU height in tipover fatalities?

Answer:

There are some cases where the victim was taller than the CSU, as represented by the points above the x=y line in the victim height by unit height chart shown below. Staff previously reported:

For 63 cases, both victim height and the height of the clothing storage unit were reported in the IDI. ESHF staff found that the victim was at least half the height of the clothing storage unit in all 63 cases, and was at least 70 percent as tall as the unit in over 80 percent of the 63 cases. Again there are a large number of unknowns in the above data, so the analysis may not be representative of the entire data set and caution must be exercised. Over ninety-five percent of children will exceed 25.2 inches (*i.e.*, 70% of three feet) by nine-months-of-age (Flegal and Cole, 2013). The largest boys will begin to exceed 33.6 inches (*i.e.*, 70% of four feet) by 17 months, while the smallest girls will not exceed 33.6 inches until 33 months (Flegal and Cole, 2013). As shown in Figure 4, most children 2 years old through 5 years old will be between 70 and 100 percent as tall as a four foot tall dresser (Flegal and Cole, 2013). Because the range of 24 inches to 48 inches range encompasses most children, the appearance of a correlation between child height and dresser height is likely to be simply an artifact of children's physical growth compared against typical dressers. In addition, the developmental growth factors discussed above that suggest children climb to reach the upper drawers and top of the dresser and to challenge themselves. (Nesteruk, 2016)



Question raised: Does the weight of the victim show any relationship to the CSU height in tipover fatalities?

Answer:

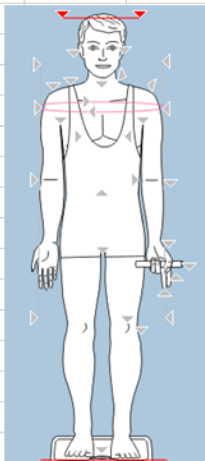
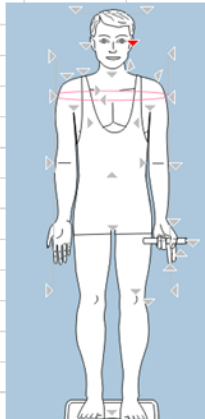
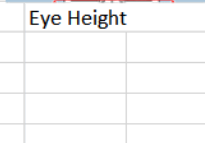
There were 61 cases where both a victim weight and a unit height were known. For those cases, victim weight is weakly correlated to unit height ($R^2 = 0.14$)



Question raised: Are there other sources for anthropometric data on eye height?

Answer:

The tables below provided data on stature and eye height from two anthropometric resources used by CPSC staff. Staff research on these data concluded that both datasets rely on scaling known measures to determine eye height. Values for *stature-eye height* and *eye height/stature* were calculated by staff, and suggest that 90 percent of stature is an appropriate estimate for eye height for children 3 to 5 years old.

| | | | | | | | | | |
|---|------------|-----------------|-----------------|----------------------|--------------------|---|--|--|--|
| Source: PeopleSize 2008 Professional. Open Ergonomics Ltd. | | | | | | | | | |
| Note: these are estimates based on PeopleSize algorithms. Data not available for 2 year olds. | | | | | | | | | |
| | | PeopleSize Data | | | | | | | |
| | Percentile | stature (in) | eye height (in) | stature - eye height | eye height/stature | | | | |
| US boy age 3 | 5th | 35.6 | 32.3 | 3.3 | 0.91 |  | | | |
| | 25th | 37.5 | 33.8 | 3.7 | 0.90 | | | | |
| | 50th | 38.8 | 34.9 | 3.9 | 0.90 | | | | |
| | 75th | 40.1 | 36 | 4.1 | 0.90 | | | | |
| | 95th | 42 | 37.5 | 4.5 | 0.89 | | | | |
| US girl age 3 | 5th | 36 | 32.6 | 3.4 | 0.91 | | | | |
| | 25th | 37.6 | 34 | 3.6 | 0.90 | | | | |
| | 50th | 38.7 | 34.9 | 3.8 | 0.90 | | | | |
| | 75th | 39.8 | 35.8 | 4 | 0.90 | | | | |
| | 95th | 41.5 | 37.1 | 4.4 | 0.89 | | | | |
| US boy age 4 | 5th | 38.8 | 34.8 | 4 | 0.90 | | | | |
| | 25th | 40.8 | 36.7 | 4.1 | 0.90 | | | | |
| | 50th | 42.2 | 38.1 | 4.1 | 0.90 | | | | |
| | 75th | 43.5 | 39.4 | 4.1 | 0.91 | | | | |
| | 95th | 45.5 | 41.4 | 4.1 | 0.91 | | | | |
| US girl age 4 | 5th | 38.4 | 33.6 | 4.8 | 0.88 |  | | | |
| | 25th | 40.2 | 35.9 | 4.3 | 0.89 | | | | |
| | 50th | 41.4 | 37.4 | 4 | 0.90 | | | | |
| | 75th | 42.6 | 38.9 | 3.7 | 0.91 | | | | |
| | 95th | 44.4 | 41.2 | 3.2 | 0.93 | | | | |
| US boy age 5 | 5th | 41.7 | 37.4 | 4.3 | 0.90 | | | | |
| | 25th | 43.7 | 39.3 | 4.4 | 0.90 | | | | |
| | 50th | 45 | 40.6 | 4.4 | 0.90 | | | | |
| | 75th | 46.4 | 41.9 | 4.5 | 0.90 | | | | |
| | 95th | 48.4 | 43.8 | 4.6 | 0.90 | | | | |
| US girl age 5 | 5th | 40.2 | 35.5 | 4.7 | 0.88 | | | | |
| | 25th | 42.5 | 38.1 | 4.4 | 0.90 | | | | |
| | 50th | 44.2 | 39.9 | 4.3 | 0.90 | | | | |
| | 75th | 45.8 | 41.7 | 4.1 | 0.91 | | | | |
| | 95th | 48.2 | 44.3 | 3.9 | 0.92 | | | | |
| US male (age 18-64) | 5th | 64.8 | 60.3 | 4.5 | 0.93 |  | | | |
| | 25th | 67.7 | 63.1 | 4.6 | 0.93 | | | | |
| | 50th | 69.6 | 65.1 | 4.5 | 0.94 | | | | |
| | 75th | 71.6 | 67.1 | 4.5 | 0.94 | | | | |
| | 95th | 74.5 | 69.9 | 4.6 | 0.94 | | | | |
| US female (age 18-64) | 5th | 59.8 | 55.9 | 3.9 | 0.93 | | | | |
| | 25th | 62.4 | 58.3 | 4.1 | 0.93 | | | | |
| | 50th | 64.2 | 60 | 4.2 | 0.93 | | | | |
| | 75th | 65.9 | 61.7 | 4.2 | 0.94 | | | | |
| | 95th | 68.5 | 64.1 | 4.4 | 0.94 | | | | |

Source: Pheasant, S. (1996). Bodyspace. Anthropometry, Ergonomics and the Design of Work. Second Edition. Bristol, PA: Taylor and Francis.

Note: These are estimates based on ratio scaling. Data converted from millimeters to inches

| | Percentile | BodySpace Data | | stature - eye height | eye height/stature |
|-----------------------------------|------------|----------------|-----------------|----------------------|--------------------|
| | | stature (in) | eye height (in) | | |
| British 2 year olds: boys | 5th | 33.5 | 29.9 | 3.5 | 0.89 |
| | 50th | 36.6 | 33.1 | 3.5 | 0.90 |
| | 95th | 39.8 | 36.2 | 3.5 | 0.91 |
| British 2 year olds: girls | 5th | 32.5 | 28.5 | 3.9 | 0.88 |
| | 50th | 35.0 | 31.7 | 3.3 | 0.90 |
| | 95th | 37.6 | 34.8 | 2.8 | 0.93 |
| British 3 year olds: boys | 5th | 35.8 | 31.9 | 3.9 | 0.89 |
| | 50th | 39.0 | 35.0 | 3.9 | 0.90 |
| | 95th | 42.1 | 38.2 | 3.9 | 0.91 |
| British 3 year olds: girls | 5th | 35.2 | 30.9 | 4.3 | 0.88 |
| | 50th | 38.2 | 34.4 | 3.7 | 0.90 |
| | 95th | 41.1 | 38.0 | 3.1 | 0.92 |
| British 4 year olds: boys | 5th | 38.4 | 34.1 | 4.3 | 0.89 |
| | 50th | 41.3 | 37.0 | 4.3 | 0.90 |
| | 95th | 44.3 | 40.0 | 4.3 | 0.90 |
| British 4 year olds: girls | 5th | 38.0 | 33.3 | 4.7 | 0.88 |
| | 50th | 41.3 | 37.2 | 4.1 | 0.90 |
| | 95th | 44.7 | 41.1 | 3.5 | 0.92 |
| British 5 year olds: boys | 5th | 40.4 | 35.8 | 4.5 | 0.89 |
| | 50th | 43.7 | 39.2 | 4.5 | 0.90 |
| | 95th | 47.0 | 42.5 | 4.5 | 0.90 |
| British 5 year olds: girls | 5th | 40.0 | 34.8 | 5.1 | 0.87 |
| | 50th | 43.3 | 39.0 | 4.3 | 0.90 |
| | 95th | 46.7 | 43.1 | 3.5 | 0.92 |
| British adults (age 19-65): Men | 5th | 64.0 | 59.6 | 4.3 | 0.93 |
| | 50th | 68.5 | 64.2 | 4.3 | 0.94 |
| | 95th | 73.0 | 68.7 | 4.3 | 0.94 |
| British adults (age 19-65): Women | 5th | 59.3 | 55.3 | 3.9 | 0.93 |
| | 50th | 63.4 | 59.3 | 4.1 | 0.93 |
| | 95th | 67.3 | 63.4 | 3.9 | 0.94 |