



Pediatric Poisoning Fatalities from 1972 Through 2016



August 2019

Angie Qin
Directorate for Epidemiology
Division of Hazard Analysis
U.S. Consumer Product Safety Commission
4330 East West Highway
Bethesda, MD 20814

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

Introduction

Unintentional poisonings from drugs and other household chemical substances pose a hazard to children younger than 5 years of age. To address this hazard, Congress passed the [Poison Prevention Packaging Act](#) (PPPA) in 1970. Under the PPPA, the U.S. Consumer Product Safety Commission (CPSC) issued regulations that require child-resistant packaging for about 30 categories of medicines and hazardous household products.¹ Fatalities for children younger than age 5 have declined substantially since Congress founded the CPSC in 1972—from 216 that year, to an average of about 31 each year from January 1, 2014, through December 31, 2016. This report provides updated information on unintentional pediatric poisonings based on death certificate data from 2016.

Data Sources

Death counts for 1972 through 1996 are from a previous report prepared by CPSC's Directorate for Health Sciences staff (see Methodology Appendix). Death counts for 1997 through 2016 are based on data from the National Center for Health Statistics (NCHS) that are coded using the International Classification of Diseases (ICD).² Population data for the years 1994 through 2016 were obtained from the U.S. Census Bureau. More information on the data sources is available in the Appendix A: Methodology.

¹ The Child Nicotine Poisoning Prevention Act of 2015 (CNPPA), Public Law No. 114-116, requires any nicotine provided in a liquid nicotine container, sold, offered for sale, manufactured for sale, distributed in commerce, or imported into the United States shall be packaged in accordance with the standards of the Poison Prevention Packaging Act (PPPA).

² Not all of these incidents are addressable by an action the CPSC could take. It was not the purpose of this report to evaluate whether the incidents could be addressed, but rather, to update the death counts associated with pediatric poisonings.

Results

Table 1: Pediatric Poisoning Fatalities from 1972 Through 2016.

Note: The horizontal lines in Table 1 indicate when the World Health Organization switched from using ICD-8 to ICD-9 in 1979, and when it switched from using ICD-9 to ICD-10 in 1999.

<i>Year</i>	<i>Deaths</i>	<i>Percent Decrease Since 1972</i>
1972	216	0%
1973	149	31%
1974	135	38%
1975	114	47%
1976	105	51%
1977	94	56%
1978	81	63%
1979	78	64%
1980	73	66%
1981	55	75%
1982	67	69%
1983	55	75%
1984	64	70%
1985	56	74%
1986	59	73%
1987	31	86%
1988	42	81%
1989	55	75%
1990	49	77%
1991	62	71%
1992	42	81%
1993	50	77%
1994	34	84%
1995	29	87%
1996	46	79%
1997	22	90%
1998	26	88%
1999	29	87%
2000	28	87%
2001	31	86%
2002	42	81%
2003	45	79%
2004	22	90%
2005	31	86%
2006	35	84%
2007	39	82%
2008	34	84%
2009	44	80%
2010	28	87%
2011	37	83%
2012	30	86%
2013	27	88%
2014	27	88%
2015	36	83%
2016	30	86%

For 2016, the NCHS data contains reports of 30 poisoning deaths of children younger than age 5 in the ICD-10 categories included in this report (see Appendix A: Methodology for information on the included categories).

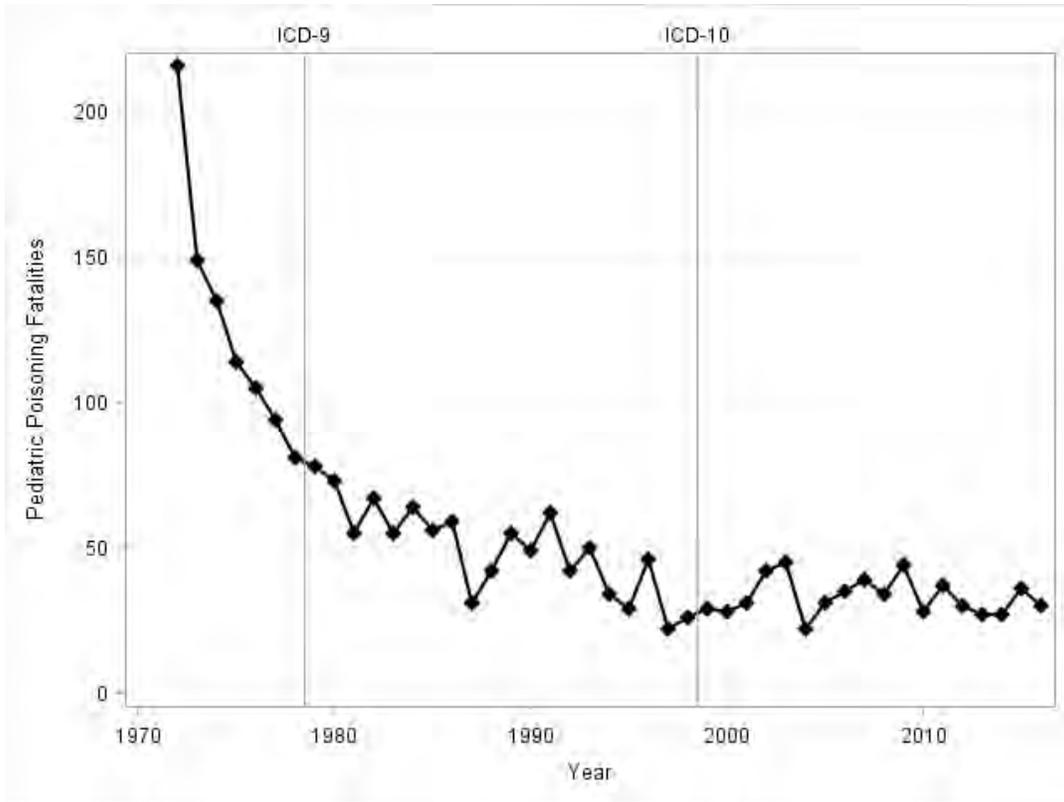


Figure 1: Pediatric Poisoning Fatalities from 1972 Through 2016.

This figure shows the number of poisoning fatalities in the United States for children younger than age 5. The vertical lines indicate the WHO's switch from deaths coded under ICD-8 to deaths coded under ICD-9 in 1979, and the switch from deaths coded under ICD-9 to deaths coded under ICD-10 in 1999.

Data Source: National Center for Health Statistics.

Poisoning death counts for children younger than age 5 were categorized into two sub-categories: children younger than 1 year of age, and children from 1 year through 4 years of age. The death counts for each age category from 2007 through 2016, along with the total death counts, are shown in Figure 2.

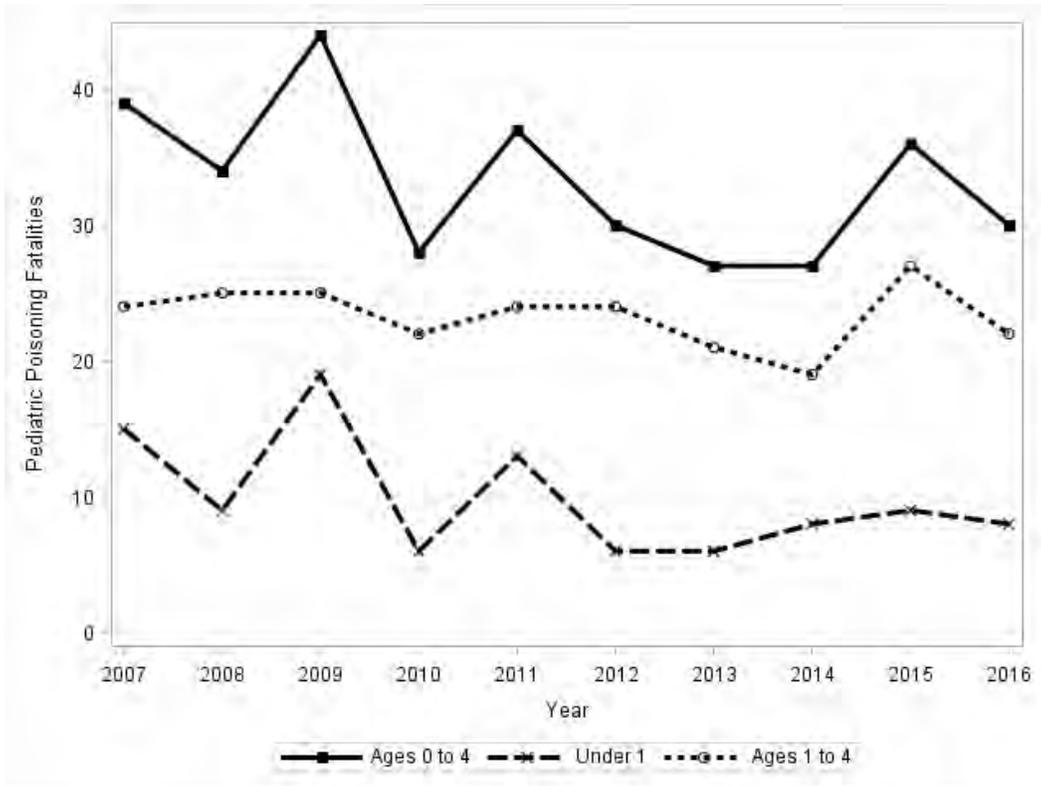


Figure 2: Pediatric Poisoning Fatalities from 2007 Through 2016.

This figure shows the number of poisoning deaths in the United States for children younger than age 5.

Data Source: National Center for Health Statistics.

Poisoning death rates were calculated using population estimates from the U.S. Census Bureau. These rates are shown in Table 2 and Figure 3 (next page).

Table 2: Pediatric Poisoning Death Rates of Children Under Age 5 per Million Population from 2007 Through 2016*

Year	Under 1	Ages 1 to 4	Ages 0 to 4
2007	3.60	1.46	1.89
2008	2.09	1.50	1.62
2009	4.36	1.48	2.07
2010	1.52	1.35	1.39
2011	3.28	1.49	1.84
2012	1.52	1.50	1.50
2013	1.52	1.32	1.36
2014	2.03	1.19	1.36
2015	2.26	1.69	1.81
2016	2.02	1.38	1.51

*The rates in Table 2 are per million population of the specified age.

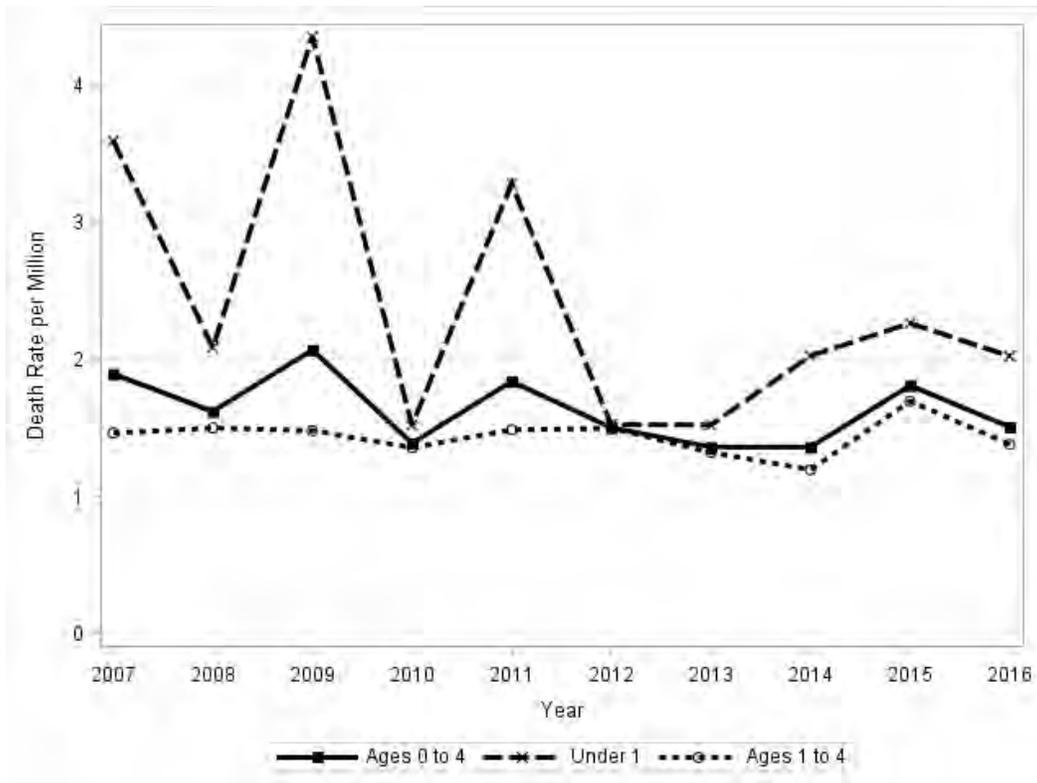


Figure 3: Pediatric Poisoning Death Rates from 2007 Through 2016.

This graph shows the death rates in the United States from poisoning for children younger than age 5.

Data Source: National Center for Health Statistics and U.S. Census Bureau.

Poisoning death rates and reported death counts decreased for all age categories from 2015 to 2016. The ICD-10 death codes with increases from 2015 to 2016 were X40 (non-opioid analgesics, antipyretics, and antirheumatics), which increased from one death to two deaths; X41 (antiepileptic, sedative- hypnotic, and psychotropic), which increased from three deaths to four deaths; X42 (narcotics and psychodysleptics³), which increased from 18 deaths to 20 deaths; and X45 (alcohol), which increased from zero deaths to two deaths. The ICD-10 death codes with decreases from 2015 to 2016 were X44 (unspecified drugs, medicaments, and biological substances), which decreased from 12 deaths to two deaths; and X49 (other and unspecified chemicals), which decreased from two deaths to zero deaths. The ICD-10 death codes with no changes were X43, X46, and X48.

Table 3: Pediatric Poisoning Death Counts of Children Under 5 by Age Category and ICD-10 Code,⁴ 2016

<i>ICD-10 Code</i>	<i>Ages</i>		
	<i>Under 1</i>	<i>1 to 4</i>	<i>0 to 4</i>
X40 (non-opioid analgesics, antipyretics, and antirheumatics)	0	2	2
X41 (antiepileptic, sedative- hypnotic, . . . and psychotropic)	2	2	4
X42 (narcotics and psychodysleptics, not elsewhere classified)	4	16	20
X43 (drugs acting on the autonomic nervous system)	0	0	0
X44 (other and unspecified drugs . . . and biological substances)	1	1	2
X45 (alcohol)	1	1	2
X46 (organic solvents and halogenated hydrocarbons)	0	0	0
X48 (pesticides)	0	0	0
X49 (other and unspecified chemicals and noxious substances)	0	0	0
Total	8	22	30

³ Psychodysleptics are hallucinogens.

⁴ The code definitions were abbreviated due to space considerations. Please see the full list of codes and definitions on page 11.

APPENDIX A: METHODOLOGY

Data Sources

Data for 1972 through 1996 are from a previous report prepared by CPSC's Directorate for Health Sciences staff.⁵ Counts of deaths for 1997 through 2002 were obtained from the National Center for Health Statistics (NCHS) website, using data in the under-1-year-old age group and the 1-to 4-year-old age group. Counts of deaths for 2003 through 2006 for children under the age of 5 years were determined from data obtained by CD-ROM from NCHS. Counts of deaths for 2007 through 2016 for children under the age of 5 years were determined from data downloaded from the NCHS website.

The downloads for the NCHS data for 1997 through 2002 were:

- Total Deaths for Each Cause by 5-Year Age Groups, United States, 1994–1998. Downloaded from: www.cdc.gov/nchs/datawh/statab/unpubd/mortabs/gmwiki.htm on 5 Jan 2001.
- Total Deaths for Each Cause by 5-Year Age Groups, United States, 1999. Downloaded from: www.cdc.gov/nchs/datawh/statab/unpubd/mortabs/gmwiki10.htm on 10 Jan 2002.
- Deaths for Each Cause, by 5-Year Age Groups, Race, and Sex, United States, 2000. Downloaded from: www.cdc.gov/nchs/dvs/wktbli.pdf on 4 Feb 2003.
- Deaths for Each Cause, by 5-Year Age Groups, Race, and Sex: United States, 2001. Downloaded from: www.cdc.gov/nchs/datawh/statab/unpubd/mortabs/gmwiki10.htm on 29 Apr 2004.
- Deaths for Each Cause, by 5-Year Age Groups, Race, and Sex: United States, 2002. Murphy, Sherry. "Worktable I for 2002 - part 4," E-mail to Craig O'Brien. 12 Apr 2005.
- Currently the data above is located at: https://ftp.cdc.gov/pub/health_statistics/nchs/datasets/dvs/mortality.

The NCHS CD-ROMs for 2003 through 2006 were:

- U.S. Department of Health and Human Services. National Center for Health Statistics. *Multiple Cause-of-Death Public-Use File* CD-ROM. Hyattsville, MD: NCHS, 2006.
- U.S. Department of Health and Human Services. National Center for Health Statistics. *Multiple Cause-of-Death Public-Use File* CD-ROM. Hyattsville, MD: NCHS, 2007.
- U.S. Department of Health and Human Services. National Center for Health Statistics. *Multiple Cause-of-Death Public-Use File* CD-ROM. Hyattsville, MD: NCHS, 2008.
- U.S. Department of Health and Human Services. National Center for Health Statistics. *Multiple Cause-of-Death Public-Use File* CD-ROM. Hyattsville, MD: NCHS, 2009.
- Now the data above is located at: https://ftp.cdc.gov/pub/health_statistics/nchs/datasets/dvs/mortality.

⁵ Memorandum from Susan Aitken, Ph.D., to Kenneth P. Giles, dated 29 Jan 1999: "National Center for Health Statistics (NCHS) Data on Pediatric Fatalities for 1996." U.S. Consumer Product Safety Commission, Washington, D.C.

The downloads for the NCHS data for 2007 through 2016 were:

- U.S. Department of Health and Human Services. National Center for Health Statistics. *Mortality Multiple Cause File*. Downloaded from:
https://ftp.cdc.gov/pub/health_statistics/nchs/datasets/dvs/mortality/mort2007us.zip on 1 Jun 2010.
https://ftp.cdc.gov/pub/health_statistics/nchs/datasets/dvs/mortality/mort2008us.zip on 10 Sep 2011.
https://ftp.cdc.gov/pub/health_statistics/nchs/datasets/dvs/mortality/mort2009us.zip on 17 Apr 2012.
https://ftp.cdc.gov/pub/health_statistics/nchs/datasets/dvs/mortality/mort2010us.zip on 7 May 2013.
https://ftp.cdc.gov/pub/health_statistics/nchs/datasets/dvs/mortality/mort2011us.zip on 1 August 2014.
https://ftp.cdc.gov/pub/health_statistics/nchs/datasets/dvs/mortality/mort2012us.zip on 30 April 2015.
https://ftp.cdc.gov/pub/health_statistics/nchs/datasets/dvs/mortality/mort2013us.zip on 2 May 2016.
https://ftp.cdc.gov/pub/health_statistics/nchs/datasets/dvs/mortality/mort2014us.zip on 2 May 2017.
https://ftp.cdc.gov/pub/health_statistics/nchs/datasets/dvs/mortality/mort2015us.zip on 20 May 2018.
https://ftp.cdc.gov/pub/health_statistics/nchs/datasets/dvs/mortality/mort2016us.zip on 27 June 2019.

Population data for the years 1994 to 2016 were obtained from the website of the U.S. Census Bureau. The downloads of the population data were:

- Monthly postcensal resident population estimates for April 1, 1994, to September 1, 1999. Six files, downloaded from: www.census.gov/population/estimates/nation/e90s on 11 Feb 2002. Now the data is located at: <https://www.census.gov/data/datasets/time-series/demo/popest/intercensal-1990-2000-national.html>.
- Monthly postcensal resident population estimates, titled, “April 1, 2000 to September 1, 2000,” downloaded from www.census.gov/population/estimates/nation/e90s/e0000rmp.txt on 7 Feb 2003.
- Monthly postcensal resident population, by single year of age, sex, race, and Hispanic origin, 7/1/01 to 12/1/01, downloaded from: www.census.gov/popest/data/national/asro_detail_1.php on 29 Apr 2004. Now the 2000-2010 data are located at: <https://www.census.gov/data/datasets/time-series/demo/popest/intercensal-2000-2010-state.html>.
- Monthly postcensal resident population, by single year of age, sex, race and Hispanic origin, 7/1/02 to 12/1/02, downloaded from: www.census.gov/popest/national/asrh/2003_nat_res.html on 22 Apr 2005.
- Monthly postcensal resident population, by single year of age, sex, race and Hispanic origin, 7/1/03, downloaded from: www.census.gov/popest/national/asrh/2003_nat_res.html on 13 Feb 2006.
- Monthly postcensal resident population, by single year of age, sex, race and Hispanic origin, 7/1/04, downloaded from: www.census.gov/popest/national/asrh/2004_nat_res.html on 23 Jan 2007.
- Monthly postcensal resident population, by single year of age, sex, race and Hispanic origin, 7/1/05, downloaded from: www.census.gov/popest/national/asrh/2005_nat_res.html on 5 Feb 2008.

- Monthly postcensal resident population, by single year of age, sex, race and Hispanic origin, 7/1/06, downloaded from: www.census.gov/popest/national/asrh/2006_nat_res.html on 28 Apr 2009.
- Monthly postcensal resident population, by single year of age, sex, race and Hispanic origin, 7/1/07, downloaded from: www.census.gov/popest/national/asrh/2007_nat_res.html on 12 May 2008.
- Monthly postcensal resident population, by single year of age, sex, race and Hispanic origin, 7/1/08, downloaded from: www.census.gov/popest/national/asrh/2008_nat_res.html on 20 Oct 2009.
- Monthly postcensal resident population, by single year of age, sex, race and Hispanic origin, 7/1/09, downloaded from: www.census.gov/popest/national/asrh/2009_nat_res.html on 3 Feb 2010.
- Intercensal Estimates of the Resident Population by Single Year of Age and Sex for States and the United States: July 1, 2010, downloaded on 12 Jul 2012 from: www.census.gov/popest/national/asrh/2010_nat_res.html. Now the 2000-2010 data are located at: <https://www.census.gov/data/datasets/time-series/demo/popest/intercensal-2000-2010-state.html>.
- Annual Estimates of the Resident Population for Selected Age Groups by Sex for the United States: July 1, 2011, downloaded on 1 Aug 2014 from: <http://www.census.gov/popest/data/national/asrh/2012/index.html>.
- Annual Estimates of the Resident Population for Selected Age Groups by Sex for the United States: July 1, 2012, downloaded on 24 June 2015 from: <http://www.census.gov/popest/data/national/asrh/2013/index.html>.
- Annual Estimates of the Resident Population for Selected Age Groups by Sex for the United States: July 1, 2013, downloaded on 11 May 2016 from: <http://www.census.gov/popest/data/national/asrh/2014/index.html>. Now it is located at: https://factfinder.census.gov/faces/tableservices/jsf/pages/productview.xhtml?pid=PEP_2015_PEPSYASEX&prodType=table.
- Annual Estimates of the Resident Population by Single Year of Age and Sex for the United States, States, and Puerto Rico Commonwealth: July 1, 2015, downloaded on 10 May 2017 from: https://factfinder.census.gov/faces/tableservices/jsf/pages/productview.xhtml?pid=PEP_2015_PEPSYASEX&prodType=table.
- Annual Estimates of the Resident Population by Single Year of Age and Sex for the United States, States, and Puerto Rico Commonwealth: July 1, 2016, downloaded on 20 May 2018 from: https://factfinder.census.gov/faces/tableservices/jsf/pages/productview.xhtml?pid=PEP_2016_PEPSYASEX&prodType=table.
- Annual Estimates of the Resident Population by Single Year of Age and Sex for the United States, States, and Puerto Rico Commonwealth: July 1, 2017, downloaded on 27 June 2019 from: https://factfinder.census.gov/faces/tableservices/jsf/pages/productview.xhtml?pid=PEP_2016_PEPSYASEX&prodType=table.

Data Subsetting

For 2016, we used the NCHS mortality data file, as downloaded from the Internet. The data are provided in a column-format text file, with documentation on the table layout. CPSC staff wrote SAS Studio v3.6 code to subset the data provided by the ICD-10 cause of death code, age, and resident status.

In this report, staff used ICD-10 codes X40 through X49, excluding X47. Traditionally, we collect the X47 code for analysis, but we excluded it from the report because it covers carbon monoxide poisonings not relevant to the PPPA. We included incidents in the subset only if a relevant ICD-10 code was listed as the underlying cause of death.

The NCHS data uses two-variable age encoding with a unit and a value. Included in the subset are all incidents with a unit of years and a value less than five. It also includes all incidents with a unit shorter than 1 year, which is used for children younger than 1 year-old. There is an “unknown” age unit that is not included in the subset.

The data are arranged in the subset by resident status to exclude foreign nationals from the report.

International Classification of Diseases Revisions

Fatalities from 1994 through 1998 were coded in 17 E-codes (850 through 866) from the ninth revision of the International Classification of Diseases (ICD-9). Fatalities for 1999 through 2015 are identified under the nine codes from X40 through X49, excluding X47, from the tenth revision of the International Classification of Diseases (ICD-10). These codes are:

- X40 Accidental poisoning by and exposure to nonopioid analgesics, antipyretics, and antirheumatics.
- X41 Accidental poisoning by and exposure to antiepileptic, sedative-hypnotic, antiparkinsonism, and psychotropic drugs, not elsewhere classified.
- X42 Accidental poisoning by and exposure to narcotics and psychodysleptics (hallucinogens), not elsewhere classified.
- X43 Accidental poisoning by and exposure to other drugs acting on the autonomic nervous system.
- X44 Accidental poisoning by and exposure to other and unspecified drugs, medicaments, and biological substances.
- X45 Accidental poisoning by and exposure to alcohol.
- X46 Accidental poisoning by and exposure to organic solvents and halogenated hydrocarbons and their vapors.
- X48 Accidental poisoning by and exposure to pesticides.
- X49 Accidental poisoning by and exposure to other and unspecified chemicals and noxious substances.

The excluded code, X47, is for accidental poisoning by and exposure to other gases and vapors, a code that includes carbon monoxide poisoning.

The United States began using ICD-10 codes for deaths occurring in 1999, replacing ICD-9, which had been adopted in 1979. The revision of ICD-9 into ICD-10 involved increasing the number of categories from about 5,000 to about 8,000, changing from numeric to alphanumeric codes, and changing some rules for selecting the underlying cause of death.⁶ Because ICD-10 codes are not directly comparable to ICD-9 codes, discontinuities can appear in trend analyses that use data on deaths occurring before 1999. Year-to-year variability is also evident in the data.

Comparability ratios can be used to adjust past NCHS counts to reflect how many deaths would have been coded in certain groupings had ICD-10 been in effect during a given year. However, NCHS has not released a comparability ratio for poisonings as of this writing. NCHS released *preliminary* estimates of comparability ratios for the transition from ICD-9 to ICD-10 in May 2001. The estimates were based on a sample of double-coded death certificates from 1996.⁷ For most cause-of-death groupings, the NCHS researchers provided ratios. For the poisoning group, however, the preliminary ratio estimate was deemed unreliable. This may have been for several possible reasons, including a paucity of deaths in the poisoning codes; a lack of inclusion of deaths from the poisoning grouping in the preliminary study; or an increase or decrease in deaths due to poisoning, which was determined by the researchers to be both large-scale and erroneous.⁷

In the absence of a ratio for poisoning, the ratio for nontransport accidents was considered for use by CPSC staff in this analysis. Nontransport accidents include all accidental deaths that do not involve a vehicle. Because of the possibility that the comparability ratio for the poisoning group could differ significantly from that for all nontransport accidents for any one of the reasons above, CPSC staff ultimately chose to postpone the use of an NCHS comparability ratio. Comparisons between pre-1999 and post-1999 data should be made with caution.

The ICD-10 categories included in this report were chosen in an attempt to present comprehensive statistics on childhood poisonings, with a particular interest in including any death that may have been prevented through the use of child-resistant packaging. Some of the deaths included may involve situations or products that fall outside of the CPSC's jurisdiction. For example, the category X44 may include deaths due to food poisoning (*e.g.*, salmonella, botulism toxin) or due to exposure to wild mushrooms; and category X42 may include deaths due to exposure to illegal drugs.

In the absence of a detailed analysis of the full complement of death certificates in the given categories, it is not possible to determine what percentage of the deaths included in these codes may have been preventable through the use of child-resistant packaging. However, the true number of deaths associated with household products or the drug packaging within the CPSC's jurisdiction is likely a subset of the number presented in this report in any given year. A detailed study might be conducted in the future.

⁶ Anderson, RN, Minino, AM, Hoyert, DL, Rosenburg, HM. Comparability of Cause of Death Between ICD-9 and ICD-10: Preliminary Estimates. National Vital Statistics Report; vol 49 no 2. Hyattsville,

Maryland: National Center for Health Statistics. 2001.
⁷ See note 5 on page 8 of 12.