



UNITED STATES
 CONSUMER PRODUCT SAFETY COMMISSION
 WASHINGTON, DC 20207

Memorandum

Date: OCT 24 2003

TO : The Commission
 Todd Stevenson, Secretary

THROUGH: W. H. DuRoss, III, General Counsel *WHD*
 Patricia M. Semple, Executive Director

FROM : Jacqueline Elder, Assistant Executive Director
 Hazard Identification and Reduction

Susan Ahmed, Ph.D., Associate Executive Director *SA*
 Directorate for Epidemiology

SUBJECT : Annual Report: All-Terrain Vehicle (ATV)-Related Deaths and Injuries

Attached is the annual report of ATV-related deaths and injuries for the year 2002. This report covers death data available as of December 31, 2002 and data on injuries occurring up to December 31, 2002.

This year we made several changes to the report to bring it more in line with the current ATV market and to aid in its readability. All of these are explained in detail in the methodology section. Briefly, these changes include:

- The addition of Appendix A, giving a year-by-year breakdown of the percentage of deaths involving children.
- The addition of a methodology appendix (Appendix B) to explain how each number in the report was calculated.
- New risk estimates (for injuries and deaths) that make use of improved estimates of the numbers of ATVs in use. The improved estimates are from a model derived using data from the 2001 injury and exposure studies. The effects of these new estimates are highlighted in Appendix C.
- New injury estimates for 2001 and 2002, using the latest adjustment factors that resulted from the 2001 ATV injury and exposure studies; and to be consistent, revised estimates for several other years using a revised 1997 adjustment factor.

Attachment (1)

NOTE: This document has not been reviewed or accepted by the Commission.
 Initial rh Date 10/24/03

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UNITED STATES
CONSUMER PRODUCT SAFETY COMMISSION
WASHINGTON, DC 20207

Memorandum

Date: September 15, 2003

TO : Susan Ahmed, Ph.D.
Associate Executive Director
Directorate for Epidemiology

THROUGH: Russell Roegner, Ph.D., Director *RR*
Division of Hazard Analysis
Directorate for Epidemiology

FROM : Robin L. Ingle, Mathematical Statistician *RL*
Division of Hazard Analysis
Directorate for Epidemiology

SUBJECT : 2002 Annual Report of ATV Deaths and Injuries

Introduction

Injuries and deaths associated with the use of all-terrain vehicles (ATVs) have shown an increasing trend in the last several years. This report provides an update of the U.S. Consumer Product Safety Commission's data on ATV injuries and deaths. This report utilizes death data available as of December 31, 2002 and data on injuries occurring up to December 31, 2002.

The number of deaths associated with ATVs that have been reported to the Commission has increased by 698 since the last report. There was an increase in the estimated number of emergency-room-treated injuries for 2002, up about three percent over 2001. This increase was not statistically significant. The 2002 estimate does represent a statistically significant increase over the estimates from the years 1997 to 2000, however. The increase is not fully explained by an increase in the number of ATVs in use. Children under 16 years of age accounted for 37 percent of the total estimated injuries from 1985 through 2002.

Deaths Reported to the Commission

On December 31, 2002, the Commission had reports of 5,239 ATV-related deaths that have occurred since 1982 (Table 1). The reported deaths increased by 698 since the December 31, 2001 tabulation for the last report dated May 15, 2002.

Table 1
Reported ATV-Related Deaths by Year
ATVs with 3, 4 or Unknown Number of Wheels
January 1, 1982 to December 31, 2002

Year ¹	Number of Deaths	Difference Since Last Update (12/31/2001)
Total	5,239	+698
2002	357	+357
2001	467	+197
2000	446	+102
1999 ²	399	+42
1998	251	0
1997	241	0
1996	248	0
1995	200	0
1994	198	0
1993	183	0
1992	221	0
1991	230	0
1990	234	0
1989	230	0
1988	250	0
1987	264	0
1986	299	0
1985	251	0
1984	156	0
1983	85	0
1982	29	0

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

Table 2 on the next page is a listing of ATV-related deaths for each state, the District of Columbia and Puerto Rico. The highest numbers of deaths were reported for California (305), Pennsylvania (287), Texas (233), Michigan (224) and New York (224).

¹ Reporting is incomplete for 2000, 2001 and 2002.

² Beginning in 1999, deaths were coded under the Tenth Revision of the International Classification of Diseases (ICD-10). See Appendix B for an explanation of the effect of this change.

Table 2
Deaths Associated With ATVs by State
ATVs with 3, 4 or Unknown Number of Wheels
Reported for the Period January 1, 1982 Through December 31, 2002

State	Frequency	Percent	Cumulative Frequency	Cumulative Percent
CALIFORNIA	305	5.8	305	5.8
PENNSYLVANIA	287	5.5	592	11.3
TEXAS	233	4.4	825	15.7
MICHIGAN	224	4.3	1,049	20.0
NEW YORK	224	4.3	1,273	24.3
WEST VIRGINIA	220	4.2	1,493	28.5
KENTUCKY	215	4.1	1,708	32.6
FLORIDA	200	3.8	1,908	36.4
TENNESSEE	200	3.8	2,108	40.2
NORTH CAROLINA	189	3.6	2,297	43.8
MISSISSIPPI	168	3.2	2,465	47.1
ARKANSAS	158	3.0	2,623	50.1
GEORGIA	150	2.9	2,773	52.9
MISSOURI	143	2.7	2,916	55.7
MINNESOTA	142	2.7	3,058	58.4
WISCONSIN	142	2.7	3,200	61.1
OHIO	140	2.7	3,340	63.8
LOUISIANA	124	2.4	3,464	66.1
ILLINOIS	118	2.3	3,582	68.4
ARIZONA	112	2.1	3,694	70.5
ALABAMA	110	2.1	3,804	72.6
VIRGINIA	101	1.9	3,905	74.5
INDIANA	93	1.8	3,998	76.3
UTAH	91	1.7	4,089	78.0
ALASKA	88	1.7	4,177	79.7
OREGON	87	1.7	4,264	81.4
IOWA	75	1.4	4,339	82.8
OKLAHOMA	75	1.4	4,414	84.3
MAINE	72	1.4	4,486	85.6
KANSAS	68	1.3	4,554	86.9
IDAHO	62	1.2	4,616	88.1
COLORADO	58	1.1	4,674	89.2
NEW MEXICO	53	1.0	4,727	90.2
WASHINGTON	53	1.0	4,780	91.2
SOUTH CAROLINA	50	1.0	4,830	92.2
NEBRASKA	46	0.9	4,876	93.1
NEW HAMPSHIRE	44	0.8	4,920	93.9
MASSACHUSETTS	43	0.8	4,963	94.7
VERMONT	38	0.7	5,001	95.5
NEW JERSEY	37	0.7	5,038	96.2
NEVADA	34	0.6	5,072	96.8
MARYLAND	32	0.6	5,104	97.4
SOUTH DAKOTA	30	0.6	5,134	98.0
NORTH DAKOTA	27	0.5	5,161	98.5
MONTANA	24	0.5	5,185	99.0
CONNECTICUT	19	0.4	5,204	99.3
WYOMING	18	0.3	5,222	99.7
DELAWARE	5	0.1	5,227	99.8
HAWAII	4	0.1	5,231	99.8
RHODE ISLAND	4	0.1	5,235	99.9
DISTRICT OF COLUMBIA	2	0.0	5,237	100.0
PUERTO RICO	2	0.0	5,239	100.0

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

Characteristics of ATVs and Fatalities

A review of the reported fatalities indicated that 1706 victims (33% of the 5,239 total) were under 16 years of age and 723 (14% of the total) were under 12 years of age. These figures have been corrected since previous reports.³ Appendix A gives the numbers and percentages of reported fatalities by age group and year.

Production of three-wheel ATVs ceased in the mid- to late-1980s, and most ATVs currently distributed in the U.S. are four-wheel ATVs. The percent of reported fatalities that involved four-wheel ATVs has increased from seven percent or less prior to 1985 to about 88 percent for 2002, based on those fatalities reported so far for 2002. (Data collection for 2002 is not yet complete.) CPSC estimates that of the 5.6 million three- or four-wheel ATVs in use in 2001, about 86 percent were four-wheelers.⁴

Estimated Deaths and Risk of Death, 1985 to 2001

The deaths reported to the Commission represent a minimum count of ATV-related deaths. To account for deaths not reported to the Commission, estimates of the annual deaths were calculated for 1985 through 2001 using a statistical approximation method. Table 3 on the next page shows the annual reported and estimated numbers of ATV-related deaths for ATVs with three, four or unknown number of wheels, in addition to the annual estimates and risk of death (per 10,000 in use) for four-wheel ATVs from 1985 to 2001.

The heavy line between 1998 and 1999 in Table 3 demarcates the switch from data collection under the Ninth Revision of the International Classification of Diseases (ICD-9) and the Tenth Revision (ICD-10), a transition that occurred worldwide in January of 1999. The ICD-10 transition and the resulting necessary changes in methodology are discussed more fully in Appendix B. Because ICD-10 allows CPSC to gather data on more ATV-related deaths than had been possible under ICD-9, some of the increase in deaths from 1998 to 1999 may be due to changes in data collection. However, such a conclusion would indicate that the death estimates calculated by the pre-1999 methodology were underestimates, though they are the best estimates possible using available data.

For this report, the risk of death per 10,000 four-wheel ATVs in use was recalculated for the years 1987 onward based on new exposure data. A discussion of the methodology used for the recalculation as well as the new exposure data is given in Appendices B and C.

³ Values previously reported for victims under 16 and under 12 included 16-year-olds and 12-year-olds, respectively.

⁴ Levenson, M. *All-Terrain Vehicle 2001 Injury and Exposure Studies*. January 2003. U.S. Consumer Product Safety Commission.

Table 3
Annual Estimates of ATV-Related Deaths
And Risk of Death for Four-Wheel ATVs
As of December 31, 2002

Year ⁵	Reported Deaths	Estimated Deaths Associated With ATVs with 3, 4 or Unknown Wheels	Estimated Deaths Involving 4-Wheel ATVs	Risk of Death per 10,000 4-Wheel ATVs In Use ⁶
2001	467	634	584	1.2
2000	446	569	516	1.2
1999 ⁷	399	566	516	1.4
1998	251	287	245	0.8
1997	241	291	243	0.9
1996	248	267	208	0.9
1995	200	276	212	1.0
1994	198	244	168	0.8
1993	183	211	144	0.7
1992	221	241	158	0.8
1991	230	255	152	0.8
1990	234	250	151	0.9
1989	230	258	153	0.9
1988	250	286	152	1.1
1987	264	282	126	1.1
1986	299	347	95	1.3
1985	251	295	55	1.5

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

Estimated Hospital Emergency Room Treated Injuries

Table 4 shows estimates of ATV-related injuries treated in hospital emergency rooms nationwide between January 1, 1982 and December 31, 2002. Children under 16 years of age accounted for about 37 percent of the total estimated injuries from 1985 through 2002 inclusive. These estimates are generated from CPSC's National Electronic Injury Surveillance System, a probability sample of U.S. hospitals with 24-hour emergency rooms and more than six beds.

⁵ Reporting is incomplete for 2000 and 2001.

⁶ Risk of death has been recalculated since the last report according to the methodology detailed in Appendix B. Changes affecting this table in this year's report are discussed in Appendix C.

⁷ Beginning in 1999, deaths were coded under the Tenth Revision of the International Classification of Diseases (ICD-10). See Appendix B for an explanation of the effect of this change.

Table 4
Annual Estimates⁸ of ATV-related Hospital Emergency Room Treated Injuries
ATVs with 3, 4 or Unknown Number of Wheels
January 1, 1982 through December 31, 2002

Year	All Ages	Ages less than 16 years
2002	113,900	37,100
2001	110,100	34,300
2000	92,200	32,000
1999	82,000	27,700
1998	67,800	25,100
1997	52,800	20,600
1996	53,600	20,200
1995	52,200	19,300
1994	50,800	21,400
1993	49,800	17,900
1992	58,200	22,000
1991	58,100	22,500
1990	59,500	22,400
1989	70,300	25,700
1988	74,600	28,500
1987	93,600	38,600
1986	106,000	47,600
1985	105,700	42,700
1984	77,900	⁹
1983	32,100	⁹
1982	10,100	⁹

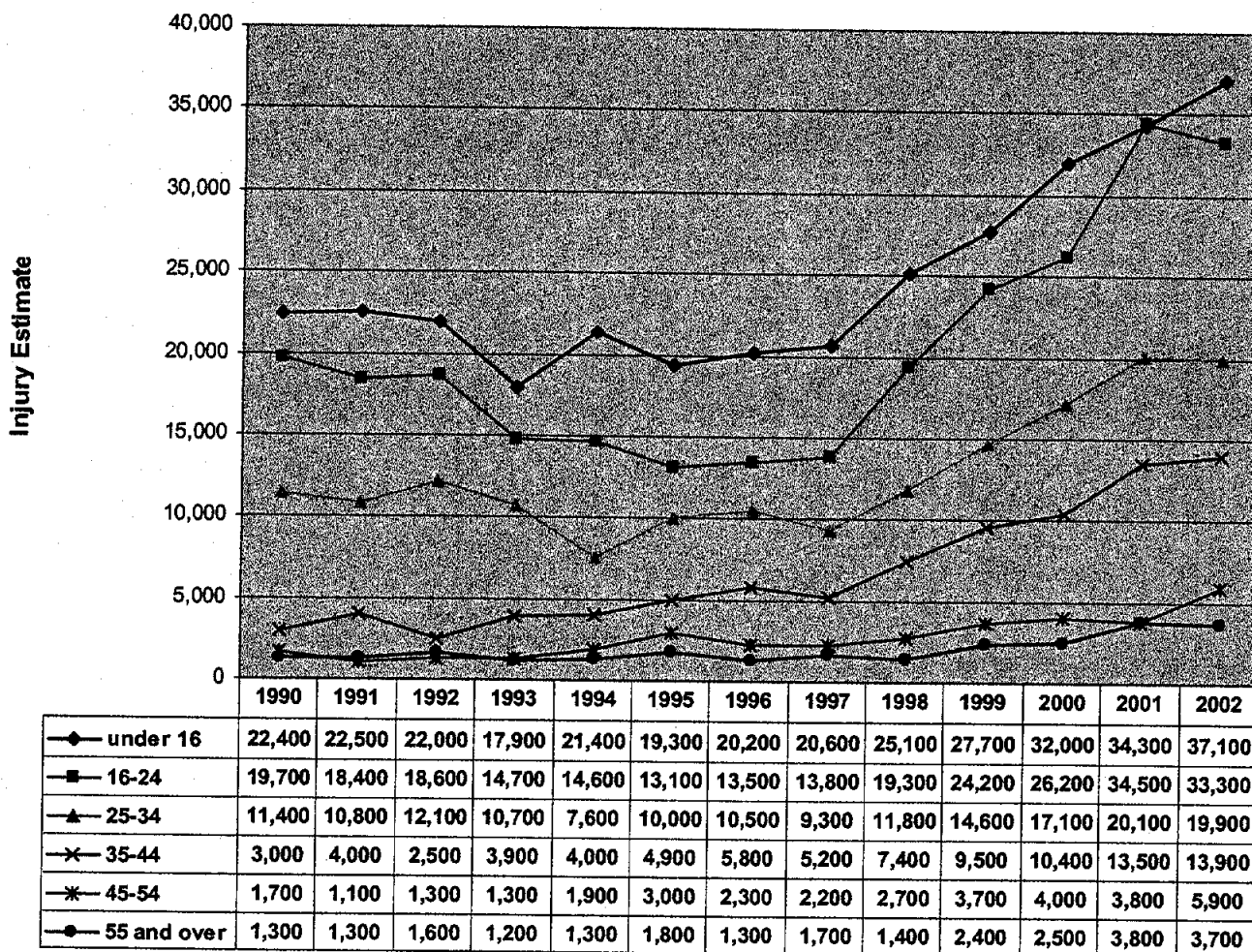
Source: National Electronic Injury Surveillance System, U.S. Consumer Product Safety Commission

Figure 1 presents annual estimates by age group for ATV-related injuries treated in hospital emergency rooms since 1989. The total estimate for 2002 reflects an increase of about three percent over the 2001 estimate. This increase was not statistically significant. The 2002 estimate does represent a statistically significant increase over the estimates from the years 1997 to 2000, however. This increase is not fully explained by an increase in the number of ATVs in use. The 45- to 54-year-old age group showed a statistically significant increase over 2001; the other age groups did not have statistically significant changes between 2001 and 2002.

⁸ Estimates have been adjusted according to the methodology in Appendix B. Changes affecting this table in this year's report are discussed in Appendix C.

⁹ Adjusted estimates for children under 16 years old were not computed prior to 1985.

Figure 1
Annual ATV-Related Injury Estimates¹⁰
ATVs with 3, 4 or Unknown Number of Wheels
1990-2002



Source: National Electronic Injury Surveillance System, U.S. Consumer Product Safety Commission

The greatest percentage change in number of injuries occurred in the 45- to 54-year-old age group, where injuries increased by 55 percent between 2001 and 2002. The under-16 age group increased by eight percent. A slight increase was also seen in the 35-44 age group. The number of injuries in the 16- to 24-year-old and 55-and-older age groups decreased by three percent, and the 25- to 34-year-old group showed virtually no change.

Table 5 shows estimates of four-wheel ATV-related injuries and risk of injury for January 1, 1985 through December 31, 2002, where risk is defined as the estimated number of injuries divided by the number of vehicles in use, multiplied by 10,000. The increasing trend in the risk of injury from the late 1990s to 2001 may suggest that the increase in deaths in corresponding years is not due merely to the fact that under the Tenth Revision of the International Classification of Diseases, CPSC began receiving death certificates for ATV deaths on public roads.¹¹

¹⁰ Estimates have been adjusted according to the methodology in Appendix B.

¹¹ For full details, see Appendix B.

Table 5
Estimated Number of Injuries And Risk of Injury
Associated with Four-Wheel ATVs
January 1, 1985 – December 31, 2002

Year	Injury Estimate ¹²	Risk Estimate per 10,000 ATVs ¹³
2002	104,800	190.0
2001	98,200	200.9
2000	82,300	197.2
1999	68,900	193.0
1998	57,100	184.7
1997	39,700	146.1
1996	40,700	168.1
1995	36,200	165.7
1994	33,300	165.4
1993	32,000	164.9
1992	33,000	175.1
1991	34,400	188.1
1990	30,800	175.1
1989	35,700	217.8
1988	39,400	276.1
1987	33,900	305.9
1986	23,400	319.2
1985	14,700	391.1

Source: U.S. Consumer Product Safety Commission, Directorate for Epidemiology, Division of Hazard Analysis, National Electronic Injury Surveillance System, and the Directorate for Economic Analysis.

Discussion

The use of three-wheel ATVs has declined; therefore, ATVs in use are primarily four-wheel vehicles. Estimated numbers of deaths for four-wheel ATVs (Table 3) were generally constant from the late 1980s through the early 1990s; thereafter, estimated numbers of deaths increased. In 1999, a revision of the system for coding deaths was implemented. Because of those changes, some of the increase seen between 1998 and 1999 may be due to CPSC's increased abilities to obtain more accurate counts of deaths occurring on public roads. Any conclusion indicating that at least some of the increase in estimated deaths is due to data collection also implies that the estimates for years prior to 1999 have always been underestimates, though they are the best estimates possible using available data. CPSC staff believes this to be the case; while the 1999 estimates and preliminary 2000 and 2001 estimates

¹² Annual estimates have been adjusted according to the methodology in Appendix B. Changes affecting this table in this year's report are discussed in Appendix C.

¹³ Risk of injury has been recalculated since the last report according to the methodology detailed in Appendix B. Changes affecting this table in this year's report are discussed in Appendix C.

indicate there is an actual increase in deaths, the trend may not be rising as sharply as it appears because the numbers of deaths in the late 1990s were underestimates. Such is also the case for risk of death.

The estimated number of injuries for four-wheel vehicles (Table 5) was also relatively constant for the late 1980s through the early-to-mid 1990s; thereafter the numbers of injuries also increased, and statistically significant increases have occurred most years since 1997. The increase in the estimated injuries suggests that the increase in deaths may not be entirely due to better data collection.

Appendix A

Reported ATV-Related Deaths by Year and Age Group ATVs with 3, 4 or Unknown Number of Wheels January 1, 1982 to December 31, 2002

Year ¹⁴	0-11 Years Old	0-11 Years Old Percent of Total	0-15 Years Old	0- 15 Years Old Percent of Total
Total	723	14	1,706	33
2002	37	10	99	28
2001	52	11	119	25
2000	51	11	124	28
1999 ¹⁵	36	9	92	23
1998	30	12	82	33
1997	38	16	79	33
1996	40	16	87	35
1995	26	13	64	32
1994	20	10	54	27
1993	18	10	59	32
1992	32	14	71	32
1991	40	17	68	30
1990	27	12	81	35
1982-1989	276	18	627	40

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

¹⁴ Reporting is incomplete for 2000, 2001 and 2002. Percentages for years for which reporting is incomplete should be interpreted with caution because the rate at which deaths are reported may not be consistent across all age groups.

¹⁵ Beginning in 1999, deaths were coded under the Tenth Revision of the International Classification of Diseases (ICD-10). See Appendix B for a discussion of the effect of this change.

Appendix B

Methodology

Deaths

CPSC staff estimates the number of deaths associated with ATVs by use of a capture-recapture approach. This approach involves examining the numbers of reports of fatalities gathered by two different methods. The first method is the collection of death certificates purchased from the states, where the death was deemed ATV-related by the medical examiner. These incidents are entered into CPSC's death certificate database (DTHS). The second method is the collection of various types of reports of fatal ATV-related incidents by any other means available to the agency: news clips, reports from the Medical Examiners' and Coroners' Alert Project (MECAP), reports from consumers via phone or internet, hospital reports from the National Electronic Injury Surveillance System (NEISS), as well as other types of reports.

The calculation of the capture-recapture estimate entails examining the number of incidents included in DTHS or from non-DTHS sources as well as the number included on both lists of incidents. The estimate is given by

$$\text{estimate} = \frac{(M+1)(N+1)}{n+1} - 1$$

Formula 1

where

M is the number of incidents captured by purchase of death certificates from the states,

N is the number of incidents collected by other means, and

n is the number of incidents captured by both death certificate purchase and by at least one other source.

Estimates of fatalities occurring after January 1, 1999 that were associated with ATVs with three, four or an unknown number of wheels were calculated using formula 1.

In 1999, CPSC began collecting death certificates of all fatalities involving an ATV, as coded under the Tenth Revision of the International Classification of Diseases (ICD-10). ICD-10 marks the first revision for which all ATV-related fatalities are grouped under a single code, thus facilitating more complete collection of these incidents by CPSC than was accomplished prior to 1999.

Prior to 1999, CPSC received death certificates only of fatalities occurring in places other than public roads and of fatalities occurring in public road locations that were erroneously reported as non-public-road locations. Because of this, the procedure for estimating ATV-related deaths had two parts. Because death certificates generally were not collected for public road fatalities, the count for these fatalities was the number of reports received, mostly in the Injury or Potential Injury Incident file

(IPII). For incidents occurring in other places, the capture-recapture approach was applied. The two parts (incidents occurring on public roads and incidents occurring in other places) were then combined for the annual estimate of deaths, as in the following formula:

$$estimate = \frac{(M_{NP} + 1)(N_{NP} + 1)}{n_{NP} + 1} - 1 + C_P \quad \text{Formula 2}$$

where

M_{NP} is the number of reports of non-public-road fatalities captured by purchase of death certificates from the states,

N_{NP} is the number of reports of non-public-road fatalities collected by other means,

n_{NP} is the number of reports of non-public-road fatalities captured by both death certificate purchase and by at least one other source,

and

C_P is the count of reports of ATV-related fatalities occurring on public roads from any source.

We believe estimates for years prior to 1999 to be under-estimates because those estimates used only the available count of public road fatalities, and did not account for missing reports. Since CPSC now receives death certificates for ATV incidents occurring anywhere, the capture-recapture approach has been utilized for the entire estimate of ATV-related deaths from 1999 forward. The resulting estimates of deaths after January 1, 1999 represent a better approximation of the number of deaths associated with ATVs.

A number of incidents reported to CPSC involve ATVs for which the number of wheels is unknown. Because some of these actually involve four-wheel ATVs, the unknowns are apportioned in the calculation of the estimated number of deaths associated with four-wheelers. This estimate was calculated by first dividing the reported number of deaths for four-wheel ATVs by the combined reported number of deaths for three- and four-wheel ATVs, then multiplying this quotient by the estimated number of deaths for all ATVs (three, four or unknown number of wheels). Thus, the estimate of deaths associated with four-wheel ATVs is given by

$$Estimate_{4W} = \frac{rep_{4W}}{rep_{3W+4W}} Est_{3W+4W+UW} \quad \text{Formula 3}$$

where

$Estimate_{4W}$ is the estimated number of fatalities associated with four-wheel ATVs,

rep_{4W} is the reported number of fatalities associated with four-wheel ATVs,

rep_{3W+4W} is the reported number of fatalities associated with three- and four-wheel ATVs,

and

$Est_{3W+4W+UW}$ is the estimated number of fatalities associated with ATVs with three, four or an unknown number of wheels.

Risk of death associated with four-wheel ATVs was calculated by dividing the annual estimate by the number of ATVs in use in a given year. Annual ATV population estimates are based on ATV sales and operability rates provided by industry, as well as on injury and exposure studies conducted by CPSC.¹⁶ Annual population estimates for 1994 and prior years were computed from a survival model derived from 1994 data. Annual population estimates for years 2001 and after were computed from a survival model derived from 2001 data. Population estimates for the intervening years come from a model that provides a smooth transition between the 1994 and the 2001 models. Because of the availability of more recent exposure and operability data, risk estimates were recalculated for 1995 forward. In order to ensure consistency with post 1994 operability rates, we also took the opportunity to recalculate risk estimates for 1987 to 1994 using unrounded denominators. Risk figures may differ from previously published figures because of these changes.

Because reliable operability rates data are not available for three-wheel ATVs, the risk of death is given in this report only for four-wheel ATVs.

Fatal incidents considered in-scope in this report include any unintentional incident involving an ATV, whether or not the ATV was in operation at the time of the incident. Because of the difficulties inherent in distinguishing between occupational and non-occupational use, occupational fatalities are included when reported to CPSC. For instance, a fatality that occurs when a victim is riding alongside a fence on a ranch for the purpose of checking it and then overturns his ATV while deviating from his usual work routine to take a "joy ride" up a nearby hill may be difficult to classify. In addition, ATVs are primarily recreational products, and the relative proportion of occupational fatalities in this report is small.

Injuries

All injury estimates in this report were derived from data collected through CPSC's National Electronic Injury Surveillance System, a probability sample of U.S. hospitals with 24-hour emergency rooms and more than six beds.¹⁷ Estimates have been adjusted due to revisions in the NEISS Coding Manual in 1985, as well as to account for NEISS sampling frame updates.¹⁸ Estimates for 1982 through 1985 were adjusted based on a review of NEISS comments to exclude dune buggies and identify ATVs classified as mini or trail bikes.

Injury estimates for 1985 and 1989 are based on injury surveys using NEISS cases. Injury estimates for other years have been adjusted by factors to account for out-of-scope (non-ATV) cases based on injury

¹⁶ See Levenson, M., 2001 ATV Operability Rate Analysis, memorandum. May 6, 2003. U.S. Consumer Product Safety Commission. Also see Levenson, M. *All-Terrain Vehicle 2001 Injury and Exposure Studies*. U.S. Consumer Product Safety Commission. January 2003.

¹⁷ Schroeder, T. and Ault, K. *The NEISS Sample (Design and Implementation) From 1979 to 1996*. U.S. Consumer Product Safety Commission. June 2001.

Schroeder, T. and Ault, K. *The NEISS Sample (Design and Implementation) From 1997 to the Present*. U.S. Consumer Product Safety Commission. June 2001.

¹⁸ Marker, D.; Waksberg, J.; and Braden, J. *NEISS Sample Update*. Westat, Inc. June 3, 1988.

Marker, D., and Lo, A. *Update of the NEISS Sampling Frame and Sample*. Westat, Inc. October 11, 1996.

studies in 1985, 1989, 1997 and 2001.¹⁹ An in-scope case was defined to be any non-occupational, unintentional case involving an ATV, whether or not the victim was operating the ATV at the time of the incident. (NEISS does not collect occupational injuries.) The adjustment factors were 0.93 for 1986 through 1988, 0.95 for 1990 through 1996, 0.903 for 1997 through 2000 (amended from 0.935) and 0.922 for 2001 and after.

NEISS includes incidents associated with ATVs for which the number of wheels is unknown. Because of this, the unknowns are apportioned in the calculation of the estimated injuries associated with four-wheelers. The four-wheel calculation was accomplished by the following formula:

$$Total\ Estimate_{4W} = \frac{Estimate_{4W}}{Estimate_{3W+4W}} (Estimate_{3W+4W+UW}) \quad Formula\ 4$$

where

Total Estimate_{4W} is the total estimated injuries associated with four-wheel ATVs with unknowns apportioned,

Estimate_{4W} is the estimated injuries associated with four-wheel ATVs not including unknowns,

Estimate_{3W+4W} is the combined estimated injuries associated with three- and four-wheel ATVs (not including unknowns),

Estimate_{3W+4W+UW} is the combined estimated injuries associated with ATVs with three, four or an unknown number of wheels.

Risk of injury in this report is defined as the estimated number of injuries divided by the number of vehicles in use, multiplied by 10,000. Annual ATV population estimates were the same as those used in the calculation of risk of death and are discussed elsewhere in this appendix.

¹⁹ Levenson, M., ATV Injury Adjustment Factors for 1997 and 2001, memorandum. September 12, 2003. U.S. Consumer Product Safety Commission.

Rodgers, G. and Zamula, W. Results of the ATV Exposure Study, memorandum. September 12, 1986. U.S. Consumer Product Safety Commission.

Rodgers, GB. *Descriptive Results of the 1989 All-Terrain Vehicle Exposure Survey*. U.S. Consumer Product Safety Commission. September 1990.

U.S. Consumer Product Safety Commission. *All-Terrain Vehicle Exposure, Injury, Death and Risk Studies*. April 1998.

Appendix C

Changes in Tables

In this report we made several changes to various tables. While most of the quantitative changes affected only tables 3 and 5, minor quantitative changes were also made in other tables. The methodology used is explained in detail in Appendix B. This appendix highlights the differences in the tables from previous reports.

Changes in Table 3

Table 3A below gives a comparison of the risk of death per 10,000 four-wheel ATVs in use as reported in column five of Table 3 in this report and the same column from last year's report (dated May 15, 2002).

Table 3A
Annual Risk of Death for Four-Wheel ATVs
As of December 31, 2002 and
As of December 31, 2001

Year	Risk of Death per 10,000 4-Wheel ATVs in Use		Difference
	As Reported in Last Year's Report (Column 5, Table 3)	As Reported in This Report (Column 5, Table 3)	
2001	Not reported	1.2	N/A
2000	1.5	1.2	-0.3
1999	1.5	1.4	-0.1
1998	0.9	0.8	-0.1
1997	1.0	0.9	-0.1

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

We recalculated the 1995 to 2000 risk estimates in order to ensure a smooth transition between the 1994 model used in the past and the 2001 model that was developed based on new exposure data. These models provide our estimates of ATVs in use for use in the calculation of the risk estimates (risk of death is the death estimate divided by the number of ATVs in use). The effect of this change was greater for the more recent years than for the years just after 1994. The greatest change in the risk estimates was for the year 2000, for which the risk estimate changed from 1.5 to 1.2. If deaths had remained constant, there would have been an even larger decrease in the risk estimates for recent years.

Although the results did not change, we recalculated the rates from 1987 to 1994 using the same number of decimal places in the calculations as we used in the post-1994 figures.

Changes in Table 4

Table 4A below gives a comparison of the annual estimates of ATV-related injuries (for ATVs with three, four or an unknown number of wheels) from Table 4 of this report and the estimates reported in last year's report (dated May 15, 2002). Shown are estimates for all ages, corresponding to column two of Table 4 in both reports; and estimates for children under 16, corresponding to column three of Table 4 in both reports.

Table 4A
Annual Estimates of ATV-related Hospital Emergency Room Treated Injuries
ATVs with 3, 4 or Unknown Number of Wheels
As Reported in 2001 and 2002 Annual Reports

Year	All Ages		Ages Under 16 Yrs	
	As Reported in Last Year's Report (Column 2, Table 4)	As Reported in This Report (Column 2, Table 4)	As Reported in Last Year's Report (Column 3, Table 4)	As Reported in This Report (Column 3, Table 4)
2001	111,700	110,100	34,800	34,300
2000	95,500	92,200	33,100	32,000
1999	85,100	82,000	28,700	27,700
1998	70,200	67,800	26,000	25,100
1997	54,700	52,800	21,300	20,600

Source: U.S. Consumer Product Safety Commission, Directorate for Epidemiology, Division of Hazard Analysis, National Electronic Injury Surveillance System.

It has been standard practice over the years that when new exposure and injury studies on ATVs are completed, a new adjustment factor is calculated. The adjustment factor is used to correct for the possibility that some of the NEISS cases used to calculate each annual estimate could be determined to be out of scope if each incident underwent investigation through telephone follow-ups.

Often the exposure and injury studies are not complete by the time an injury estimate is published in the annual report. Such was the case for the original 2001 injury estimate, which was first published in last year's report. Once the 2001 exposure and injury studies were complete last year, we developed a new adjustment factor (0.922) for NEISS ATV estimates. This factor is applied to annual injury estimates from 2001 forward.²⁰

The injury estimates for 1997 through 2000 have changed because we revised the adjustment factor for the years 1997 to 2000 (that is, the adjustment factor that was based on the 1997 injury and exposure studies) in order to ensure that it was calculated using the same in-scope criteria as the other adjustment factors. The revised adjustment factor is 0.903, amended from 0.935. The adjustment

²⁰ Levenson, M., ATV Injury Adjustment Factors for 1997 and 2001, memorandum. September 12, 2003. U.S. Consumer Product Safety Commission.

factors that have been applied to the years 1986-1988, 1990-1996 and 2001-2002 used slightly different criteria than the factor that had been applied to 1997-2000, so this recalculation brought the 1997-2000 factor in line with the others and results in greater comparability among the annual estimates. The effect of this change was small. For further details on adjustment factors, see Appendix B.

Changes in Table 5

Table 5A below gives a comparison of the annual estimates of four-wheel ATV-related injuries from Table 5 of this report and the estimates reported in last year's report (dated May 15, 2002). These estimates come from column two of Table 5 in both reports.

Table 5A
Estimated Number of Injuries
Associated with Four-Wheel ATVs
As Reported in 2001 and 2002 Annual Reports

Year	Injury Estimate	
	As Reported in Last Year's Report (Column 2, Table 5)	As Reported in This Report (Column 2, Table 5)
2001	99,600	98,200
2000	85,200	82,300
1999	71,400	68,900
1998	59,200	57,100
1997	41,100	39,700

Source: U.S. Consumer Product Safety Commission, Directorate for Epidemiology, Division of Hazard Analysis, National Electronic Injury Surveillance System.

The changes in this table result from application of the newly calculated injury adjustment factor from the 2001 ATV Exposure and Injury Studies (for the year 2001), and the refined 1997 adjustment factor for the years 1997-2000, as noted above in Table 4A.

Table 5B below gives a comparison of the annual estimates of the risk of injury for four-wheel ATVs from Table 5 of this report and the estimates reported in last year's report (dated May 15, 2002). These estimates come from column three of Table 5 in both reports.

Table 5B
Risk of Injury
Associated with Four-Wheel ATVs
As Reported in 2001 and 2002 Annual Reports

Year	Risk Estimate Per 10,000 4-Wheel ATVs in Use		Difference
	As Reported in Last Year's Report (Column 2, Table 5)	As Reported in This Report (Column 2, Table 5)	
2001	261.8	200.9	-60.9
2000	257.4	197.2	-60.2
1999	245.4	193.0	-52.4
1998	226.4	184.7	-41.7
1997	171.2	146.1	-25.1
1996	181.5	168.1	-13.4
1995	172.0	165.7	-6.3
1994	165.7	165.4	-0.3
1993	164.7	164.9	0.2
1992	175.2	175.1	-0.1

Source: U.S. Consumer Product Safety Commission, Directorate for Epidemiology, Division of Hazard Analysis, National Electronic Injury Surveillance System, and the Directorate for Economic Analysis.

As mentioned above, for 2001, we developed a new model for the number of ATVs in use based on 2001 exposure data. Since risk is defined as the injury estimate divided by the number of ATVs in use, the 2001 injury risk estimate changed as a result of the new model. The effect was a decrease of 60.9 injuries per 10,000 ATVs in use, though a small part of this change was also due to the new NEISS adjustment factor (0.922) for 2001.

As with the deaths, we recalculated the 1995 to 2000 injury risk estimates in order to ensure a smooth transition between the 1994 model and the 2001 model. The effect of this change was greater on the more recent years than on the years just after 1994. For example, the greatest change in the risk of injury was for 2001, which exhibited a decrease of 60.9 injuries per 10,000 ATVs. The smallest change was for 1995, which showed a decrease of 6.3 injuries per 10,000 ATVs. A small part of these changes was due to the revised NEISS adjustment factor (0.903, amended from 0.935) for 1997-2000.

Although the effect was quite small, we recalculated the injury risk estimates from 1987 to 1994 using the same number of decimal places in the calculations as we used in the post-1994 figures. The greatest change occurred in the 1994 risk estimate, which decreased by 0.3 injuries per 10,000 ATVs. Some years in this time period did not show any change.