



2000 ELECTROCUTIONS ASSOCIATED WITH CONSUMER PRODUCTS

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Introduction

One of the strategic goals at the U.S. Consumer Product Safety Commission (CPSC) has been to lower the consumer product-related electrocution rate by 20 percent from the level in 1994 by the year 2004. This report contains estimates of the number of electrocutions involving consumer products and the corresponding death rates from 1990 through 2000 in order to evaluate the progress toward reaching the strategic goal.

Results

Based on data from the National Center for Health Statistics (NCHS), the total number of electrocutions in the U.S. has decreased from 670 in 1990 to 400 in 2000, a reduction of 40 percent. Table 1 shows that during this same time period, the estimated number of electrocutions related to consumer products decreased from 270 to 150, resulting in a reduction of 44 percent. In 1990, the age-adjusted rate for consumer product-related electrocutions was 1.09 per million U.S. population. In 2000, that rate dropped to 0.53 electrocutions per million, reflecting a decrease of 51 percent. A regression analysis confirms the statistical significance of the decline in both total electrocutions and consumer product-related electrocutions ($p=0.0005$ and $p=0.0006$ respectively, see Figure 1). The decline in the age-adjusted death rates is also statistically significant ($p=0.0002$).

Table 1. Total Electrocutions, Consumer Product-Related Electrocutions and Death Rates in U.S., 1990-2000

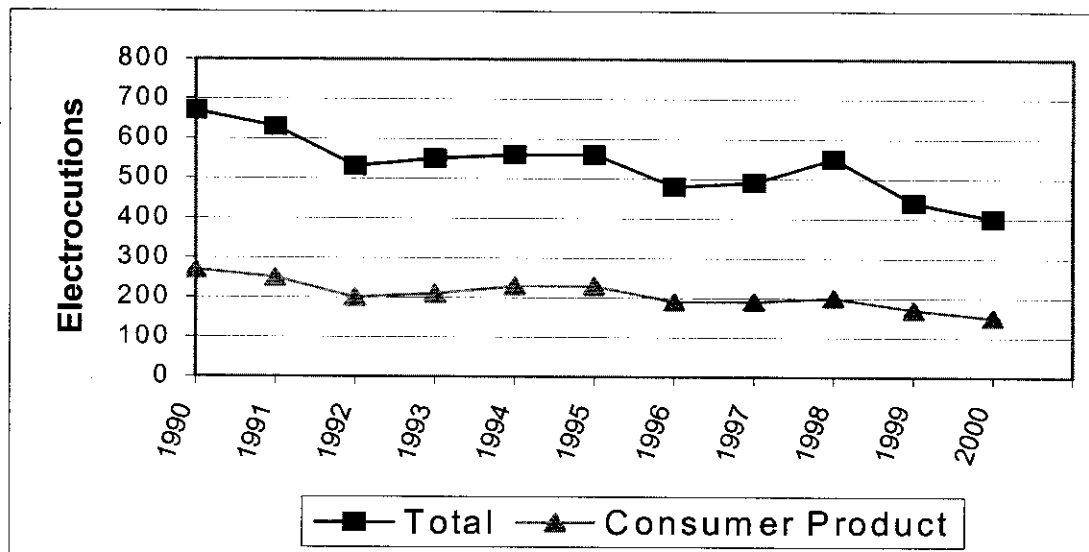
Year	U.S. Total Electrocutions ¹	Consumer Product-Related Electrocutions		
		Estimates	Percent of Total	Age-Adjusted Death Rates per Million Population
1990	670	270	40%	1.09
1991	630	250	40%	0.99
1992	530	200	38%	0.78
1993	550	210	38%	0.82
1994	560	230	41%	0.89
1995	560	230	41%	0.88
1996	480	190	40%	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

Source:

1. NCHS, Multiple Cause of Death data, 1990-2000.
2. U.S. Census Bureau, Population Division; see References [3] and [4].

¹ Deaths from 1990 -1998 are based on the ninth revision of the International Classification of Diseases (ICD-9) while deaths from 1999-2000 are based on the tenth revision (ICD-10). Statistics for 1990-1999 on total electrocutions, consumer product-related electrocution estimates and age-adjusted death rates are from Reference [1].

Figure 1. Total Electrocutions and Consumer Product-Related Electrocutions in U.S., 1990-2000



Source: NCHS, Multiple Cause of Death data, 1990-2000.

In terms of the strategic goal, 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 2000, this rate dropped to 0.53 deaths per million U.S. population, representing a reduction of about 40 percent.

Table 2 shows the breakdown of the 150 consumer product-related electrocutions by specific products involved. Large appliances, such as air conditioners, sump pumps, pool pumps, water heaters, furnaces, clothes dryers, refrigerators, and range hoods were responsible for the largest proportion (19%) of the electrocutions. Ladders coming in contact with power lines, ranked second, accounting for 15% of the deaths. Small appliances, such as microwave ovens, electric fans, extension cords, and televisions were the next most frequently reported (11%) group of products. Power tools such as drills, grinding machines, saws, and welding equipment accounted for 10% of the electrocutions. Another 10% of the electrocutions involved some sort of damaged or exposed wiring, although the exact nature of the wiring was unspecified. Lighting equipment (lamps, fixtures, work lights, etc.) was involved in 8% of the deaths. Installed household wiring accounted for 7% of the electrocutions. Sports and recreational equipment such as fishing / bowling equipment, boat lifts and recreational vehicles were responsible for 6% of the deaths. Gardening and farming equipment, antennas that touched overhead power lines, and other unspecified appliances were responsible for 2%, 1%, and 1% of the deaths, respectively. Miscellaneous other products, such as pipes and poles that contacted power lines, electric fences, septic tanks, building structures such as mobile home tongues or metal carport roofs accounted for another 9% of the deaths. No product was specified for the remaining 1% of the electrocutions.

Table 2. Electrocutions by Types of Consumer Products, 2000

Type of Consumer Product	Estimate*	Percent
Total	150	100
Large Appliances	29	19
Air Conditioners	8	
Pumps (sump, pool, other)	7	
Water Heaters	3	
Furnaces	3	
Clothes Dryers	3	
Refrigerators	2	
Range hoods	2	
Ladders	22	15
Small Appliances	17	11
Microwave ovens	7	
Electric Fans	5	
Extension Cords	3	
Televisions	2	
Power Tools	15	10
Drills	5	
Grinding Machines	3	
Saws	2	
Welding Equipment	2	
Unspecified	3	
Wiring – Unspecified	15	10
Lighting Equipment	12	8
Lamps / Light Fixtures (incl. underwater lighting)	10	
Work Lights	2	
Installed Household Wiring	10	7
Sports / Recreational Equipment	8	6
Lawn / Garden / Farm Equipment	3	2
Antennas	2	1
Appliances – Unspecified	2	1
Miscellaneous Other Products	13	9
Pipes / Poles / Fences	7	
Other	7	
Unspecified	2	1

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 1990-1998 electrocution estimates and age-adjusted death rates presented in this report are based on the ninth revision [1], and the 1999-2000 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. According to a preliminary report [2], the comparability ratio is 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’s method of estimating consumer product- related electrocutions relies on the location code, this difference affects our estimates. For 1990-1998, 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 2000.

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, 2000

ICD-10 Code	Location of Incidents							Total
	Home / Residence	Sport / Recreation	Farm	Street / Public	Industrial Place	Other	Not Specified	
W85	18	1	3	24	15	31	7	99
W86	54	1	8	8	38	25	6	140
W87	45	1	6	19	35	39	16	161
Total	117	3	17	51	88	95	29	400

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 (150, see Table 4).

Table 4: Allocation of Electrocutions Occurring at “Not Specified” Locations, 2000

ICD-10 Code	Location of Incidents						Total
	Home / Residence	Sport / Recreation	Farm	Street / Public	Industrial Place	Other	
W85	19.37	1.08	3.23	25.83	16.14	33.36	99.01
W86	56.42	1.04	8.36	8.36	39.70	26.12	140.00
W87	49.97	1.11	6.66	21.10	38.86	43.30	161.00
Total	125.76	3.23	18.25	55.29	94.70	102.78	400.01
ROUND	126	3	18	55	95	103	400
Consumer Product-Related Deaths	126	3	18				147*

Source: NCHS, Multiple Cause of Death data.

* Approximately 150 (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. It is common knowledge that 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 1990 through 2000, 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 2000 are shown in Tables 5 – 8.

Table 5: Electrocutions by Location and Age Groups, 2000

Age Group	Location of Incidents							Total
	Home / Residence	Sport / Recreation	Farm	Street / Public	Industrial Place	Other	Not Specified	
Under 15	10	1	1	0	0	5	0	17
15-34	46	2	6	19	45	41	11	170
35-54	45	0	8	27	34	42	14	170
55+	16	0	2	5	9	7	4	43
Total	117	3	17	51	88	95	29	400

Source: NCHS, Multiple Cause of Death data.

Table 6: Allocation of Deaths in “Not Specified” Locations, 2000

Age Group	Location of Incidents						Total
	Home / Residence	Sport / Recreation	Farm	Street / Public	Industrial Place	Other	
Under 15	10.00	1.00	1.00	0.00	0.00	5.00	17.00
15-34	49.18	2.14	6.42	20.31	48.11	43.84	170.00
35-54	49.04	0.00	8.72	29.42	37.05	45.77	170.00
55+	17.64	0.00	2.21	5.51	9.92	7.72	43.00
Total	125.86	3.14	18.35	55.24	95.08	102.33	400.00

Source: NCHS, Multiple Cause of Death data.

Table 7: Rounding Data for Consumer Product-Related Electrocutions, 2000

Age Group	Home / Residence	Sport / Recreation	Farm	Total	Round
Under 15	10.00	1.00	1.00	12.00	12
15-34	49.18	2.14	6.42	57.74	58
35-54	49.04	0.00	8.72	57.76	58
55+	17.64	0.00	2.21	19.85	20
Total	125.86	3.14	18.35	147.35	147

Source: NCHS, Multiple Cause of Death data.

Table 8: Age-Adjusted Rate of Electrocutions Related to Consumer Products, 2000

Age Group	2000 Standard Weight ³	2000 Population ⁴	2000 Electrocutions Related to Consumer Products ⁵	Weighted Age-Specific Death Rate per Million Population	Death Rate per Million Population	
					Age-Adjusted	Crude
	1.000000	281,422,000	150		0.534975	0.533007
Under 15	0.214700	60,254,000	12.24	0.043632		
15-34	0.274219	79,075,000	59.18	0.205239		
35-54	0.297447	82,827,000	59.18	0.212539		
55 +	0.213634	59,266,000	20.41	0.073565		

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 April 1, 2000 population. See Reference [4].

⁵ Computed from Column 6, Table 7 adjusted for Total equals 150.

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: 2002, No.12, Resident Population by Age and Sex: 1980 to 2001, <http://www.census.gov/prod/2003pubs/02statab/pop.pdf>.