



2001 ELECTROCUTIONS ASSOCIATED WITH CONSUMER PRODUCTS*

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June 2004**

* 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 1991 through 2001.

Results

Based on data from the National Center for Health Statistics (NCHS), the total number of electrocutions in the U.S. has decreased from 630 in 1991 to 411 in 2001, a reduction of 35 percent. Table 1 shows that during this same time period, the estimated number of electrocutions related to consumer products decreased from 250 to 180, resulting in a reduction of 28 percent. In 1991, the age-adjusted rate for consumer product-related electrocutions was 0.99 per million U.S. population. In 2001, that rate dropped to 0.63 electrocutions per million, reflecting a decrease of 36 percent. A regression analysis confirms the statistical significance of the decline in both total electrocutions and consumer product-related electrocutions ($p=0.0007$ and $p=0.003$ respectively, see Figure 1). The decline in the age-adjusted death rates is also statistically significant ($p=0.0006$).

Table 1. Total Electrocutions, Consumer Product-Related Electrocutions and Death Rates in U.S., 1991-2001

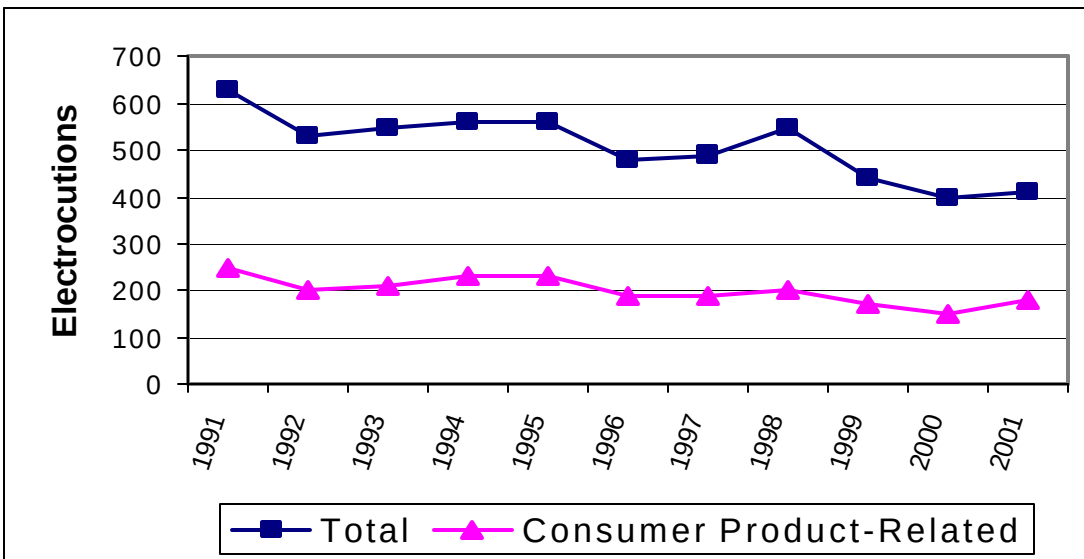
Year	U.S. Total Electrocutions ¹	Consumer Product-Related Electrocutions		
		Estimates	Percent of Total	Age-Adjusted Death Rates per Million Population
1991	630	250	40%	0.99
1992	530	200	38%	0.78
1993	550	210	38%	0.82
1994	560	230	41%	0.89
1995	560	230	41%	0.88
1996	480	190	40%	0.72
1997	490	190	39%	0.71
1998	550	200	36%	0.74
1999	440	170	39%	0.62
2000	400	150	38%	0.53
2001	411	180	44%	0.63

Source:

1. NCHS, Multiple Cause of Death data, 1991-2001.
2. U.S. Census Bureau, Population Division; see References [3] and [4].

¹ Deaths from 1991 -1998 are based on the ninth revision of the International Classification of Diseases (ICD-9) while deaths from 1999-2001 are based on the tenth revision (ICD-10). Statistics for 1991-1999 on total electrocutions, consumer product-related electrocution estimates and age-adjusted death rates are from Reference [1], while statistics for 2000 are from Reference [5].

Figure 1. Total Electrocutions and Consumer Product-Related Electrocutions in U.S., 1991-2001



Source: NCHS, Multiple Cause of Death data, 1991-2001.

The electrocution death rate in the U.S. has been declining since 1994. The age-adjusted rate for consumer product-related electrocutions was 0.89 per million U.S. population in 1994. In 2001, this rate dropped to 0.63 deaths per million U.S. population, representing a reduction of about 29%.

Table 2 shows the breakdown of the 180 consumer product-related electrocutions by specific products involved. Large appliances, such as air conditioners, sump pumps, pool pumps, water heaters, clothes dryers, washing machines, water coolers, ranges and range hoods were responsible for the largest proportion (19%) of the electrocutions. Damaged or exposed wiring, where the exact nature of the wiring was unspecified, accounted for 11% of the electrocutions. Installed household wiring accounted for another 10% of the electrocutions. Ladders, coming in contact with power lines, were responsible for 9% of the deaths as were power tools, such as saws, drills, welding equipment, pressure washers, and impact wrenches. Gardening and farming equipment were the next most frequently reported (7%) group of products. Lighting equipment (lamps, fixtures, work lights, etc.) was involved in 6% of the deaths. In another 5% of the deaths, the victims contacted high voltage power lines, although the mode of contact was not specified. Antennas and small appliances (microwaves, extension cords, etc.) were each responsible for 4% of the electrocutions. Non-powered/gasoline-powered tools (such as a wire-cutter or a chain-saw) and recreational equipment (such as a deer hunting stand or a flying airplane) accounted for 3% and 2% of the deaths, respectively. Miscellaneous other products, such as pipes and poles that were or became energized, electric fences, battery chargers, or unspecified power cords accounted for another 9% of the deaths. No product was specified for the remaining 2% of the electrocutions.

Table 2. Electrocutions by Types of Consumer Products, 2001

Type of Consumer Product	Estimate*	Percent
Total	180	100
Large Appliances	34	19
Air Conditioners	14	
Pumps (sump, pool, other)	8	
Water Heaters	3	
Clothes Dryers	3	
Washing Machines	2	
Water Coolers	2	
Ranges	2	
Range Hoods	2	
Wiring – Unspecified	20	11
Installed Household Wiring	19	10
Ladders	17	9
Power Tools	16	9
Saws	6	
Drills	3	
Welding Equipment	3	
Pressure Washers	2	
Wrenches	2	
Lawn / Garden / Farm Equipment	12	7
Lighting Equipment	11	6
Lamps / Light Fixtures (including underwater lighting)	9	
Work Lights	2	
Unspecified Contact w/ Power Line	9	5
Antennas	8	4
Small Appliances	8	4
Microwaves	3	
Extension Cords	3	
Unspecified	2	
Non-powered/ Gasoline -powered Tools	5	3
Sports / Recreational Equipment	3	2
Other Miscellaneous Products	16	9
Pipes / Poles	11	
Other	5	
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.

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 by 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 1991-1998 electrocution estimates and age-adjusted death rates presented in this report are based on the ninth revision [1], and the 1999-2001 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 of 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 [2] had 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 recently released 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 1991-1998, 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 2001.

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, 2001

ICD-10 Code	Location of Incidents							Total
	Home / Residential	Sport / Recreation	Farm	Street / Public	Industrial Place	Other	Not Specified	
W85	18	0	4	15	17	20	10	84
W86	60	2	7	13	42	18	5	147
W87	56	0	14	22	29	35	24	180
Total	134	2	25	50	88	73	39	411

Source: NCHS, Multiple Cause of Death data.

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 (180, see Table 4).

Table 4: After Allocation of Electrocutions Occurring at “Not Specified” Locations, 2001

ICD-10 Code	Location of Incidents						Total
	Home / Residential	Sport / Recreation	Farm	Street / Public	Industrial Place	Other	
W85	20.43	0	4.54	17.03	19.30	22.70	84.00
W86	62.11	2.07	7.25	13.46	43.48	18.63	147.00
W87	64.62	0	16.15	25.38	33.46	40.38	179.99
Total	147.16	2.07	27.94	55.87	96.24	81.71	410.99
ROUND	147	2	28	56	96	82	411
Consumer Product-Related Deaths	147	2	28				177*

Source: NCHS, Multiple Cause of Death data.

*** Approximately 180 (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). 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. 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, 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 1991 through 2001, 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 2001 are shown in Tables 5 – 8.

Table 5: Electrocutions by Location and Age Groups, 2001

Age Group	Location of Incidents							Total
	Home / Residential	Sport / Recreation	Farm	Street / Public	Industrial Place	Other	Not Specified	
Under 15	16	0	0	3	1	2	0	22
15-34	39	2	8	19	29	31	23	151
35-54	50	0	10	25	48	33	11	177
55+	29	0	7	3	10	7	5	61
Total	134	2	25	50	88	73	39	411

Source: NCHS, Multiple Cause of Death data.

Table 6: After Allocation of Deaths in “Not Specified” Locations, 2001

Age Group	Location of Incidents						Total
	Home / Residential	Sport / Recreation	Farm	Street / Public	Industrial Place	Other	
Under 15	16.00	0.00	0.00	3.00	1.00	2.00	22.00
15-34	46.01	2.36	9.44	22.41	34.21	36.57	151.00
35-54	53.31	0.00	10.66	26.66	51.18	35.19	177.00
55+	31.59	0.00	7.63	3.27	10.89	7.63	61.01
Total	146.91	2.36	27.73	55.34	97.28	81.39	411.01

Source: NCHS, Multiple Cause of Death data.

Table 7: Rounding Data for Consumer Product-Related Electrocutions, 2001

Age Group	Home / Residential	Sport / Recreation	Farm	Total	Round
Under 15	16.00	0.00	0.00	16.00	16
15-34	46.01	2.36	9.44	57.81	58
35-54	53.31	0.00	10.66	63.97	64
55+	31.59	0.00	7.63	39.22	39
Total	146.91	2.36	27.73	177.00	177

Source: NCHS, Multiple Cause of Death data.

Table 8: Age-Adjusted Rate of Electrocutions Related to Consumer Products, 2001

Age Group	2000 Standard Weight ³	2001 Population ⁴	2001 Electrocutions Related to Consumer Products ⁵	Weighted Age-Specific Death Rate per Million Population	Death Rate per Million Population	
					Age-Adjusted	Crude
	1.000000	285,318,000	180		0.629575	0.630875
Under 15	0.214700	60,482,000	16.27	0.057760		
15-34	0.274219	79,797,000	58.98	0.202693		
35-54	0.297447	84,369,000	65.08	0.229459		
55 +	0.213634	60,667,000	39.66	0.139663		

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, 2001 population. See Reference [4].

⁵ Computed from Column 6, Table 7 adjusted for Total equals 180.

References

1. Adler, Prowpit : 1999 Electrocution Associated With Consumer Products, July 2002, Directorate for Epidemiology, Division of Hazard Analysis, U.S. Consumer Product Safety Commission.
2. Ault, Kimberly, Ph.D.: Preliminary Comparability Ratios Between the 9th and 10th Revision of Diseases, November 2001, Directorate for Epidemiology, Division of Hazard and Injury Data Systems.
3. Anderson, R.N., Ph.D. and Rosenberg, H.M., Ph.D. Age Standardization of Death Rates: Implementation of the Year 2000 Standard, Centers for Disease Control and Prevention and the National Center for Health Statistics, Volume 47, Number 3, October 1998.
4. U.S. Census Bureau, Statistical Abstract of the United States: 2003, No.11, Resident Population by Age and Sex: 1980 to 2002, <http://www.census.gov/prod/2004pubs/03statab/pop.pdf> .
5. Chowdhury, Risana T.; 2000 Electrocution Associated With Consumer Products, July 2003, Directorate for Epidemiology, Division of Hazard Analysis, U.S. Consumer Product Safety Commission.