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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,

Kristen Talcott, PhD and Hope E J. Nesteruk

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

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[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 - 12/31/2015[2]
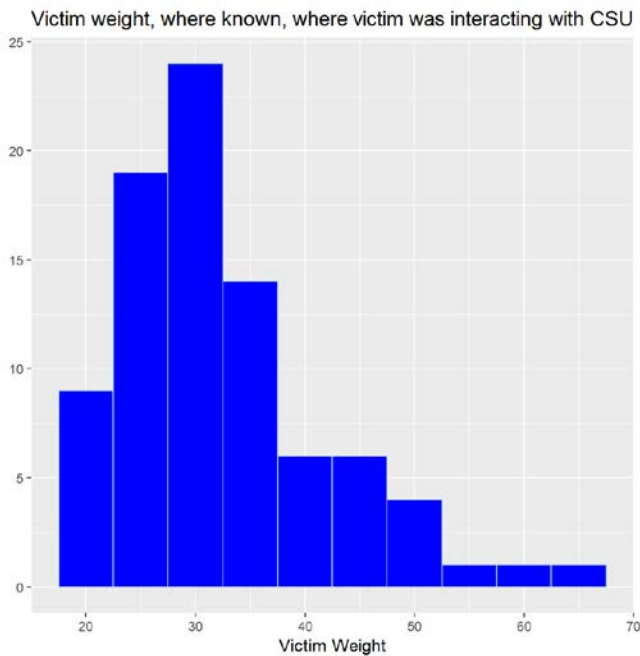
Data Summary

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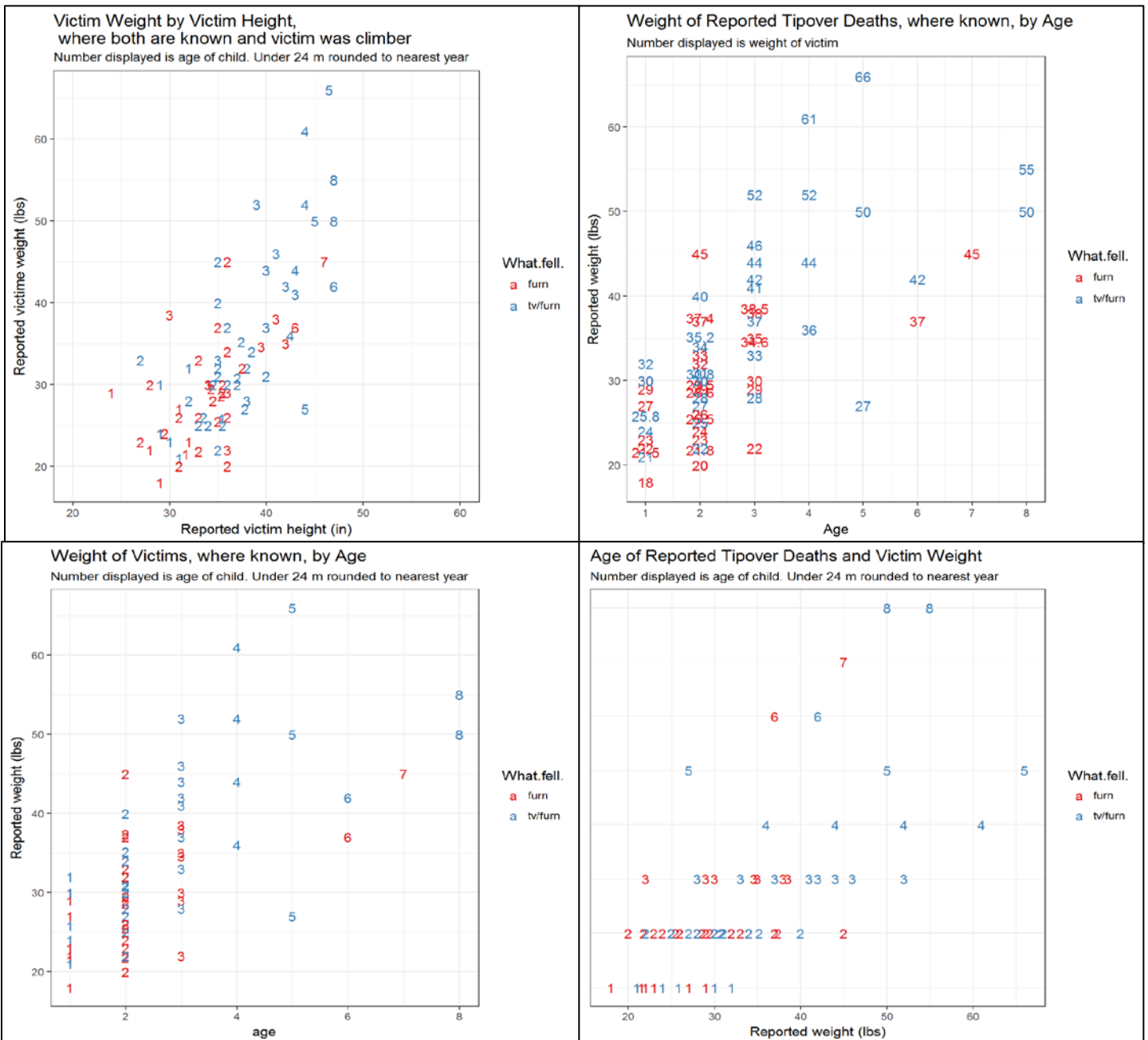
Question raised: Do the heavier victims tend to be taller and older?

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.

Victim Weight by Victim Height, where both are known and victim was climber
Number displayed is age of child. Under 24 m rounded to nearest year
(scatter plot: Reported victim weight (lbs) vs Reported victim height (in); legend What.fell. a furn, a tv/furn)

Weight of Reported Tipover Deaths, where known, by Age
Number displayed is weight of victim
(scatter plot: Reported weight (lbs) vs Age; legend What.fell. a furn, a tv/furn)

Weight of Victims, where known, by Age
Number displayed is age of child. Under 24 m rounded to nearest year
(scatter plot: Reported weight (lbs) vs age; legend What.fell. a furn, a tv/furn)

Age of Reported Tipover Deaths and Victim Weight
Number displayed is age of child. Under 24 m rounded to nearest year
(scatter plot: vs Reported weight (lbs); legend What.fell. a furn, a tv/furn)
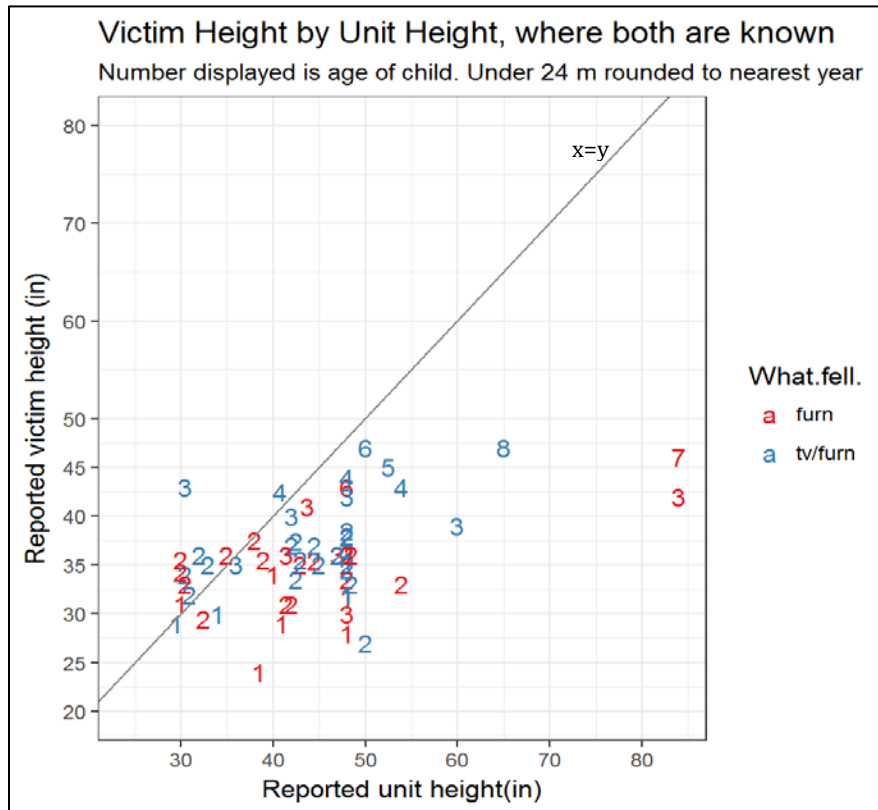
Question raised: Does the height of the victim show any relationship to the CSU height in tipover fatalities?

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:
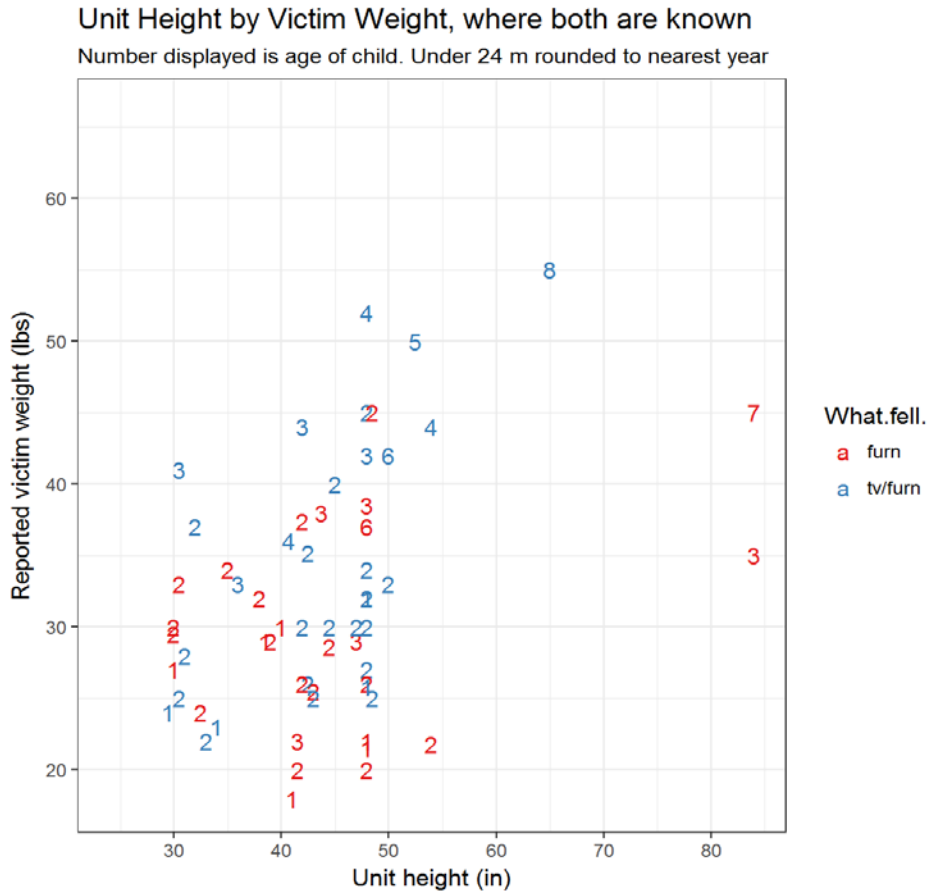
> For 63 cases, both victim height and the height of the clothing storage unit were reported in the IDI. ESHF staff found that the victim was at least half the height of the clothing storage unit in all 63 cases, and was at least 70 percent as tall as the unit in over 80 percent of the 63 cases. Again 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)

Victim Height by Unit Height, where both are known
Number displayed is age of child. Under 24 m rounded to nearest year

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 ($R^2 = 0.14$)
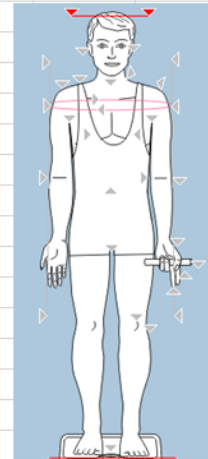
Unit Height by Victim Weight, where both are known
Number displayed is age of child. Under 24 m rounded to nearest year

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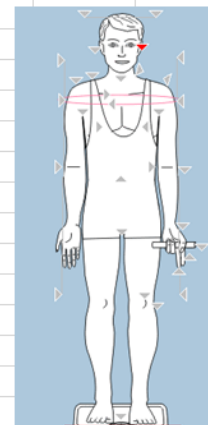
Answer:

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.

	Percentile	stature (in)	eye height (in)	stature - eye height	eye height/stature
		PeopleSize Data			
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

Stature

Eye Height

Source: Phesant, 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