



2003 ELECTROCUTIONS ASSOCIATED WITH CONSUMER PRODUCTS*

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* This analysis was prepared by the CPSC staff. It has not been reviewed or approved by, and may not necessarily reflect the views of, the Commission.

Introduction

This report was prepared by U.S. Consumer Product Safety Commission (CPSC) staff and contains estimates of the number of electrocutions involving consumer products and the corresponding death rates from 1993 through 2003.

Results

Based on data from the National Center for Health Statistics (NCHS), the total number of electrocutions in the U.S. has decreased from 550 in 1993 to 380 in 2003, a reduction of 31 percent. Table 1 shows that during this same time period, the estimated number of electrocutions related to consumer products decreased from 210 to 160, resulting in a reduction of 24 percent. In 1993, the age-adjusted rate for consumer product-related electrocutions was 0.82 per million U.S. population. In 2003, that rate dropped to 0.55 electrocutions per million, reflecting a decrease of 33 percent. A regression analysis confirms the statistical significance of the decline in both total electrocutions and consumer product-related electrocutions ($p=0.0003$ and $p=0.0025$ respectively, see Figure 1). The decline in the age-adjusted death rates is also statistically significant ($p=0.0003$).

Table 1. Total Electrocutions, Consumer Product-Related Electrocutions and Death Rates in U.S., 1993-2003

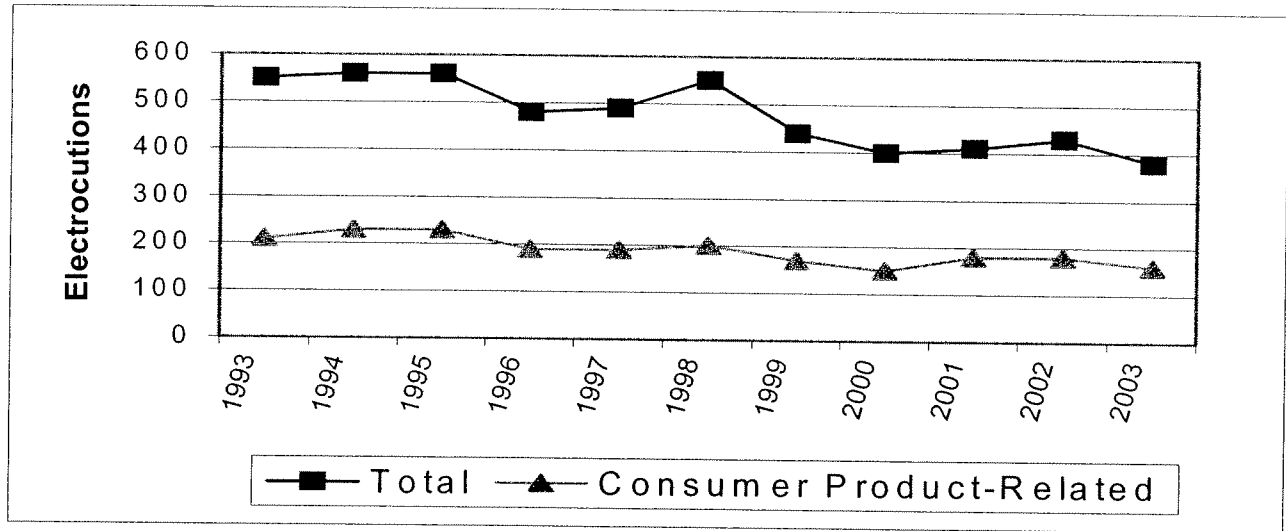
Year	U.S. Total Electrocutions ¹	Consumer Product-Related Electrocutions		
		Estimates	Percent of Total	Age-Adjusted Death Rates per Million Population
1993	550	210	38%	0.82
1994	560	230	41%	0.89
1995	560	230	41%	0.88
1996	480	190	40%	0.72
1997	490	190	39%	0.71
1998	550	200	36%	0.74
1999	440	170	39%	0.62
2000	400	150	38%	0.53
2001	410	180	44%	0.63
2002	430	180	42%	0.62
2003	380	160	42%	0.55

Source:

1. NCHS, Multiple Cause of Death data, 1993-2003.
2. U.S. Census Bureau, Population Division; see References [3] and [4].

¹ Deaths from 1993-1998 are based on the ninth revision of the International Classification of Diseases (ICD-9) while deaths from 1999-2003 are based on the tenth revision (ICD-10). Statistics for 1993-1999 on total electrocutions, consumer product-related electrocution estimates and age-adjusted death rates are from Reference [1], while statistics for 2000-2002 are from Reference [5]. All death estimates are rounded to the nearest 10.

Figure 1. Total Electrocutions and Consumer Product-Related Electrocutions in U.S., 1993-2003



Source: NCHS, Multiple Cause of Death data, 1993-2003.

Table 2 shows the breakdown of the 160 consumer product-related electrocutions by specific products involved. In 2003, installed household wiring including panel boards, circuit breakers, junction boxes, switches, and outlets accounted for the largest proportion (15%) of deaths. Contact with high voltage power lines through pipes and poles (such as the handle of a paint roller), Christmas lighting, chimney parts, and non-powered saws accounted for 12% of the deaths. Air conditioners, furnaces, pumps (sump, heat), and other large appliances accounted for another 12% of the electrocutions. Power tools (drills, welding equipment, and electric drain snakes, among others) were responsible for 10% of the electrocutions. Ladders, which in most cases contacted overhead power lines, were also responsible for another 10% of the deaths. Small appliances (such as fans, microwave ovens, extension cords) were next, responsible for 9% of the deaths. Damaged or exposed wiring, where either the wiring was located outdoors or the exact nature of the wiring was unspecified, accounted for 7% of the electrocutions. Another 7% of the deaths were associated with gardening and farming equipment. Lighting equipment (lamps, bulbs, fixtures, etc.) was involved in 5% of the deaths. Miscellaneous other products, such as pipes and poles, fences, boat lifts, amusement park rides, antennas, hot tubs or unspecified power cords, that were energized or somehow became energized accounted for another 12% of the deaths. No product was specified for the remaining 2% of the electrocutions.

Table 2. Electrocutions by Types of Consumer Products, 2003

Type of Consumer Product	Estimate*	Percent*
Total	160	100
Installed Household Wiring (includes panel board, junction box, circuit breaker, and outlet)	24	15%
Contact with Power Line Through:	19	12%
Pipe/Pole	10	
Saw (chain, other)	3	
Miscellaneous (chimney, Christmas light, paint roller handle)	4	
Unspecified	3	
Large Appliance	19	12%
Air Conditioner	7	
Furnace	4	
Pump (sump, heat)	4	
Other (compressor, power vent) / Unspecified	4	
Power Tool	15	10%
Drill	4	
Welding Equipment	4	
Drain Snake	3	
Other (floor buffer, pressure washer, skilled saw)	4	
Ladder	15	10%
Small Appliance	14	9%
Heating / Cooling (heater, fan)	3	
Cooking (microwave, grill)	3	
Personal Use (razor, muscle stimulator)	3	
Other (adapter, battery charger, extension cord, radio amplifier)	6	
Other Wiring - Outdoor (water well, yard lighting, outdoor electric box) / Unspecified	11	7%
Lawn / Garden / Farm Equipment	11	7%
Lighting Equipment (lamp, bulb, light fixture)	8	5%
Other Miscellaneous Product	19	12%
Unspecified Cord	6	
Fence	3	
Pipe / Pole	3	
Amusement Ride	3	
Boat Lift	3	
Other (antenna, hot tub)	3	
Unspecified	3	2%

Source: U.S. Consumer Product Safety Commission, Directorate for Epidemiology, Hazard Analysis Division.

*Due to rounding, detail numbers may not add to total or subtotals.

Methodology

All death certificates filed in the U.S. are compiled by the National Center for Health Statistics into multiple cause mortality data files. The mortality data files contain demographic information on the deceased as well as codes to classify the underlying cause of death and up to 20 contributing conditions. The data are compiled in accordance with the World Health Organization instructions, which request that member nations classify causes of death according to the current Manual of the International Statistical Classification of Diseases, Injuries, and Causes of Death. The ninth revision of the International Classification of Diseases (ICD) was implemented in 1979 while the tenth revision was implemented in 1999. The 1993 -1998 electrocution estimates and age-adjusted death rates presented in this report are based on the ninth revision and the 1999-2003 estimates and rates are based on the tenth revision of the ICD.

The introduction of a new revision of ICD has the potential to create discontinuities in trend data. One measure of the extent of the discontinuity between ICD-9 and ICD-10 is a comparability ratio, which is computed by double coding a large sample of the national mortality file, once by the old version (ICD-9) and again by the new version (ICD-10). The results can be expressed as a ratio of the number of deaths for a given cause coded and classified by ICD-10 to the number of deaths for the same cause coded and classified by ICD-9. ICD-9 codes for electrocution, E925.0, E925.1, E925.2, E925.8, and E925.9, are now distributed among ICD-10 codes W85, W86, and W87 as shown below. A preliminary report by Ault [2] indicated that the comparability ratio may be 1.00. A recalculation of the ratio, using the final public use U.S. ICD9 / ICD10 Comparability File released in 2004 by the National Center for Health Statistics and National Vital Statistics System confirms that it is indeed 1.00. This seems to imply that there is strict comparability between ICD-9 and ICD-10 for electrocution.

ICD-9 Version

ICD-10 Version

E925.0	-----→	W86
E925.1	-----→	W85, W86
E925.2	-----→	W86
E925.8	-----→	W86
E925.9	-----→	W87

Definition

ICD-9

- E925.0 Accident caused by electric current: Domestic wiring and appliances
- E925.1 Accident caused by electric current: Electric power generating plants, distribution stations, transmission lines
- E925.2 Accident caused by electric current: Industrial wiring, appliances and electrical machinery
- E925.8 Accident caused by electric current: Other
- E925.9 Accident caused by electric current: Unspecified

ICD-10

W85 Accident caused by electric current: Electric transmission lines

W86 Accident caused by electric current: Other specified electric current

W87 Accident caused by electric current: Unspecified electric current

Although the classification codes completely map from one ICD version to the next, the locations (where the electrocution incident occurred) within those codes have changed. For code E925.1 and E925.9 in ICD-9, all cases were coded as having occurred at an “industrial location” and at “not specified location”, respectively. There is no similar restriction in ICD-10 because each of the codes W85-W87 allows all possible locations. Since CPSC staff’s method of estimating consumer product-related electrocutions relies on the location code, this difference affects our estimates. For 1993 -1998, the restriction of code E925.1 to the industrial location may have resulted in an underestimate of cases of interest to CPSC under ICD-9. Because the restriction on location is gone in ICD-10, we may now (from 1999 onwards) see cases that we did not see before.

Outlined below are the steps used to estimate the total number of electrocutions associated with the use of consumer products and the corresponding age-adjusted death rates in 2003.

1. *Extract the electrocution data*

Using the following external cause of death ICD-10 codes in the NCHS file, the electrocution incidents were identified (Table 3):

W85 - Accident caused by electric current: Electric transmission lines

W86 - Accident caused by electric current: Other specified electric current

W87 - Accident caused by electric current: Unspecified electric current

Table 3: Electrocution Data Classified by ICD-10 Codes and Location, 2003

ICD-10 Code	Location of Incidents							Total
	Home / Residential	Sport / Recreation	Farm	Street / Public	Industrial Place	Other	Not Specified	
W85	26	1	0	22	18	14	15	96
W86	38	1	6	10	23	18	12	108
W87	59	1	7	18	33	30	25	173
Total	123	3	13	50	74	62	52	377*

Source: NCHS, Multiple Cause of Death data.

* Rounded to 380 (to nearest 10) when reported on Table 1.

2. *Estimate the total number of consumer product-related deaths (in Table 1)*

Deaths occurring in homes and residential institutions, sports and recreational areas, and farms were assumed to be related to consumer products. Assuming that electrocutions occurring in “not specified” locations followed the same distribution as those in known locations, an allocation scheme was used. For each ICD-10 code, a proportion of the “not specified” electrocutions was added to the counts for known locations. Finally, the adjusted counts for homes and residential institutions, sports and recreational areas, and farms were summed to get the total estimated number of consumer product-related deaths of 160. Calculation details are shown in Table 4 below.

Table 4: After Allocation of Electrocutions Occurring at “Not Specified” Locations, 2003

ICD-10 Code	Location of Incidents						Total
	Home / Residential	Sport / Recreation	Farm	Street / Public	Industrial Place	Other	
W85	30.81	1.19	0	26.07	21.33	16.59	95.99
W86	42.75	1.13	6.75	11.25	25.88	20.25	108.01
W87	68.97	1.17	8.18	21.04	38.57	35.07	173.00
Total	142.53	3.49	14.93	58.36	85.78	71.91	377.00
ROUND	143	3	15	58	86	72	377
Consumer Product-Related Deaths	143	3	15				161*

Source: NCHS, Multiple Cause of Death data.

* Approximately 160 (by rounding to the nearest 10)

3. Obtain product specific death estimates (in Table 2)

Since NCHS data do not provide product-specific information, we made use of CPSC databases to obtain estimates of product-specific electrocutions using the process described below.

- CPSC purchases certificates of deaths due to electrocutions and other external causes from all 50 states, New York City, and the District of Columbia. The death certificates that include sufficient information to identify the consumer product involved in the incident are coded and maintained in the Death Certificate database (DTHS). At the time of this data extraction, DTHS was over 95% complete for 2003. CPSC also maintains the Injury or Potential Injury Incident database (IPII) which contains data based on reports from newspaper clippings, consumer complaints, and medical examiner reports. These reports describe deaths, injuries, and “near miss” incidents involving consumer products.
- The electrocution incidents from the two databases, DTHS and IPII, were combined and compared by date of death, state, sex, and age to screen out any duplicate reports. Copies of death certificates and IPII source documents such as news clippings, consumer complaints, and coroner/medical examiner reports corresponding to these incidents were reviewed to verify the accuracy of the information (especially incident location) contained in the records from the databases. Any out-of-scope records (with non-addressable product involvement) were also removed. The CPSC records were then matched to the NCHS records already identified above (to obtain the total electrocution estimate) on the basis of month and day of death, state, age, and sex.
- Counts of the matching records where electrocutions occurred in homes, residential institutions, farms, and sports and recreational areas² were summed to determine the total number of electrocutions based on CPSC databases. To estimate the number of electrocutions associated with each product, the percentage of the CPSC database total for each product category was applied to the total number of estimated consumer product-related electrocutions obtained from the NCHS data. These estimates are shown in Table 2.

² Based on the locations described in CPSC records. Locations in NCHS records were used only when the information was not available in CPSC records.

4. Obtain the age-adjusted death rate (in Table 1)

The electrocution estimates were combined with the estimates of the U.S. resident population from the U.S. Census Bureau [4] to calculate annual mortality rates. The distribution of the U.S. population has been shifting over time due to the aging of the “baby boomer” population. While the unadjusted (crude) mortality rate (the total number of deaths in a specific year divided by the population for that year) accounts for the number of events occurring in a population, it does not account for the changing age structure of the population over a specified time period. An alternative measure that can be used to address such changes in the age composition of the population is the age-adjusted (standardized) rate. For the years 1993 through 2003, the “direct method of adjustment” was used to calculate the age-adjusted death rates with the 2000 U.S. resident population as the standard [3]. Direct adjustment entails weighting annual age-specific rates (the number of deaths occurring in a specified age group divided by the population of that age group) by the distribution of the standard population. The steps in computation of the age-adjusted death rate for the year 2003 are shown in Tables 5 – 8.

Table 5: Electrocutions by Location and Age Groups, 2003

Age Group	Location of Incidents							Total
	Home / Residential	Sport / Recreation	Farm	Street / Public	Industrial Place	Other	Not Specified	
Under 15	11	1	0	1	0	5	2	20
15-34	38	0	4	23	33	28	26	152
35-54	49	1	5	20	31	24	22	152
55+	25	1	4	6	10	5	2	53
Total	123	3	13	50	74	62	52	377

Source: NCHS, Multiple Cause of Death data.

Table 6: After Allocation of Deaths in “Not Specified” Locations, 2003

Age Group	Location of Incidents						Total
	Home / Residential	Sport / Recreation	Farm	Street / Public	Industrial Place	Other	
Under 15	12.22	1.11	0	1.11	0	5.56	20.00
15-34	45.84	0.00	4.83	27.75	39.81	33.78	152.01
35-54	57.29	1.17	5.85	23.38	36.25	28.06	152.00
55+	25.98	1.04	4.16	6.24	10.39	5.20	53.01
Total	141.33	3.32	14.84	58.48	86.45	72.60	377.02

Source: NCHS, Multiple Cause of Death data.

Table 7: Rounding Data for Consumer Product-Related Electrocutions, 2003

Age Group	Home / Residential	Sport / Recreation	Farm	Total	Round
Under 15	12.22	1.11	0	13.33	13
15-34	45.84	0.00	4.83	50.67	51
35-54	57.29	1.17	5.85	64.31	64
55+	25.98	1.04	4.16	31.18	31
Total	141.33	3.32	14.84		159

Source: NCHS, Multiple Cause of Death data.

Table 8: Age-Adjusted Rate of Electrocutions Related to Consumer Products, 2003

Age Group	2000 Standard Weight ³	2003 Population ⁴	2003 Electrocutions Related to Consumer Products ⁵	Weighted Age-Specific Death Rate per Million Population	Death Rate per Million Population	
					Age-Adjusted	Crude
	1.000000	290,789,000	160		0.549168	0.550227
Under 15	0.214700	60,744,000	13.08	0.046238		
15-34	0.274219	81,072,000	51.32	0.173588		
35-54	0.297447	85,198,000	64.40	0.224845		
55 +	0.213634	63,775,000	31.19	0.104497		

Source:

1. U.S. Census Bureau, Population Division.
2. NCHS, Multiple Cause of Death data.

³ The year 2000 weights are computed based on year 2000 standard population (prepared by the U.S. Bureau of the Census). See Reference [3].

⁴ Based on the July 1, 2003 population. See Reference [4].

⁵ Computed from Column 6, Table 7 adjusted for the Total of 160.

References

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