UNITED STATES
CONSUMER PRODUCT SAFETY COMMISSION
WASHINGTON, DC 20207

Memorandum

Date: July 29, 2002

TO   :   Linda Edwards, Director
                   Division of Electrical Engineering
                   Directorate for Engineering Sciences

THROUGH: Susan Ahmed, Ph.D., AED
                   Directorate for Epidemiology

                   Russell Roegner, Ph.D., Director RR
                   Division of Hazard Analysis

FROM   :   Prowpit Adler, EPHA
                   Division of Hazard Analysis

SUBJECT :   1999 Electrocutions Associated With Consumer Products

   Attached is a report on the 1999 electrocution related deaths. The report contains counts of the number of electrocution deaths in the United States, estimates for electrocutions associated with the use of consumer products, and age-adjusted death rates.

CC: N.J. Scheers

CPSA 6 6)(1) Cleared 8/26/02
No Mfrs/PrvlLblrs

1999 ELECTROCUTIONS ASSOCIATED WITH CONSUMER PRODUCTS

Prowpit Adler
Hazard Analysis Division
Directorate for Epidemiology
July 2002

Introduction

One of the U.S. Consumer Product Safety Commission's (CPSC) strategic goals involves reducing the death rate from consumer product-related electrocutions by 20 percent from 1994 to the year 2004. This report contains estimates of the number of deaths and death rates for electrocutions associated with the use of consumer products in order to evaluate 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 710 deaths in 1988 to 440 in 1999, a reduction of 38 percent. Table 1 shows that during this period, the estimated number of electrocutions related to consumer products decreased from 290 in 1988 to 170 in 1999, a reduction of 41 percent. A regression analysis shows a significant downward trend in both total electrocution deaths and consumer product-related electrocution deaths (p<.0001, see Figure 1). Both the product-related electrocution crude death rates and age-adjusted death rates were calculated and found to be similar (see Methodology). The age adjusted death rates declined significantly from 1988 to 1999 (p<.0001). In 1988, estimated consumer product-related electrocutions occurred at an age-adjusted rate of 1.18 per million U.S. population. In 1999, that rate was 0.62 per million, a reduction of about 47 percent.

Table 1. Electrocutions Related to Consumer Products and Death Rates Based On U.S. Population, 1988-1999
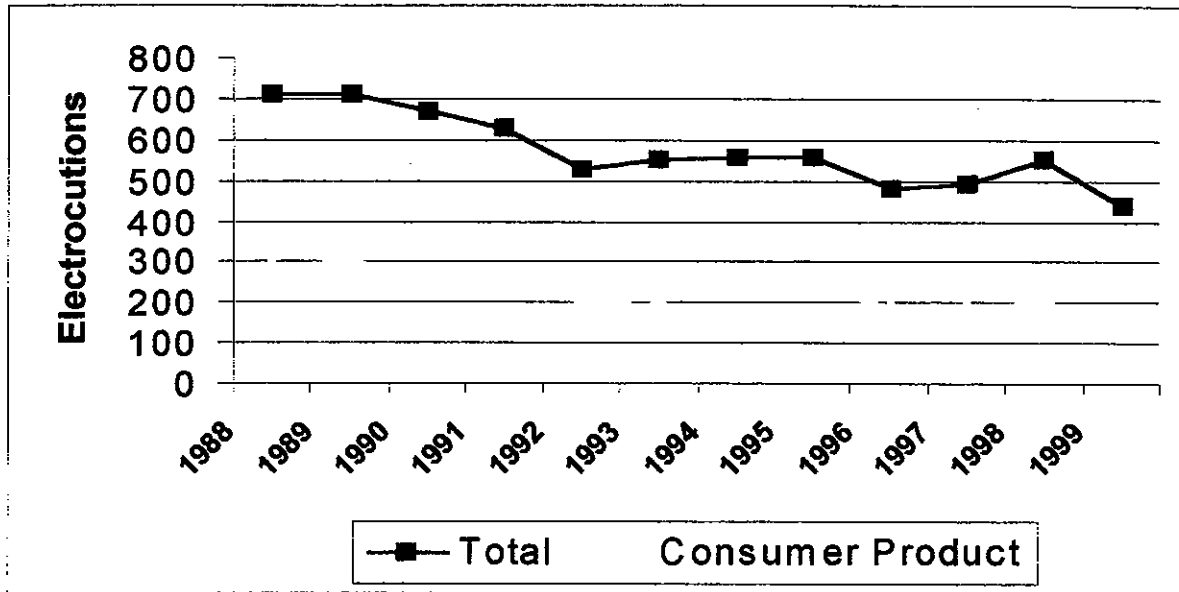
Year	U.S. Total Electrocutions[1]	Consumer Product-Related Electrocutions		Age-Adjusted Death Rates Consumer Product-Related Electrocutions per Million Population
		Estimates	Percent of Total	
1988	710	290	41%	1.18
1989	710	300	42%	1.21
1990	670	270	40%	1.09
1991	630	250	40%	0.99
1992	530	200	38%	0.78
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

Sources: National Center for Health Statistics: ICD-9 and ICD-10.
U.S. Census Bureau. Statistical Abstracts of the United States. 2000, No. 12, Resident Population by Age and Sex: 1980 to 1999, <http://www.census.gov/prod/2001pubs/statab/sec01.pdf>

---

[1] Years 1988 -1998 are based on the ninth revision of the International Classification of Diseases (ICD-9) while the year 1999 is based on the tenth revision (ICD-10). The total electrocutions, consumer product-related electrocution estimates and age-adjusted death rates from 1988-1998 came from Reference [1].

Figure 1. Total Electrocutions and Consumer Product-Related Electrocutions, 1988-1999

In terms of the strategic goal, the electrocution death rates in the U.S. have been declining since 1994. The age-adjusted death rate for consumer product-related electrocutions was 0.89 deaths per million U.S. population in 1994. In 1999, this rate was 0.62 deaths per million U.S. population, a substantial reduction of about 30 percent.

The next step is to examine a breakdown of the 170 consumer product-related electrocution deaths in 1999 by specific product involved. Table 2 shows that electrocutions related to small appliances[2], consisting of microwave ovens, extension cords, electric fans, televisions, electric blankets, humidifiers, and other (not specified) small appliances (17%) and household wiring (17%) were the two most frequently reported groups of products in 1999. Large appliances, such as air conditioners, heat pumps and other pumps, clothes dryers, water heaters, boilers, and furnaces were the next most frequently reported group of products (13%). Power tools, such as small motors, pressure washers, sanders, saws, drills, and tools not specified accounted for about 9 percent of the deaths. Ladders and antennas that came in contact with power lines accounted for 8 percent and 2 percent of the electrocutions, respectively. Garden and farm equipment such as pruning/trimming equipment and brushcutters, tractors, lawnmowers, and electric worm probes accounted for about 7 percent of the electrocutions. Lighting equipment such as hanging/floor/table lamps, lamp cords, extension work lights, and light fixtures accounted for about 5 percent of the deaths. Other products including pipes/poles/fences, wires/chains/pliers, tree stands/flying toys, vending machines, and amusement rides, accounted for the remaining 22 percent.

---

[2] Small appliances were also the most frequently reported group of products involved in electrocution deaths in 1998.

Table 2. Electrocutions by Types of Consumer Products, 1999

Type of Consumer Product	Estimate	Percent
Total	**170**	**100**
Small Appliances	**29**	**17**
Microwave Ovens	9	
Extension Cords	7	
Fans	3	
Televisions	2	
Electric Blankets	2	
Humidifiers	2	
Small Appliances, Other	4	
Household Wiring/Circuit Breakers/Fuses	**29**	**17**
Large Appliances	**22**	**13**
Air Conditioners	10	
Heat Pumps and Other Pumps	4	
Clothes Dryers	2	
Water Heaters	2	
Boilers	2	
Furnaces	2	
Power Tools	**15**	**9**
Small Electric Motors	4	
Pressure Washers	3	
Sanders	2	
Saws	2	
Drills	2	
Tools, Not Specified	2	
Ladders	**13**	**8**
Garden/Farm Equipment	**12**	**7**
Pruning/Trimming and Brushcutters	4	
Tractors	3	
Lawnmowers	2	
Electric Worm Probes	3	
Lighting Equipment	**9**	**5**
Hanging/Floor/Table Lamps and Lamp Cords	4	
Light Fixtures	3	
Extension Work Lights	2	
Antennas	**3**	**2**
Other Products	**38**	**22**
Pipes, Poles, Fences	25	
Wires, Chains, Pliers	6	
Tree stands and Flying Toys	3	
Vending Machines	2	
Amusement Rides	2	

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

Note: The number of electrocutions associated with each consumer product is an adjusted count (see methodology section).

Methodology

All death certificates filed in the U.S. are compiled by the National Center for Health Statistics (NCSH) into multiple cause mortality data files. The mortality data files contain demographic information as well as the International Classification of Diseases codes for 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 International Classification of Diseases (ICD), Ninth Revision was implemented in 1979 and was in effect between 1988 and 1998, the years on which the electrocution estimates and the age-adjusted rates of deaths from 1988-1998 in this report are based [1]. However, the 1999 electrocution estimate and the 1999 age-adjusted rate of electrocution deaths in this report are based on the tenth revision of the ICD. This is because of the implementation of this revision in the United States in 1999.

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 (ICD10). The results can be expressed as a ratio of the number of deaths for a cause of death coded and classified by ICD-10 to the number of that cause of death coded and classified by ICD-9. Codes involving electrocution ICD-9 (E925.0, E925.1, E925.2, E925.8, E925.9) are now distributed to ICD-10 (W85-W87) below, and the comparability ratio is 1.00 according to a preliminary report [2]. This might imply that there would be 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

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

However, although the codes map from one ICD version to the next, the locations (where the electrocution occurred) within those codes 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 these codes W85-W87 utilizes all possible locations (Table3). Since CPSC's method of estimating consumer-product related electrocutions relied on the location code, this difference affects our estimates.

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 see cases that we did not see before. This may mean that the difference between 1998 and 1999 is even greater than the difference in the estimates (200 and 170, respectively) would indicate, since the 1998 figure may be an underestimate [1] or conversely, the 1999 estimate may include cases that the 1998 estimate would not have included.

Table 3: Distribution of Electrocutions by Location in U.S., 1998 and 1999, Based on ICD-9 and ICD-10.

ICD Code	Location of Incidents							
	Home / Residence	Sport / Recreation	Farm	Street / Public	Industrial Place	Other	Not Specified	Total
ICD-9								
E925.0	59	0	0	0	0	0	0	59
E925.1	0	0	0	0	144	0	0	144
E925.2	0	0	0	6	17	2	2	27
E925.8	35	3	13	26	0	18	37	132
E925.9	0	0	0	0	0	0	187	187
Total	94	3	13	32	161	20	226	549
ICD10								
W85	19	3	6	38	19	33	9	127
W86	61	3	8	21	26	25	4	148
W87	52	2	6	20	29	34	20	163
Total	132	8	20	79	74	92	33	438

Source: The National Center for Health Statistics (NCHS), ICD-10 Revision.

The following steps are used to determine electrocutions associated with the use of consumer products and the age-adjusted death rates in 1999.

1. Searching the NCHS data for the following external cause of death ICD-10 codes, (Table 4):
       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 4: Electrocution Data Classified by ICD-10 Reported in NCHS File for 1999

ICD-10	Location of Incidents							
	Home / Residence	Sport / Recreation	Farm	Street / Public	Industrial Place	Other	Not Specified	Total
W85	19	3	6	38	19	33	9	127
W86	61	3	8	21	26	25	4	148
W87	52	2	6	20	29	34	20	163
Total	132	8	20	79	74	92	33	438

Source: The National Center for Health Statistics (NCHS), ICD-10 Revision.

2. Estimating the total number of electrocution deaths occurring in homes, residential institutions, sports and recreational areas, and farms from NCHS data. The deaths that occurred in these four locations were assumed to be consumer product-related. Assuming that electrocutions occurring in "not specified" locations followed the same distribution as the known electrocutions of all location categories, a proportion of the "not specified" electrocutions was added to the known electrocution counts for each ICD-10 code. The adjusted counts were summed to produce the estimated total number of electrocutions assumed to be associated with consumer products that occurred in homes, residential institutions, sports and recreational areas, and farms. This gives the total estimated number of consumer product-related deaths (173), see Table 5.

Table 5: Allocating Deaths in Location "Not Specified" for ICD-10 Codes, Reported in NCHS File for 1999

ICD-10	Location of Incidents						
	Home / Residence	Sport / Recreation	Farm	Street / Public	Industrial Place	Other	Total
W85	20.45	3.23	6.45	40.90	20.45	35.52	127.00
W86	62.69	3.08	8.22	21.58	26.72	25.69	147.98
W87	59.27	2.28	6.84	22.80	33.06	38.76	163.01
Total	142.41	8.59	21.51	85.28	80.23	99.97	437.99
ROUND	142.00	9.00	22.00	85.00	80.00	100.00	438.00
Consumer Product-Related Deaths	142.00	9.00	22.00				173.00*

Source: The National Center for Health Statistics (NCHS), ICD-10 Revision.

* Approximately 170 (by rounding to the nearest 10)

3. To provide product specific estimates of numbers of deaths from NCHS data we make use of CPSC databases. CPSC collects copies of death certificates involving electrocutions and other deaths from 50 states and the District of Columbia. The death certificates that include enough information to identify a related consumer product are coded and maintained in the Death Certificate database (DCRT). Also, CPSC maintains the Injury or Potential Injury Incident database (IPII) which contains data from sources such as letters, telephone calls, newspaper clippings, and reports from consumers, coroners, medical examiners, and fire and police departments. These reports describe deaths, injuries, and "near miss" incidents involving consumer products.

4. The electrocution incidents in both DCRT and IPII were compared by date of death, state, sex, and age to determine if there were duplicate reports. Copies of death certificates, news clippings,

and reports from consumers, coroners, medical examiners, and fire and police departments corresponding to the incidents in these two files were reviewed in order to make sure that information (especially location of the incidents) in these files was correct. The CPSC records were then matched to the NCHS records.

5. Counts of the matching records where electrocutions occurred in homes, residential institutions, farms, and sports and recreational areas[3] were summed to provide the total number of CPSC-collected electrocutions. 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.

6. In order to find the 1999 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 will 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 1988 through 1999, 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 computation of the age-adjusted death rate for year 1999 is shown in Table 6 – Table 9.

Table 6: Electrocution Data Classified by Age Group Reported in NCHS File for 1999

Age Group	Location of Incidents							
	Home / Residence	Sport / Recreation	Farm	Street / Public	Industrial Place	Other	Not Specified	Total
Under 15	10	0	1	3	1	5	0	20
15-34	30	4	7	36	30	42	16	165
35-54	62	3	8	33	33	28	14	181
55+	30	1	4	7	10	17	3	72
Total	132	8	20	79	74	92	33	438

Source: The National Center for Health Statistics (NCHS), ICD-10 Revision.

---

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

Table 7: Allocating Deaths in Location "Not Specified" by Age Groups Reported in NCHS File for 1999

Age Group	Location of Incidents						
	Home / Residence	Sport / Recreation	Farm	Street / Public	Industrial Place	Other	Total
Under 15	10.00	0.00	1.00	3.00	1.00	5.00	**20.00**
15-34	33.22	4.43	7.75	39.86	33.22	46.51	**164.99**
35-54	67.20	3.25	8.67	35.77	35.77	30.35	**181.01**
55+	31.30	1.04	4.17	7.30	10.43	17.74	**71.98**
Total	**141.72**	**8.72**	**21.59**	**85.93**	**80.42**	**99.60**	**437.98**

Source: The National Center for Health Statistics (NCHS), ICD-10 Revision.

Table 8: Rounding by Age Groups For Home, Residential Institutions, Farms, and Sports and Recreational Areas

Age Group	Home / Residence	Sport / Recreation	Farm	Total	Round
Under 15	10.00	0.00	1.00	**11.00**	**11.00**
15-34	33.22	4.43	7.75	**45.40**	**45.00**
35-54	67.20	3.25	8.67	**79.12**	**79.00**
55+	31.30	1.04	4.17	**36.51**	**37.00**
Total	141.72	8.72	21.59	**172.03**	**172.00**

Source: The National Center for Health Statistics (NCHS), ICD-10 Revision.

Table 9: Age-Adjusted Death Rate of Electrocutions Related to Consumer Products, 1999

Age Group	2000 Standard Weight[4]	1999 Population Million[5]	1999 Electrocutions Related to Consumer Products[6]	Age-Adjusted Death Rate Per 1,000,000	Crude Death Rate Per 1,000,000
	1.000000	272,691,000	170	0.6240028	0.6234162
Under 15	0.214700	58,437,000	10.872093	0.0399445	
15-34	0.274219	75,710,000	44.476744	0.1610932	
35-54	0.297447	80,615,000	78.081395	0.2880987	
55 +	0.213634	57,928,000	36.569767	0.1348664	

Source: Population Estimates, Population Division, U.S. Census Bureau, Washington, D.C. 20233 and National Center for Health Statistics (NCHS) Mortality Data for 1999.

---

[4] The year 2000 standard weights are computed based on the projected mid-year 2000 population prepared by the U.S. Bureau of the Census. These weights are not significantly different from those computed based on the April 1, 2000 population).

[5] Based on the July 1, 1999 population.

[6] Computed from Column 6, Table 8 for Total equals 170.

References

1. Hiser, Signe : 1998 Electrocution Associated With Consumer Products, July 2001, 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, Population Division: Resident Population Estimates of the Unites States by Age and Sex: April 1, 1990 to July 1, 1999, with Short-Term Projection to November 1, 2000. Internet Release Date: January 2, 2001.