



2005-2006 ELECTROCUTIONS ASSOCIATED WITH CONSUMER PRODUCTS*

Matthew V. Hnatov
Hazard Analysis Division
Directorate for Epidemiology
June 2010

* 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.

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Executive Summary

This report provides information about the estimated number of unintentional electrocutions associated with the use of consumer products in 2005 and 2006 and companion statistics since 2002. This report was prepared by U.S. Consumer Product Safety Commission (CPSC) staff.

It is important to note that the electrocution incidents covered in this report were associated with a consumer product but not necessarily caused by the product¹.

Some of the key findings in this report are:

- There was an estimated average of 70 electrocution fatalities² associated with consumer products per year over the three-year period from 2004 through 2006 with an estimated 90 consumer product-related electrocutions in 2005 and 50 in 2006.
- The age-adjusted death rate for electrocutions due to consumer product use was 0.31 and 0.15 per million population for 2005 and 2006, respectively, with the three-year average from 2004 through 2006 being 0.22. Tests indicate that there is no statistical evidence of a trend in the electrocution death rate from 2002 to 2006.
- Victim age appears to be a factor in electrocution incidents. There were nearly twice as many electrocutions to victims 40 through 59 years old than there were to victims 19 years of age and younger even though the U.S. population in these age groups is roughly equal.
- There were greater than five times more estimated consumer product-related electrocutions to males than to females over the years 2002 through 2006.
- The three most common product categories associated with electrocutions over the three-year period 2004 – 2006 were “Large Appliances”, “Small Appliances”, and “Power Tools”.

¹ Not all of these fatalities are addressable by an action the CPSC could take; however, it was not the purpose of this report to evaluate the addressability of the incidents but rather to update the estimates of the number of consumer product-associated electrocutions.

² Estimated electrocutions are rounded to the nearest 10.

Introduction

This report was prepared by U.S. Consumer Product Safety Commission (CPSC) staff and contains estimates of the number of non-work-related electrocutions involving consumer products and the corresponding age-adjusted death rates from 2002 through 2006. National estimates of consumer product-related electrocutions are derived from in-scope death certificate records contained in CPSC databases. An in-scope case is any accidental electrocution in which a consumer product was involved (e.g., power drill or microwave oven) and that was not work-related. CPSC records contain the majority of death certificates identified as electrocutions. The National Center for Health Statistics (NCHS) has records of every electrocution which occurred in the United States. NCHS records, however, lack product information. National estimates are generated by scaling or projecting CPSC records using NCHS record totals.

This report contains annual estimates for consumer product-related electrocutions for 2002 through 2006. The three-year average of the latter three years is also presented. In addition, this report presents a breakdown of consumer product-related electrocutions by age group and gender as well as age-adjusted mortality rates for direct comparison of year to year data. Finally, there is a breakdown by product category (e.g., Large Appliance or Power Tool).

National Estimates of the Number of Product-Related Electrocutions

The basis for national estimates of the number of product-related electrocutions per year is the number of in-scope fatalities reported to CPSC staff through death certificates. Appendix A presents the scope definition used for this report. The annual frequency of in-scope fatalities reported to CPSC staff is projected nationally using NCHS data. Specifics of the scaling procedure can be found in Appendix B. The NCHS database contains records of all death certificates filed in the United States. Table 1 provides a summary of the number of electrocution records in the NCHS and CPSC databases. Table 1 also provides the national estimates for consumer product-related electrocutions for the years 2002 through 2006.

Table 1: National Estimates of Electrocutions Associated with Consumer Products, 2002 – 2006

Year	NCHS Electrocutation Records	CPSC Electrocutation Records	Estimated CPSC In-Scope Records ¹	CPSC Staff National Estimates ²	Percent of Electrocutions that are in scope
2002	432	397	51	60	13%
2003	377	344	56	60	16%
2004	387	358	56	60	16%
2005	394	350	83	90	24%
2006	390	348	41	50	12%
Total 2002-2006	1980	1797	287	320	16%
Average 2004-2006	390	352	60	70	--

¹ Estimated CPSC In-Scope Records represents proportionately scaled counts after allocation of electrocution incidents with unknown location and/or scope (see Appendix B for details).

² Estimates have been rounded to the nearest 10.

The national estimates for 2005 were somewhat higher than estimates for the previous three years and the subsequent year. There is insufficient information available to CPSC staff to determine what caused the apparently higher number of electrocutions in 2005. CPSC analysts hypothesized that the spike may be weather-related due to the higher than normal levels of hurricane and ice storm activity during 2005. A review of the dates and locations of the electrocutions failed to support this hypothesis. Very few electrocution incidents occurred in the areas severely hit by hurricanes and ice storms and fewer still in the days following the storm events. It should be noted that in 2006, the number of consumer product-related electrocutions returned to pre-2005 levels.

National Estimates of Electrocutation Rates

Table 2 provides the national consumer product-related electrocution estimates categorized by age group of the victims. Table 3 gives the age-specific mortality rates and age-adjusted death

rates per one million population from electrocutions based on the standardized Year 2000 U.S. population. The Year 2000 population standard has been adopted for age-adjusting death rates in the United States by the NCHS, the Centers for Disease Control and Prevention (CDC), the U.S. Department of Health and Human Services (HHS), as well as many state vital statistics programs. Using an age-adjusted death rate standardized to a specific year allows for direct comparison of death rates between years, compensating for the changes in population age distribution.

Table 2: National Estimates of Consumer Product-Associated Electrocutions Categorized by Age of Victim, 2002 – 2006

Age of Victim	Total 2002-2006	2002	2003	2004	2005	2006	Average 2004-2006
< 1 - 19	55	14	15	6	16	5	9
20 - 39	86	15	11	15	28	16	20
40 - 59	109	15	15	29	35	15	26
60 and over	67	12	20	11	14	10	12
All	317	56	61	61	93	46	67

Note: Details may not sum to row and column totals due to rounding.

Table 3: Estimated Age-Specific and Age-Adjusted Electrocution Rates (per 1,000,000) Associated with Consumer Products, 2002 – 2006

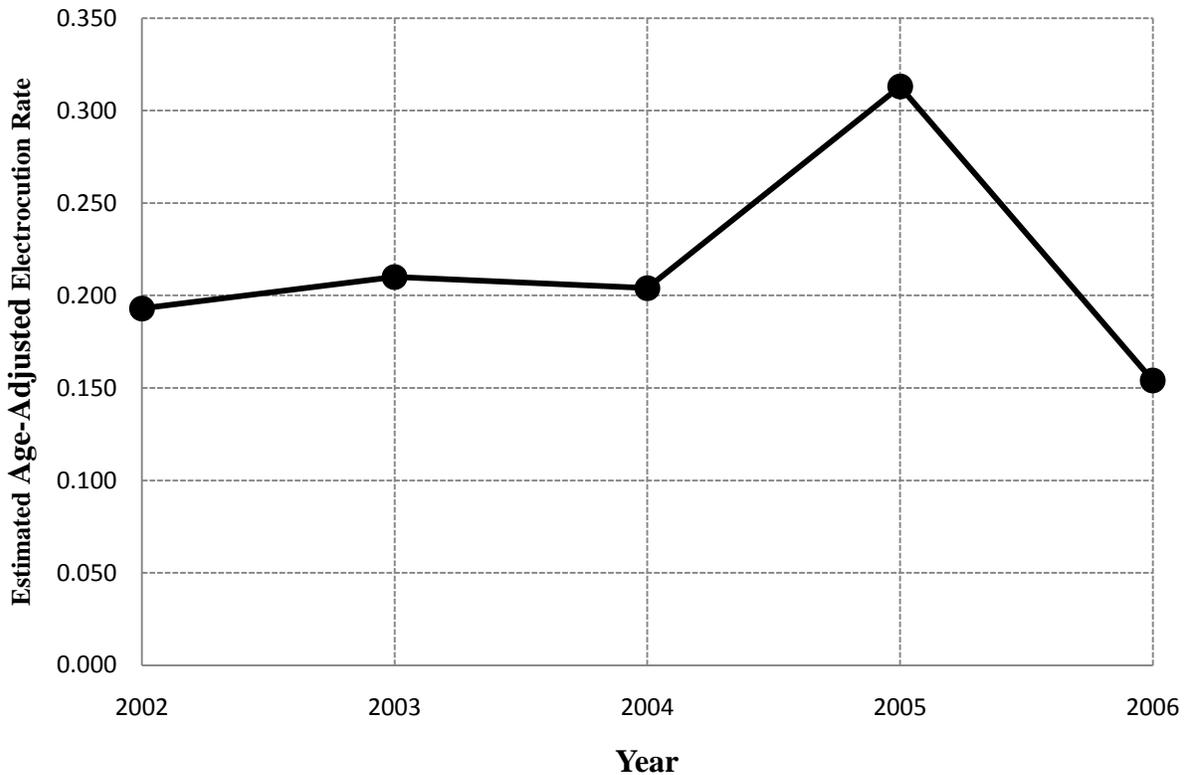
Age of Victim	2002	2003	2004	2005	2006	Average 2004-2006
< 1 - 19	0.167	0.185	0.068	0.198	0.061	0.109
20 - 39	0.183	0.138	0.186	0.347	0.198	0.244
40 - 59	0.193	0.189	0.359	0.425	0.179	0.321
60 and over	0.255	0.417	0.227	0.272	0.198	0.232
Electrocution Rate, All Ages	0.193	0.211	0.208	0.315	0.155	0.226
Standardized Age-Adjusted Rate*	0.193	0.210	0.204	0.313	0.154	0.224

* Standardized to Year 2000 Population

There are fewer electrocutions to young consumers (19 years of age and younger) than might be expected given the proportion of the U.S. population that is in that age range (81.465 million). For example, the five-year average U.S. population of individuals younger than 20 years of age is slightly higher than the average population size of individuals 40 to 59 years old (81.006 million), yet the estimated number of electrocutions in the older age group was nearly double that of the younger group (109 versus 55). Over the last three years, the difference is even greater. From 2004 through 2006, there were an estimated 27 consumer product-related electrocutions to persons younger than 20 while there were 79 electrocutions to consumers in the 40 to 59 year old range. A Pearson's Chi-Square Test for Independence was performed on the

2002 – 2006 five-year average electrocution estimates to determine if there was statistically significant evidence that age was a factor in electrocution incidents³. The statistical test rejected independence, which would indicate that age is a factor in electrocution incidents. Figure 1 presents the estimated age-adjusted annual electrocution rates for the years 2002 through 2006.

Figure 1: Estimated Age-Adjusted Annual Electrocution Rates (per 1,000,000) Associated with Consumer Products, 2002 – 2006



There does not appear to be a trend in the electrocution rates. To test this hypothesis, a regression analysis was performed to determine if there is sufficient evidence to conclude that there is a trend in the estimated age-adjusted electrocution rate over the period from 2002 through 2006. The results of the analysis indicate that there is insufficient evidence of a trend in the electrocution rates over this time period⁴. Details of the analysis are provided in Appendix C with the Analysis of Variance table provided as Table C3.

Table 4 presents the national estimates of electrocutions characterized by gender. As can be seen in the table, male victims comprise the large majority of electrocutions, accounting for 88 percent (176 of 200) of all consumer product-related electrocutions over the three-year period 2004 – 2006.

³ See Appendix C for details.

⁴ No trend was declared unless the attained significance (p-value) of the statistic was < 0.05 .

**Table 4: National Estimates of Consumer Product-Associated Electrocutions
Categorized by Gender of Victim, 2002 – 2006**

Gender of Victim	Total 2002-2006	2002	2003	2004	2005	2006	Average 2004-2006
Female	46	15	6	12	7	5	8
Male	272	41	55	49	86	41	59
All	317	56	61	61	93	46	67

Note: Details may not sum to row and column totals due to rounding.

There are much fewer electrocutions to female consumers than might be expected given the proportion of the U.S. population that is female. The five-year average U.S. population of females is slightly higher than the average population of males (148.987 million and 144.249 million, respectively), yet the estimated number of electrocutions to males is more than five times greater than to females. A Pearson’s Chi-Square Test for Independence rejected independence, which would indicate that gender is a factor in electrocution incidents⁵.

Number of Reported Electrocutions by Product Type

Because of the broad distribution of incidents over many products and product categories, the specific counts are small and would not show any change when applying scaling factors. Based on this fact, product and product category summaries in Table 5 are presented as actual observed frequencies in the CPSC death certificate databases and are not national estimates.

The three most common product categories associated with electrocutions over the three-year period 2004 – 2006 were “Small Appliances” (18 deaths, or 12% of reported consumer product-related electrocutions), “Large Appliances” (17, 11%), and “Power Tools” (16, 11%). The most common scenario for electrocutions involving large and small appliances was the consumer being electrocuted while attempting to repair the appliance. The most common scenario for electrocutions involving power tools was the equipment coming in contact with electrical wires while the consumer was using the power tool.

There appears to have been an unusually high number of electrocutions in 2005 associated with power tools and recreational equipment. Information available to CPSC staff is insufficient to determine the cause of any observed increases for specific product category-related electrocutions. It is unclear as to why the number of power tool-related electrocutions in 2005 (11) appears high, although this number was only slightly higher than 2003 (8). However, a partial explanation for the increase of recreational equipment-related electrocutions in 2005 is a single incident where four individuals were electrocuted while moving a tent, which happened to come in contact with a power line. This one incident accounted for more than half (4 of 7) of the recreational equipment-related electrocutions for the year.

⁵ See Appendix C for details.

**Table 5: Number of Electrocutions Reported to CPSC
By Consumer Product Category and Year**

Product Category	Total 2002-2006	2002	2003	2004	2005	2006	Average 2004-2006
Amusement Ride	1	0	1	0	0	0	0
Antenna	9	4	0	2	2	1	2
Boat Lift	1	0	1	0	0	0	0
Electric Fence	9	1	3	1	1	3	2
Extension Cord	8	1	2	3	2	0	2
Holiday Lighting	5	1	1	1	1	1	1
Household Wiring	13	2	1	5	1	2	3
Ladder	12	2	0	4	4	2	3
Large Appliance	28	4	7	8	4	5	6
Lawn & Garden Equipment	8	2	2	2	2	0	1
Lighting Equipment	21	4	5	4	6	2	4
Miscellaneous Wiring	5	0	3	0	1	1	1
Other Household Appliance	4	2	2	0	0	0	0
Other Miscellaneous Product	2	0	0	1	0	1	1
Outdoor Wiring	7	4	3	0	0	0	0
Pole	15	5	2	2	6	0	3
Pool / Whirlpool / Hot Tub	7	1	1	3	3	1	2
Power Tool	24	0	8	3	11	2	5
Recreational Equipment	10	0	0	2	7	1	3
Small Appliance	21	1	4	1	7	10	6
Unspecified Appliance	9	1	1	1	5	1	2
Unspecified Electrical Cord	12	2	2	0	3	4	2
Unspecified Tool	2	0	0	1	3	0	1
All Consumer Products	233	37	49	44	69	37	50

APPENDIX A: CPSC Scope Assessments

CPSC has jurisdiction over thousands of consumer products used in and around the home, in sports and recreation, and in schools. In the cases of electrocution, the following determinate factors were used to assess if the case was in scope or not:

- All work-related incidents were determined to be out of scope.
- All incidents involving products outside CPSC jurisdiction were determined to be out of scope. Examples of these include, but are not limited to, incidents involving autos, boats, direct contact with power lines, direct contact with household wiring with no other consumer product involvement, and industrial equipment.
- Incidents involving a product under CPSC jurisdiction which comes in contact with an electrical source such as power lines or household current (e.g., a drill or power saw cutting into an electrical wire) were considered in-scope.

When there was insufficient information to make a definitive determination of whether a case was in scope or out of scope, or where apparent contradictions existed, the following assumption was used:

- Incidents involving an individual apparently functioning in his/her regular occupation in which the death certificate indicates that the fatality was not work-related are assumed to be in error. In these cases, the incident was assumed to be work-related. For example, a tree-trimmer by profession was electrocuted while trimming trees at a residence, other than his own, yet was classified as not work-related on the death certificate. There are many reasons that could explain this discrepancy. First, the death certificate may simply have been miscoded, or the coder may have a different interpretation of the “work-related” question on the death certificate. On many death certificates, the work-related question field states something to the effect of, “Did the death occur at work?” Perhaps the coders interpreted “at work” as referring to an office or factory, and working in a yard of a residence does not fit this interpretation. Finally, it may be possible that the individual may actually not be “working” and may have been helping out a friend or family member. Without evidence of this, however, it was assumed to be miscoded.

There are also many cases where one or more key piece(s) of information are missing and a determination cannot be made from the known information. An imputation method (simple proportional adjustment) was applied to adjust the overall and categorical counts if possible. The key factors to determining scope are:

1. Work-related status,
2. Location of injury,
3. Profession of victim,
4. Age of victim (to assist in work-related status determination when this information is not provided),
5. Product involved, and
6. Activity engaged in when the incident occurred.

Even though there may be some missing key data, a determination can often be made with limited information. For example, all work-related incidents can be eliminated regardless of what other information is missing. As another example, if a child is injured, it would be assumed not to be a work-related injury even if work status were missing. In this latter case, the incident would be considered in scope unless some other factor would eliminate it, such as the product involved.

APPENDIX B: Derivation of National Estimates and Age Standardized Electrocutation Rate Calculations

This appendix describes the data sources and methodology used to compute the national estimates of electrocutions associated with the use of consumer products.

All death certificates filed in the United States are compiled by the National Center for Health Statistics (NCHS) into a multiple cause of mortality data file. The NCHS Mortality File contains demographic and geographic information, as well as the International Statistical Classification of Diseases and Related Health Problems codes for the underlying cause of death. 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 and Related Health Problems. The International Classification of Diseases, Tenth Revision (ICD-10) was implemented in 1999. Although the NCHS data contain cause of death codes that are helpful in identifying deaths due to electrocution, the data do not contain any narrative information that might indicate the involvement of a consumer product.

To complement the NCHS mortality data, the CPSC staff purchases death certificates from the 50 states, the District of Columbia, and New York City. Specifically, the CPSC staff purchases death certificates with certain cause of death codes for which there is a high probability that consumer products are involved. In addition to the cause of death codes and demographic and geographic information, the death certificate contains information about the incident location and a brief narrative describing the incident. Any references to consumer products are usually found in these narratives. The CPSC staff conducts follow-up in-depth investigations on selected deaths to confirm and expand upon the involvement of consumer products, as resources allow. The in-depth investigation reports, or IDIs, are contained within the CPSC In-depth Investigation (INDP) File. Additionally, information which may help the analyst in the determination of product involvement can sometimes be ascertained from the Injury or Potential Injury Incident (IPII) File which contains news articles and medical examiner reports associated with the incident.

Searches were conducted on both of the CPSC death certificate databases, Death Certificate (DTHS) File and Abbreviated Death Certificate (ABDT) File, and the NCHS database to retrieve all electrocution cases available within the timeframe of concern. The search criteria limited the death certificate records to those classified by ICD-10 codes as electrocution. These death certificates have one of the following ICD-10 cause of death codes:

- 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

The search criteria also constrained the records to those fatalities which occurred between January 1, 2002 and December 31, 2006.

Step 1: Review of CPSC records for scope determination

The first step in computing the annual estimates of electrocutions associated with consumer products is to compile an electrocution dataset of all electrocution death certificates available to CPSC staff. The CPSC's DTHS File and the CPSC's ABDT File were both searched for cases associated with ICD-10 codes W85 through W87.

Each death found in the DTHS database coded as an electrocution was reviewed by an analyst and categorized as in scope, out of scope, or of unknown scope. In-scope cases are unintentional electrocutions associated with a consumer product under the jurisdiction of the CPSC. Out-of-scope cases are cases that involve products that are not under the jurisdiction of the CPSC, work-related incidents, or intentional electrocutions. The scope of a case was classified as unknown in incidents where a consumer product was possibly associated with the incident but could not be explicitly identified. An example of this scenario might be a consumer who was electrocuted in his home that was determined to not be work-related, but a product was not identified.

Most deaths found in the ABDT database were categorized as out-of-scope cases. Most of the ABDT File contains death certificates for electrocutions that involve non-consumer situations, such as a lineman being electrocuted while working on power lines, or involve non-consumer products such as motor vehicles and industrial equipment. Occasionally, an analyst review of an ABDT case resulted in a case being reassessed as being either in CPSC jurisdiction or possibly in CPSC jurisdiction. The former cases were included as in-scope deaths and the latter cases were identified as "unknown scope" and used in the allocation of unknown scope phase (Step 3) of the staff's analysis.

Step 2: Allocation of unknown location cases to known location categories

After review of the death certificate records in the two databases (DTHS and ABDT) for scope determination, the two databases were combined. Location of the incident is an important factor in the likelihood that an incident would be in scope or not. For example, based on CPSC records, a significant proportion of residential electrocutions were determined to be in scope (consumer product- and non-work-related), while virtually no industrial incidents were within CPSC scope. Table B1 provides a summary of the CPSC electrocution death certificates categorized by location and scope for each of the years 2005 and 2006.

**Table B1: Scope Characterization by Year and Location
of Death in the CPSC Database Records**

2005	Scope			
Location	In	Out	Unknown	Total
Farm	1	14	0	15
Recreational	4	1	0	5
Residential	60	49	24	133
School	0	6	0	6
Public Land	0	24	3	27
Industrial	0	93	0	93
Street	0	52	2	54
Auto or Boat	0	3	1	4
Unknown	4	8	1	13
2005 Total	69	250	31	350

2006	Scope			
Location	In	Out	Unknown	Total
Farm	3	19	0	22
Recreational	0	4	1	5
Residential	30	63	11	104
School	0	4	0	4
Public Land	1	32	0	33
Industrial	0	105	1	106
Street	1	48	1	50
Auto or Boat	0	5	0	5
Unknown	2	14	3	19
2006 Total	37	294	17	348

Source: U.S. Consumer Product Safety Commission / EPHA.
CPSC Death Certificate File, In-Depth Investigation File, Injury or Potential Injury Incident File,
Abbreviated Death Certificate File.

The totals for death certificates where a location of the death could not be identified were then allocated proportionately amongst the known location categories based on the observed frequency of occurrence by location. The results of the proportional allocation are given in Table B2. It should be noted that, in order to minimize rounding error, the individual cell counts were kept as fractional numbers until the last stage of the estimation process and are presented to two decimal places in the tables.

**Table B2: Allocation of “Unknown” Location Electrocutions
to Known Location Categories**

2005	Scope			
Location	In	Out	Unknown	Total
Farm	1.06	14.46	0.00	15.52
Recreational	4.25	1.03	0.00	5.28
Residential	63.69	50.62	24.80	139.11
School	0.00	6.20	0.00	6.20
Public Land	0.00	24.79	3.10	27.89
Industrial	0.00	96.07	0.00	96.07
Street	0.00	53.72	2.07	55.79
Auto or Boat	0.00	3.10	1.03	4.13
Unknown				
Grand Total	69.00	250.00	31.00	350.00

2006	Scope			
Location	In	Out	Unknown	Total
Farm	3.17	19.95	0.00	23.12
Recreational	0.00	4.20	1.21	5.41
Residential	31.71	66.15	13.36	111.22
School	0.00	4.20	0.00	4.20
Public Land	1.06	33.60	0.00	34.66
Industrial	0.00	110.25	1.21	111.46
Street	1.06	50.40	1.21	52.67
Auto or Boat	0.00	5.25	0.00	5.25
Unknown				
Grand Total	37.00	294.00	17.00	348.00

Step 3: Allocation of unknown scope cases to known scope categories within location categories

In this step, the “unknown scope” summary counts are allocated to the known scope categories. This is performed using the observed in-scope and out-of-scope ratios within location categories because of the rationale previously stated in regards to the probability that an in-scope case is dependent on the location of the incident. Table B3 presents the number of death certificates summarized from the two CPSC databases by scope determination (after allocation of unknowns) and the total number of electrocution records in the NCHS database.

Table B3: Allocation of “Unknown” Scope Electrocutions to Known Scope Categories

2005	Scope			
Location	In	Out	Unknown	Total
Farm	1.06	14.46		15.52
Recreational	4.25	1.03		5.28
Residential	77.51	61.60		139.11
School	0.00	6.20		6.20
Public Land	0.00	27.89		27.89
Industrial	0.00	96.07		96.07
Street	0.00	55.79		55.79
Auto or Boat	0.00	4.13		4.13
Unknown				
Grand Total	82.82	267.18		350.00

2006	Scope			
Location	In	Out	Unknown	Total
Farm	3.17	19.95		23.12
Recreational	0.00	5.41		5.41
Residential	36.04	75.18		111.22
School	0.00	4.20		4.20
Public Land	1.06	33.60		34.66
Industrial	0.00	111.46		111.46
Street	1.08	51.59		52.67
Auto or Boat	0.00	5.25		5.25
Unknown				
Grand Total	41.35	306.65		348.00

Step 4: Generating national estimates of consumer product-related electrocutions

The proportion of death certificates found in the CPSC databases associated with electrocutions and associated with consumer products was applied to the NCHS totals to calculate the total estimated number of electrocutions associated with consumer products. In theory, the NCHS totals comprise all death certificates in the U.S. and the same proportion of in-scope cases should exist in the death certificates that are missing from the combined CPSC Death Certificate and Abbreviated Death Certificate files. Applying the proportion of in-scope cases to the NCHS database totals should, therefore, provide an estimate of in-scope cases nationwide. This was done for each year separately in the following way:

1. The number of in-scope deaths in the CPSC’s Death Certificate File coded as W85, W86, or W87 that were associated with an accidental, non-work-related electrocution and a consumer product were identified (n_1).

2. The total number of deaths in the CPSC’s Death Certificate File and the Abbreviated Death Certificate File coded as W85 through W87 was summed separately for each year (n_2).
3. The total number of deaths in the NCHS data coded as W85 through W87 was counted (n_3).
4. The estimate of the number of accidental, non-work-related electrocutions associated with consumer products in codes W85 through W87 was calculated separately for each year using the formula:

$$N = (n_1 / n_2) * n_3$$

The proportion (n_1/n_2) represents the number of in-scope cases found in the CPSC’s files divided by the total of in-scope and out-of-scope cases in the CPSC data files.

The ratio (n_3 / n_2) represents the weighting factor used to calculate the annual estimates. The CPSC’s Death Certificate File does not contain death certificates for all deaths listed in the NCHS file; therefore, a weighting factor was calculated to account for those death certificates that are missing. The weighting factor is used to scale up the CPSC counts to compensate for the records missing in the CPSC databases. Under the assumption that the characteristics of the deaths not contained in the CPSC database follow the same proportions as those in which CPSC has records, this weighting factor allows for the computation of national estimates of electrocutions by consumer products and by other characteristics collected by CPSC about each death by scaling up the data observed in the CPSC subset.

The following table contains the values for the variables used in the calculation as well as the final computed 2005 and 2006 estimates of electrocutions associated with consumer products.

Table B4: Derivation of Consumer Product Associated Electrocution National Estimates

	2005	2006
n_1	82.82	41.35
n_2	350	348
n_3	394	390
<i>Weighting Factor (n_3 / n_2)</i>	1.1257	1.1207
N	93.23	46.34

Source: U.S. Consumer Product Safety Commission / EPHA.
 CPSC Death Certificate File, In-Depth Investigation File, Injury or Potential Injury Incident File,
 Abbreviated Death Certificate File, National Center for Health Statistics Mortality File, 2005-2006.

Step 5: Generating national estimates of consumer product-related electrocutions by age group and calculating age-adjusted death rates

The weighting factors derived above for adjusting the counts for the number of missing records in the CPSC databases were also applied to the age and gender categorizations to develop national estimates by these characterizations. A second weighting factor is also needed to make

the age and gender category estimates consistent with the national estimates generated previously. The second weighting factor is a weight to accommodate the scaling up procedure for the “unknowns” outlined in Steps 2 and 3 above. This weight is simply the ratio of the number of in-scope CPSC records after allocation of “unknowns” for a given year to the number of CPSC records where scope and location are known for the same year. The two weights are both multipliers so they can be combined into one factor by multiplying one by the other. Table B5 shows the calculation of the weighting factor. Table B6 shows the number of in-scope records in CPSC’s databases characterized by age group. Table B7 shows the national estimates after the combined weighting factor was applied.

Table B5: Consumer Product Associated Electrocution Death Certificates in the NCHS Database and the Combined CPSC Databases After Allocation of Unknowns

	2002	2003	2004	2005	2006
Observed In-Scope Records	37	49	44	69	37
In-Scope Records After Allocation of “Unknowns”	51.05	56.00	56.41	82.82	41.35
“Unknowns” Allocation Weight	1.3798	1.1429	1.2820	1.2003	1.1177
Weighting Factor (from Table B4)	1.0882	1.0959	1.0810	1.1257	1.1207
Combined weight	1.5015	1.2526	1.3859	1.3512	1.2526

Table B6: Consumer Product Associated Electrocution Death Certificates in the CPSC Database Characterized by Age Group

Age Group	Total 2002-2006	2002	2003	2004	2005	2006	Average 2004-2006
< 1 - 19	41	9	12	4	12	4	7
20 - 39	64	10	9	11	21	13	15
40 - 59	81	10	12	21	26	12	20
60 and over	50	8	16	8	10	8	9
ALL	236	37	49	44	69	37	50

Source: U.S. Consumer Product Safety Commission / EPHA.
 CPSC Death Certificate File, In-Depth Investigation File, Injury or Potential Injury Incident File, Abbreviated Death Certificate File.

**Table B7: National Estimates of Consumer Product Associated Electrocutions
Characterized by Age Group After Weights were Applied
Prior to Rounding to Nearest Whole Number**

Age Group	Total 2002-2006	2002	2003	2004	2005	2006	Average 2004-2006
< 1 - 19	55.31	13.51	15.03	5.54	16.21	5.01	8.92
20 - 39	86.19	15.01	11.27	15.24	28.37	16.28	19.97
40 - 59	109.31	15.01	15.03	29.10	35.13	15.03	26.42
60 and over	66.67	12.01	20.04	11.09	13.51	10.02	11.54
ALL	317.48	55.55	61.38	60.98	93.23	46.34	66.85

The crude death rate is typically defined as the number of deaths in a given population during a given time period divided by the total population and multiplied by one thousand (or some other population scaler). Crude death rates are a widely used measure of mortality which can be used to compare subpopulations within the greater population of incidents. However, crude death rates are not the best measure when comparing year to year death rates. In a National Vital Statistics Report titled “Age Standardization of Death Rates: Implementation of the Year 2000 Standard” a rationale for age-adjusting death rate is stated: “...crude death rates are influenced by age composition of the population. As such, comparisons of crude death rates over time or between groups may be misleading if the populations being compared differ in age composition. This is relevant, for example, in trend comparisons of U.S. mortality given the aging of the U.S. population.” For this report, the electrocution incidents were characterized into subpopulations by year of death and age group and by year of death and gender. The death rates by year/age are presented as standardized death rates using the 2000 U.S. population as the standard. In August 1998 the use of the Year 2000 standard population was established in a policy statement from the Secretary of the Department of Health and Human Services (DHHS) which directed all DHHS agencies, including NCHS and the Centers for Disease Control and Prevention (CDC), to use this standard.

The crude death rate is determined by dividing the total number of deaths for a specific characterization by the mid-year population for the same characterization. The standardized age-adjusted death rate is calculated by multiplying each age-specific category rate by a standardized weight which represents the proportion of the population in the specific subpopulation for the given standard year (Year 2000). The products of the age-specific rates and the weights are then summed over age group to produce the age-adjusted rate. Table B8 presents the U.S. population subdivided by age group for the years 2002 through 2006. Table B9 provides the standardized age group weights based on the Year 2000 U.S. Population. Table B10 provides a summary of the calculations to determine age-adjusted death rates for the years 2002 and 2006 standardized to Year 2000 population.

It should be noted that the age-adjusted death rates for the years 2002 through 2004 presented in Table 3 of the main body of this report have changed slightly from the previous electrocutions

report⁶ due to changes in U.S. population estimates obtained from the U.S. Census Bureau's 2009 Statistical Abstract of the United States from the population estimates presented in the U.S. Census Bureau's 2006 Statistical Abstract which was used in the previous report.

Table B8: U.S. Population (1,000,000's)

Age Group	2002	2003	2004	2005	2006	Average Population
< 1 - 19	80.983	81.188	81.479	81.690	81.987	81.465
20 - 39	81.827	81.733	81.742	81.854	82.295	81.890
40 - 59	77.989	79.469	81.090	82.612	83.869	81.006
60 and over	47.089	48.057	48.880	49.739	50.603	48.874
ALL	287.888	290.448	293.192	295.896	298.755	293.236

Source: U.S. Census Bureau, Statistical Abstract of the United States: 2009

Table B9: Standardized Age Group Weights based on Year 2000 U.S. Population

Age Group	Census Year 2000 Estimated Population (1,000,000's)	Std. Wt. (Year 2000)
< 1 - 19	80.473	0.28597
20 - 39	81.563	0.28984
40 - 59	73.590	0.26151
60 and over	45.780	0.16268

Source: U.S. Census Bureau, Statistical Abstract of the United States: 2009

⁶ Hnatov, M. V. 2004 *Electrocutions Associated with Consumer Products*. U.S. Consumer Product Safety Commission. October 2008.

**Table B10: Age-Specific and Age-Adjusted Electrocution Rates
Standardized to Year 2000 Population, 2002 – 2006**

Year 2002 Age Group	Estimated Number of Deaths	Population: 2002	Age-Specific Rate*	Std. Wt. (Year 2000)	Product of Rate x Weight*
< 1 - 19	13.51	80.983	0.1669	0.28597	0.0477
20 - 39	15.01	81.827	0.1835	0.28984	0.0532
40 - 59	15.01	77.989	0.1925	0.26151	0.0503
60 and over	12.01	47.089	0.2551	0.16268	0.0415
Total	55.55	287.888	0.1930^a	1.00000	0.1927^b

Year 2003 Age Group	Estimated Number of Deaths	Population: 2003	Age-Specific Rate*	Std. Wt. (Year 2000)	Product of Rate x Weight*
< 1 - 19	15.03	81.188	0.1851	0.28597	0.0529
20 - 39	11.27	81.733	0.1379	0.28984	0.0400
40 - 59	15.03	79.469	0.1891	0.26151	0.0495
60 and over	20.04	48.057	0.4170	0.16268	0.0678
Total	61.38	290.448	0.2113^a	1.00000	0.2102^b

Year 2004 Age Group	Estimated Number of Deaths	Population: 2004	Age-Specific Rate*	Std. Wt. (Year 2000)	Product of Rate x Weight*
< 1 - 19	5.54	81.479	0.0680	0.28597	0.0195
20 - 39	15.24	81.742	0.1865	0.28984	0.0541
40 - 59	29.10	81.090	0.3589	0.26151	0.0939
60 and over	11.09	48.880	0.2268	0.16268	0.0369
Total	60.98	293.192	0.2080^a	1.00000	0.2043^b

Year 2005 Age Group	Estimated Number of Deaths	Population: 2005	Age-Specific Rate*	Std. Wt. (Year 2000)	Product of Rate x Weight*
< 1 - 19	16.21	81.690	0.1985	0.28597	0.0568
20 - 39	28.37	81.854	0.3466	0.28984	0.1005
40 - 59	35.13	82.612	0.4252	0.26151	0.1112
60 and over	13.51	49.739	0.2716	0.16268	0.0442
Total	93.23	295.896	0.3151^a	1.00000	0.3126^b

Year 2006 Age Group	Estimated Number of Deaths	Population: 2006	Age-Specific Rate*	Std. Wt. (Year 2000)	Product of Rate x Weight*
< 1 - 19	5.01	81.987	0.0611	0.28597	0.0175
20 - 39	16.28	82.295	0.1979	0.28984	0.0573
40 - 59	15.03	83.869	0.1792	0.26151	0.0469
60 and over	10.02	50.603	0.1980	0.16268	0.0322
Total	46.34	298.755	0.1551 ^a	1.00000	0.1539 ^b

* Death rate is presented on a *per million population* basis.

a Crude rate

b Age-adjusted rate

Table B11 provides a summary of the consumer product-related electrocutions characterized by gender of victim. Table B12 provides the national estimates categorized by gender after application of the combined weight calculated above (derivation shown in Table B5 above).

Table B11: Electrocution Death Certificates Associated with Consumer Products in the CPSC Databases Characterized by Gender of Victim

Gender of Victim	Total	Average 2004-2006	2002	2003	2004	2005	2006
Female	24	6	10	5	9	5	4
Male	106	44	27	44	35	64	33
All	130	50	37	49	44	69	37

Source: U.S. Consumer Product Safety Commission / EPHA.

CPSC Death Certificate File, In-Depth Investigation File, Abbreviated Death Certificate File.

Table B12: National Estimates of Electrocutions Associated with Consumer Products Categorized by Gender of Victim Prior to Rounding to Nearest Whole Number

Gender of Victim	Total	Average 2004-2006	2002	2003	2004	2005	2006
Female	45.52	8.08	15.01	6.26	12.47	6.76	5.01
Male	271.97	58.77	40.54	55.11	48.51	86.47	41.33
All	317.48	66.85	55.55	61.38	60.98	93.23	46.34

APPENDIX C: Statistical Test Results

Chi-Square Statistic - Calculations

Pearson's Chi-Square Test for Independence was used to determine if the observed distribution on consumer product-related electrocutions was independent of age of the victim. If electrocutions were independent of age, we would expect the observed proportions of electrocutions in each age group to be similar to the proportions of the U.S. population within the same age group categories. To test this assertion, the observed data, the national estimates total over the five years of this report (2002 through 2006), were compared to the expected number of electrocutions in each age group given the estimated total number of electrocutions observed. The expected number of electrocutions for a specific age group is calculated using the formula:

$$E_i = \left(\frac{\text{population } n_i}{\text{total population}} \right) \times (\text{total estimated electrocutions}),$$

where,

E_i is the expected number of electrocutions in the i^{th} age group, and
 $\text{population } n_i$ is the average U.S. population (2002-2006) in the i^{th} age group.

$$x^2 = \sum_{n=1}^4 \frac{(O_i - E_i)^2}{E_i}$$

where,

E_i is the expected number of electrocutions in the i^{th} age group, and
 O_i is the observed (estimated) number of electrocutions in the i^{th} age group.

All calculations were performed on the non-rounded estimates.

Table C1 presents the results of the statistical test. The p-value of the test indicates that there is significant evidence to conclude that the observed proportions of electrocutions are not independent and are in fact dependent on age. Therefore, we can conclude that age is a factor in electrocution incidents. As can be seen in Table C1, there were much fewer electrocutions in the younger than 20 years old range than would be expected based on the proportion of the U.S. population in that age range.

Table C1: Chi-Square Test for Independence Table to Determine If Age Is a Significant Factor in Electrocution Incidents

AGE	Average Population (millions)	Electrocutions, Expected	Electrocutions, Observed (Estimated)	Chi-Square Statistic	p-Value (3 degrees of freedom)
< 1 - 19	81.465	88.20	55.31	13.279	
20 - 39	81.890	88.66	86.19	0.075	
40 - 59	81.006	87.70	109.31	5.763	
60 and over	48.874	52.92	66.67	3.872	
ALL	293.236	317.48	317.48	22.988	0.000041

Table C2 presents the results of the Pearson’s Chi-Square statistic testing the assertion that electrocutions are independent of gender. The p-value of the test indicates again that there is significant evidence to conclude that the observed proportions of electrocutions are not independent and in fact are dependent on gender. Therefore, we can conclude that gender is a factor in electrocution incidents. As can be seen in Table C2, there were far fewer electrocutions to females than would be expected considering the proportion of the U.S. population that is female.

Table C2: Chi-Square Test for Independence Table to Determine If Gender Is a Significant Factor in Electrocution Incidents

AGE	Average Population (millions)	Electrocutions, Expected	Electrocutions, Observed (Estimated)	Chi-Square Statistic	p-Value (1 degree of freedom)
Female	148.987	161.31	45.52	89.990	
Male	144.249	156.18	271.97	92.945	
ALL	293.236	317.48	317.48	182.935	0.000000

Regression Analysis of Annual Age-Adjusted Death Rates

A regression analysis was performed in order to determine if there was sufficient evidence to conclude that there was a trend over time in the age adjusted fatality rates. For this analysis, the dependent variable was the estimated age-adjusted death rate and the independent variable was the year. The analysis of variance (ANOVA) table for the regression is given in Table C3.

Table C3: ANOVA Table of Regression Model Testing For Trend in Age-Adjusted Death Rates Due to Electrocutions Associated with Consumer Products

Source	Degrees of Freedom	Sum of Squares	Mean Square	F Value	Prob. > F
Year	1	0.0000615	0.0000615	0.01	0.9153
Error	3	0.01383	0.00461		
Corrected Total	4	0.01389			

The probability value given in the table is the probability that the regression slope is equal to zero (i.e., that there is no trend). Since the resultant probability value is greater than 0.05, we conclude that there is insufficient evidence to reject the hypothesis that there is no trend. Therefore, we can conclude that there is insufficient evidence of a trend in the age-adjusted electrocution rates.

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