



**All-Terrain Vehicle
Exposure, Injury, Death, and Risk Studies**



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OVERVIEW AND SUMMARY OF RESULTS

This overview describes and summarizes the results of four all-terrain vehicle (ATV) studies recently conducted by the U.S. Consumer Product Safety Commission: an exposure survey, an injury survey, a death study, and a risk analysis.

Background

The U.S. Consumer Product Safety Commission (CPSC) initiated a regulatory proceeding in the 1980s to evaluate the hazards associated with ATVs. Results of the staff evaluation were presented to the Commission in November 1986 and formed the basis for the consent decrees between the CPSC and ATV distributors that became effective in April 1988. The consent decrees included agreements by distributors not to sell three-wheel ATVs, to implement an extensive nationwide training program, and to develop a voluntary standard to make ATVs safer. The distributors also agreed, among other things, to put into effect age restrictions on the ATVs they sell and to provide extensive safety warnings to prospective buyers.

ATV-related emergency department (ED) injuries have declined from an estimated 106,000 in 1986 to about 54,500 in 1997. Similarly, estimated deaths have declined from about 350 in 1986 to an estimated 269 in 1996. However, about 40% of ATV-related injuries and over 35% of the deaths are to children under the age of 16, and this has remained relatively constant since 1985.

The consent decrees expire on April 28, 1998; the Commission will decide if further actions should be taken to address the ongoing hazards of ATV riding. To make an informed decision, the Commission sponsored two national surveys during 1997 -- an injury survey and an exposure survey. The injury survey provided detailed information about ATV-related injuries, and the characteristics and ATV use patterns of those who were injured. The exposure survey collected information about the characteristics and use patterns of the general population of ATV drivers.

These surveys are useful in several ways. First, they provide a description of current hazard and usage patterns, information that is critical in determining what further actions might be warranted. Second, the results can be compared to the results of the 1985 and 1989 injury and exposure surveys, to evaluate trends in use and hazard patterns. Finally, as in the 1985 and 1989 ATV studies, the characteristics and use patterns of drivers who are involved in injury incidents (as inferred from the injury survey) can be compared against those who are not (as inferred from the exposure survey) to determine the factors associated with risk.

The remainder of this overview includes a brief description of the injury and exposure studies and a summary of the findings. The technical reports and analyses are attached. Part I presents the results of the exposure survey, Part II presents the results of the injury survey, Part III provides a description of ATV-related deaths, and Part IV contains the ATV risk analysis.

Summary of Findings

Exposure Survey

The exposure survey collected information on the characteristics and use patterns of the general population of ATV users (see Part I). The survey excluded occupational exposure to ATVs outside of the household. The survey was a national telephone probability survey of U.S. households owning ATVs; it employed a single stage list-assisted random-digit-dialing (RDD) sample design.

The survey was conducted between September 15 and November 18, 1997. Eligible households included those owning one or more ATVs in which at least one of the ATVs had been used by a household member during the preceding 12 months. When eligible households were reached, one driver was selected randomly to be interviewed. Interviews were completed with 464 ATV drivers.

Based on the survey results, there are an estimated 5.85 million ATV drivers in about 2.4 million ATV-owning households. These households own about 3.91 million ATVs, but had operated only about 3.66 million during the 12 month time period before the survey.

Some of the exposure survey highlights follow:

- o 14% of the drivers are children under the age of 16 years (compared with about 23% in 1989);
- o almost two-thirds of drivers are males;
- o the mean level of driver experience was 9.6 years (about 4.5% of drivers had less than one year of experience);
- o 11% of drivers reported participating in an organized training program; another 12% said they had received some training by ATV dealers or sales people;
- o 23% of drivers reported never carrying passengers;
- o 35% of drivers reported always wearing a helmet; 32% reported never wearing a helmet;
- o 74% of drivers reported some nonrecreational use, including farming or ranching, household chores, and

- occupational or commercial tasks;
- o about 22% of the ATVs are the three-wheel models (this compares with about 54% in 1989);
 - o 26% of the four-wheel models are four-wheel drive vehicles, most with engines greater than 300 cc;
 - o 36% of the ATVs were reported to have engines with 300 cc or more (compared with about 10% in 1989);
 - o 51% of the ATVs had been purchased as used vehicles; 42% (82% of those purchased used) had been purchased from the previous owner, rather than from an ATV dealer.
 - o about half of the ATVs in use were originally sold after the 1988 consent decrees went into effect.

Injury Survey

The injury survey collected information on injuries treated in hospital emergency departments between May 1 and August 31, 1997, and reported through the CPSC's National Electronic Injury Surveillance System (NEISS) (see Part II). NEISS is a stratified national probability sample of hospitals in the U.S. that have at least six beds and provide 24-hour emergency service.

CPSC followed up on initial NEISS injury reports with telephone interviews with injured persons or their representatives (usually a parent or spouse) to collect detailed information on the characteristics of drivers, their ATV use patterns, the characteristics of the ATVs they drove, and injury scenarios.

The injury survey completed interviews with a total of 319 injury victims or their representatives. Of this total, 227 victims were drivers and 85 victims were passengers. These victims were involved in a total of 295 injury incidents; 23 included injuries to both the driver and at least one passenger.

Highlights from the injury study (including both 1997 emergency department injury estimates from NEISS and the injury survey) follow:

- o 47% of the injuries occurring during the study period involved children under the age of 16; this was comparable to the percentage in 1985 (46%);
- o Despite the large proportion of children injured, the number of injuries involving children under age 16 declined from about 42,700 in 1985 to about 21,300 in 1997;

- o 95% of injured children were driving ATVs larger than recommended for their age;
- o an estimated 54,500 ATV-related injuries were treated in hospital emergency departments during 1997;
- o the rate of ATV-related injury declined from 5.4 per hundred ATVs in use in 1985 to 2.5 in 1989 and to about 1.5 per hundred ATVs in 1997, an overall rate reduction of about 72%;
- o 25% of the injuries were to passengers;
- o 75% of the injuries occurred to males;
- o 22% of the injuries involved the head; most of the head injuries were concussions or internal organ (i.e., brain) injuries; at least 65% of the persons suffering head injuries were not wearing helmets;
- o the largest injury diagnosis categories were contusions and abrasions (27%), and fractures and dislocations (26%);
- o 37% of the injuries involved the arm region; 28% involved the leg region;
- o 13% of the emergency department injuries were hospital admitted (compared with 4% of all NEISS product-related injuries);
- o about 4% of drivers involved in injury incidents reported formal ATV training or training by a dealer or sales person;

Report on Deaths

The CPSC has closely monitored deaths involving ATVs since the mid-1980s and estimates that there have been over 3,200 ATV-related deaths since 1985. Part III provides a description of the characteristics of drivers and ATVs that have been involved in fatal injuries, and fatality trends since 1985. Some of the findings are:

- o over 35% of the deaths involved children under age 16;
- o 87% of the deaths since 1985 were to males;
- o 85% of those killed were drivers, 14% passengers (1% were drivers or passengers of other types of vehicles);
- o the percentage of three-wheel ATVs involved in deaths declined from 80% in 1985 to less than 20% in 1996;

- o incidents reported as collisions accounted for 56% of the deaths; overturns accounted for about 28% of all deaths.

Risk Analysis

The risk analysis was conducted as a *case-control study*. In this type of study, the factors associated with risk are determined by comparing the characteristics of those who are injured with those who are not injured. In the instance of the ATV risk analysis, the characteristics and use patterns of drivers involved in ATV-related injury incidents (drivers from the injury survey) were compared with those who were not involved in injury incidents (drivers from the exposure survey).

The statistical methodology used to make the comparison was a multiple-regression technique known as "logit analysis." This is a special type of regression analysis used to evaluate the relationship between a dichotomous outcome variable, such as whether or not an injury resulting in emergency department treatment has occurred, and a set of independent explanatory variables. This type of analysis is especially useful when, as in the case of ATVs, a large number of factors simultaneously affect the injury risk.

Although the overall risk of ATV-related injury has declined substantially since the 1980s (as indicated in the injury analysis), the factors associated with risk are consistent with those quantified in the earlier 1985 and 1989 risk analyses. As in the earlier analyses, risk patterns are related to the characteristics and use patterns of the drivers, and the types of ATVs that they drive. The results suggest that:

- o risk declines with age (the younger the driver the higher the risk);
- o risk for children is about 2.5 times the risk for drivers aged 16 to 34, and about 4.5 times the risk for drivers aged 35 to 54;
- o risk declines with driving experience;
- o risk declines with the percentage of time that ATVs are used in nonrecreational (as opposed to recreational) activities;
- o risk is higher for males than for females (all else equal, risk is about 3 times higher for males than for females);
- o risk is 2.5 to 3 times higher on three-wheel ATVs than on four-wheel ATVs.



PART I
Report on 1997 ATV Exposure Survey



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INTRODUCTION

This report presents the methodology and results of the U.S. Consumer Product Safety Commission's (CPSC) 1997 all-terrain vehicle (ATV) exposure survey. The survey was conducted to collect information about the general population of ATV drivers and the ATVs they use. In addition to providing up-to-date information on the characteristics and use patterns of ATV drivers, the survey results are compared to an earlier 1989 ATV exposure survey to evaluate changes in ATV use patterns over time (Rodgers, 1990a). Second, in a separate report, the exposure survey results are integrated with those of a parallel survey of ATV-related injuries reported through the CPSC's National Electronic Injury Surveillance System (NEISS) to determine and quantify the factors associated with the injury risk.

SURVEY METHODOLOGY

Sample Design

The survey was conducted for the CPSC by Abt Associates (Abt), a social science research and survey firm located in Cambridge, MA. Abt designed the survey to provide a national probability sample of about 500 households owning ATVs and located in the 48 contiguous states and the District of Columbia (Stoner and Srinath, 1998).

The ATV survey employed a single stage list-assisted random-digit-dialing (RDD) sample design. The list-assisted RDD sample was selected using the latest version of the Marketing Systems Group's (MSG) proprietary list-assisted RDD system, called the GENESYS Sampling System (Kulp, 1995; MSG, 1997). This system provides a program for selecting the equivalent of a simple random sample of ten-digit telephone numbers. It uses the AT&T master tape of combinations of area codes and central office system codes (i.e., telephone exchanges) as the basis for constructing a sampling frame of banks of 100 consecutive telephone numbers.

Following the creation of these 100-number banks, MSG used the most recent release of the Donnelly Marketing Information Services (DMIS) data file of directory-listed, residential telephone numbers to delete from the sampling frame banks of 100 consecutive telephone numbers that have a low probability of containing actual working residential numbers. The MSG list-assisted RDD system also screened out a portion of the nonworking phone numbers and business numbers.

The population of telephone exchanges was stratified by census region (i.e., Northeast, Midwest, South, West) and, within each census region, by the population size of metropolitan and nonmetropolitan areas (i.e., less than 100,000, 100,000-499,999, 500,000-1,999,999, 2,000,000 and over) in which the exchanges were located. The regional stratification ensured a representative sample from each of the four census regions.

Additionally, given the low incidence of household ownership of ATVs (estimated at less than three percent), the cross-classification of exchanges by region and population size allowed Abt to exploit existing information on the differential incidence of ATV ownership by region and population density to reduce the number of households that needed to be screened. The total number of screenings needed to complete 500 interviews was allocated to the four census regions, and to the population size groups within each region, using Neyman allocation to minimize the variance of the estimated overall eligibility rate (Cochran, 1977). For this allocation, rough estimates of eligibility rates in each stratum derived from earlier studies were used.

The initial sample of telephone numbers ordered from GENESYS was segmented into replicates of approximately equal size. Replicates can be viewed as providing a miniature national sample of residential numbers. After the numbers in the first replicate were called, Abt reallocated the total remaining telephone numbers to strata based on the actual eligibility rates determined in the first phase of interviewing. Abt also ordered from GENESYS an additional sample of telephone numbers in some of the strata with high-eligibility rates to achieve the desired number of interviews.

Questionnaire Development and Interviewing Procedures

The survey questionnaire was developed by CPSC staff in consultation with Abt, and was designed to collect information on the characteristics and use patterns of ATV drivers and on the types of ATVs they use. The CPSC solicited comments on the survey methodology and the questionnaire in a public notice of the proposed survey (CPSC, 1997). Comments received from various industry and consumer groups resulted in several changes to the questionnaire. Several minor revisions were also made following a pretest conducted by Abt on July 29-30, 1997 (Abt, 1997).

The survey began on September 15, 1997, with the training of the interviewers, and was completed on 18 November. Eligible households included those owning one or more ATVs, with at least one of the ATVs having been used by a household member during the preceding 12 month time period. The initial respondent in each household was asked how many ATVs were owned and how many drivers had used the ATVs during the last year. If there was more than one driver, the driver who had the most recent birthday was selected to be interviewed. If the selected driver was a child under age 16, a parent or guardian was asked to respond on the child's behalf. Screenings and data collection were done via computer-assisted telephone interviews (CATI).

Information was collected about the respondent's use of ATVs and about the characteristics of up to four ATVs owned by the household. The results of the pretest suggested that a relatively large proportion of respondents might not recall the engine size of the ATV (or ATVs) owned by the household. Because

of the importance of this variable, respondents who did not know an ATV's engine size were asked to try to obtain the information. The interviewer suggested asking someone else in the household, or looking up the engine size. Of the 62 respondents who originally did not know the engine size, 42 agreed to the callback. The callbacks resulted in the retrieval of engine size for 48 ATVs.

Survey Response

A total of 36,232 telephone numbers were called. Up to eight attempts were made to obtain an answered call for each sampled telephone number. The disposition of the telephone calls is described in Table 1.

The overall response rate is the product of the screening response rate (i.e., the proportion of numbers successfully screened to determine household eligibility) and the interview response rate (i.e., the proportion of eligible respondents who completed interviews). The screening response rate can be calculated in two ways. The *minimum* screening response rate, defined as the number of telephone numbers successfully screened (rows 1 and 2 of Table 1) divided by the total of the successfully screened plus unresolved numbers (rows 1, 2, and 3), was 76.6%. This is a *minimum* response rate because some unknown proportion of the unresolved numbers described at row 3 are likely to have been nonhousehold (i.e., business) numbers. Alternatively, if we assume that the proportion of household numbers in row 3 is equal to the proportion of all resolved numbers that were household numbers (the sum of rows 1 and 2 divided by the sum of rows 1, 2, and 4b), then the screener response rate would have been about 80.4%.

The interview response rate, defined as the 464 completed interviews divided by the 561 numbers screened-in, was 82.7%. Thus, the overall *minimum* response rate, defined as the product of the minimum screening response rate (76.6%) and the interview response rate (82.7%), was 63.3%. Assuming an 80.4% screener response rate, the overall response rate increases to 66.5%.

Weighting

After the survey data were collected the sample was weighted to make population based estimates of households, drivers, and ATVs. As a first step, each of the 464 households sampled received a weight relating to the household. This weight combined a base weight reflecting the probability of selection of a household from each of the strata,¹ an adjustment for households with multiple telephone numbers, and an adjustment for unit nonresponse. A final adjustment for the household weight

¹A stratum was defined as the cross-classification of the four census regions and the four population-size groups, resulting in 16 independent strata.

brought the total weight in each stratum into agreement with the known number of households in the stratum.

To produce estimates relating to individuals or ATV drivers, the household weight was adjusted in a two step procedure. First, since only one driver per household was interviewed, the household weight was multiplied by the number of drivers in the household. This procedure yielded a driver-population weight that reflects the total number of ATV drivers in the U.S. (Kish, 1965).

The second step took advantage of further driver information collected in the survey. While the interview focused on the characteristics of the 464 respondents, it also collected information on the age and gender of all ATV drivers in the respondents' households. This enabled further refinement of the weighting process by accounting for the apparent over- or underrepresentation of some of the age and gender categories in the sample of 464 respondents. To do this, the data on the age and gender of all 1,225 household ATV drivers were distributed into 16 age and gender categories, based on the household weights. The individual weight that applied to each of the 464 respondents was then adjusted by a factor equal to the ratio of the estimated number in each cell of the larger sample to the estimated number based on the smaller respondent sample.

Survey Limitations

The survey results are subject to some nonsampling errors. The survey excluded the approximately 6% of U.S. households that have no telephone. Alaska and Hawaii were excluded from the survey. Inferences from the survey are therefore limited to the 48 contiguous states and the District of Columbia. Additionally, some households with telephones may have been omitted from the sampling frame due the elimination of zero banks. However, because the number of such households is small, the resulting bias in the estimates, if any, is expected to be small.

Statistical Analysis

Because of the complex survey design, SUDAAN software was used to calculate the reported standard errors (Shah, Barnwell, and Bieler, 1997). Variance estimation was based on the Taylor linearization methods.

SURVEY RESULTS

Drivers and Ownership of ATVs

Based on the survey results there are an estimated 5.85 (se=0.51) million ATV drivers in about 2.39 (se=0.14) million

ATV-owning households.² While these households own an estimated 3.91 (se=0.32) million ATVs, they had operated only about 3.66 (se=0.30) million during 12 month time period before the survey.

Table 2 summarizes household data on drivers and ATV ownership, and calls attention to the large proportion of ATV-owning households with multiple drivers and ATVs. Almost 70% of the owning households have more than one driver, and almost 40% have more than one ATV. The average ATV-owning household has 2.44 (se=0.18) drivers and owns 1.63 (se=0.10) ATVs, or about 1.50 drivers per ATV. Since only about 94% of the vehicles had been used in the 12 months prior to the survey, there were about 1.53 ATVs in use per ATV-owning household, and about 1.59 drivers per ATV in use.

At the national level, there were an additional 2.78 (se=1.16) million drivers from outside of the owning households. The national estimate is based on information from survey respondents in 36.4% (se=5.3) of the owning households. They reported that from 1 to 30 drivers from outside the household used the household ATV during the month before the survey interview.³ For nearly three out of every four households reporting outside users, nonowners were estimated to account for no more than 15% of total household ATV use.

Household Demographics

ATV owning households differ somewhat from the general population of households. (Table 3). The majority (59.5%) of ATV-owning households is located in low-density areas, compared with 22.9% of all U.S. households. Regional variations appear to correlate with the population density results. They show that the northeastern states are underrepresented among ATV-owning households, and the midwest and south are overrepresented.

Owning-households tend to have higher education levels and incomes than the US norm. Over 35% of owning households have at least one college graduate, compared with about 23.6% of all US households. Additionally, while the median income in US households is about \$34,000, the median income in ATV households is over \$45,000.

Characteristics of ATV Drivers

Selected characteristics of the rider population are shown in Table 4. While driver age varies widely, from 4 to 85 years,

²The standard error of the estimate (se), shown in parentheses here and subsequently in this report, can be used to construct confidence intervals (CI) around the statistic. For example, for any statistic " β " the 95% CI is $\beta \pm (1.96 \times se)$.

³Of households reporting outside users during the previous month, only 22.5% reported more than three.

more than three of every four drivers (77.7%) are between the ages of 16 and 54 years. About 14.3% (se=3.7) are under age 16,⁴ and only 7.8% (se=1.80) are over age 54. Almost two-thirds of drivers (65.7%, se=4.72) are male. Most drivers have been using ATVs for a long time. The mean experience level (i.e., years that the drivers have been operating ATVs) is about 9.6 (se=0.6) years: only 17.0% (se=3.3) have less than three years of driving experience.

While the age distribution of males and females is about the same, males tend to be somewhat more experienced (10.4 years, se=0.8) than females (8.2 years, se=0.8). Not surprisingly, experience increases with age. The mean years of driving experience increases from 4.1 years (se=1.0) for children under age 16, to 8.5 years (se=0.7) for 16 to 24 year olds, to 11.4 years (se=0.8) for drivers over age 24.

Driver Use Patterns

ATV Usage

The survey collected a substantial amount of information on driver practices, including the frequency of vehicle use, riding surfaces, and specific riding activities. The estimated amount of time spent riding an ATV, measured in hours per month or year, was based on responses to a series of questions intended to determine, for each rider, the number of months of ATV use during the previous 12 month time span, and the number of hours of driving an ATV in a average month of usage. According to the Table 5 results, drivers use ATVs an average of about 7.9 (se=0.53) months per year and ride an average of about 26.9 (se=3.0) hours per month.

As Table 6 shows, the estimated mean and median annual usage is about 252 (se=35) hours and 111 (se=18) hours, respectively. The fact that the mean estimate is substantially higher than the median indicates that annual usage is positively skewed; that is, some drivers reported substantially more hours of use than most, thereby increasing the mean value relative to the median.⁵ Although approximate, these riding times imply aggregate annual ATV usage on the order of 0.6-1.5 billion hours annually. Estimated driving times vary substantially from individual to individual. About 31% (se=4.0) of drivers report usage of under

⁴Drivers outside of ATV-owning households appear to be somewhat younger than drivers from households owning ATVs. Of the estimated 2.78 million drivers from outside of the owning households, an estimated 0.71 (se=0.16) million are under age 16 years.

⁵If the observations² for which the estimated riding time is greater than 1,000 hours per year are excluded (n=23) as outliers, the mean annual riding time decreases to 170.9 hours (se=21.2) per year.

50 hours annually. At the other extreme, almost 16.8% (se=3.4) reported 400 hours or more of annual driving.

Driving times appear to vary somewhat by driver age, with usage decreasing for older drivers. However, the differences are not statistically significant. Similarly, while the estimated driving time for males (266.1 hours, se=49.1) was somewhat higher than for females (229.6 hours, se=47.9), the difference was not statistically significant.

Driving times do not vary meaningfully for three- and four-wheel ATVs, but are directly (and significantly) related to engine size. The survey results show a mean annual riding time of about 101 hours (se=24.8) for ATVs with engines no larger than 125 cc, to 241 hours (se=48.5) for 160 to 250 cc models, and 328 (se=72.0) for models over 250 cc.

Rider Use Patterns

Table 7 provides information on selected driver practices and riding surfaces. The survey asked respondents to estimate how often they engaged in various driving practices (e.g., doing various maneuvers, racing, and frequency of use of selected driving terrains and roadways). Responses were on a four-point scale ranging from "never" to "frequently." About 25.3% (se=5.2) of drivers frequently do difficult maneuvers, such as "wheelies" or "jumping." Most of these drivers are males (84.1%, se=8.9) and most (67.3%, se=12.4) are in the 16 to 24 year old age group. More than half (56.8%) frequently drive on terrain that is especially hilly, uneven, or otherwise difficult. Only 6.7% (se=2.3) frequently or sometimes compete in organized racing, a small proportion compared with the 25.2% (se=5.0) who frequently or sometimes race informally.

About 53.7% (se=4.6) carry passengers frequently or sometimes, and another 23.3% (se=4.0) also do so on rare occasions. The mean reported carrying time, for the 77.0% who acknowledge carrying passengers at all, is about 2.45 (se=0.30) hours for every 10 hours of riding time. Additionally, almost half of all drivers (47.4%, se=4.6) frequently drive alone (rather than with other drivers on their ATVs), another practice that is generally warned against.

Common riding terrains include forests, woods, fields, pastures or ranges, and sand dunes. About 9.2% (se=2.3) of drivers frequently drive on paved roads, a practice strongly warned against; another 17.1% (se=3.6) sometimes drive on paved roads. Additionally, most riding takes place on private lands: 89.3% (se=5.5) of drivers ride on private lands at least some of the time and 27.4% (se=3.9) ride on private lands exclusively.

Safety Equipment

According to the survey, 51.8% (se=4.5) of drivers frequently wear helmets and another 15.8% (se=3.0) do so

sometimes or rarely. (Table 8) Because of the importance of helmets in reducing ATV-related injuries and deaths (Rodgers, 1990b), all respondents who wear helmets at least "rarely" were asked to estimate the number of hours of helmet use for every 10 hours of riding time. As shown in Table 8, helmet use is high at both ends of the distribution: of helmet users, 29.5% wear them for 3 or fewer of every 10 hours of riding time, and 63.2% wear them for 8 or more of every 10 hours. Among helmet users, 52.4% wear them all the time. Among all ATV drivers, 35.5% (se=4.6) wear helmets all of the time.

Helmet use is significantly lower for males, is inversely related to driver experience, and has a nonlinear relationship with driver age. While 50.4% (se=7.7) of women always wear helmets, only 27.9% (se=4.4) of men always do so. With respect to experience, the percentage of drivers who always wear helmets is 48.1% (se=9.2) for those with less than three years of experience, 38.9% (se=9.0) for those with 3 to 9 years of experience, and 30.0% (se=5.8) for those with more than 9 years of experience. With respect to age, 65.6% (se=12.6) of children under age 16 always use helmets, 19.4% (se=7.2) of 16 to 24 year olds always use helmets, and 35.7% (se=4.3) of drivers over age 24 always use helmets.

The results regarding the use of other safety equipment and clothing show that long heavy pants and ankle length boots are frequently used by drivers (78.3% and 53.4%, respectively). Other preferred articles of clothing, worn at least sometimes, are long sleeve shirts and gloves. However, just under half of drivers (46.4%) never wear goggles.

Nonrecreational ATV Use

Almost three of every four drivers (73.7%, se=4.0) use ATVs for at least one nonrecreational activity; 50.8% use ATVs for farming or ranching, 63.0% use them for household chores such as yard and garden work, and 7.7% use them for occupational or commercial tasks. (Table 9) Table 9 provides a frequency distribution of hours of nonrecreational use. Of those who use their ATV for nonrecreational activities, about half (49.6%) use their ATVs nonrecreationally 3 or fewer hours out of every 10 hours of total use, and about 24.2% use their ATVs nonrecreationally 8 or more hours out of every 10.

Drivers in the high nonrecreational use bands (80% or more of the time) may be characterized as those who use their ATVs exclusively or almost exclusively for nonrecreational activities. Over 83% of these users report farming or ranching activity. Relative to other drivers, high use nonrecreational drivers tend to be older (36 years, se=3.5, vs. 29.5 years, se=1.4) and more experienced (11.6 years, se=1.4 vs. 9.1 years, se=0.6), but they ride less frequently (184 hours per year, se=28.6 vs. 267 hours per year, se=43.6). Interestingly, 35.5% (se=4.6) of all drivers use helmets all of the time, compared with only 19.3% (se=8.6) of

high nonrecreational use drivers. High nonrecreational use drivers also wear helmets less frequently (2.8 hours out of every 10, se=0.8) than other drivers (5.2 hours, se=0.5).

ATV Driver Training

Table 10 shows how drivers learned to operate ATVs.⁶ Nearly two-thirds of respondents (66.9%, se=4.5) said they taught themselves to ride, and half (50.5%, se=5.4) received training from friends or relatives. About 11% said they took an organized training program either arranged through a dealer as part of the ATV purchase (9.5%, se=5.5) or by some other means (1.6%). Additionally, 11.7% (se=5.4) said they received some training from the dealer or salesperson.

Under the requirements of the 1988 consent decrees, distributors who are members of the Specialty Vehicle Institute of America (SVIA) offer buyers of new ATVs "free training" as part of the purchase price of a new vehicle.⁷ As added inducement, buyers who take the training get a \$50 cash payment, a \$100 U.S. Savings Bond, or (at the discretion of the distributors) a merchandise certificate in an amount no less than \$50. Polaris Inc., which negotiated a separate consent decree, provides training at the point-of-sale. Buyers of the Polaris ATVs must take the point-of-sale training before the ATV warranty can go into effect. Trainings required by the Consent Decrees began in 1988.

A more detailed evaluation of the training responses (which accounts for factors such as the manufacturer, model year, number of wheels, and whether the ATV was purchased new or used), suggests that about 7.3% (se=5.5) of the drivers (about 425,000) may have taken the training program offered by members of the SVIA.⁸ Additionally, the Polaris agreement may have led to training of about 3.6% (se=1.2), or about 210,000 drivers.

Nearly one-third of the respondents (32.6%) drove ATV models subject to the training provisions of the consent decrees (i.e.,

⁶Multiple responses were permitted. About 31.7% of drivers used more than one method.

⁷The current members of the SVIA include Honda, Kawasaki, Suzuki, and Yamaha, and Arctic Cat (which recently entered the ATV market). Under the SVIA program, the training is also offered to the members of the buyer's immediate family.

⁸As suggested by the relatively large standard error, the estimated number of drivers who took the SVIA training is not precise. However, industry reports that about 323,000 ATV buyers and family members had participated in the SVIA training program as of December 1997, a figure that is well within the 95% confidence level for SVIA training (SVIA, 1998).

were newly purchased 1989 or later model year ATVs), but had not participated in the SVIA or Polaris training programs. Most of these respondents (62.1%, se=6.1) recalled that the dealer had offered free training at the time of purchase. Of those who did recall the offer, the most common explanation for not taking the training was that they already knew how to ride (32.1%). Others reasons cited for not taking the training was the inconvenience of location (11.1%) or time (21.8%), or the fact that a friend or relative had provided training (7.6%).

Characteristics of ATVs in Use

This section summarizes survey responses concerning an estimated 3.75 million ATVs owned by households. Because the survey collected information on no more than four ATVs per household, these 3.75 million ATVs represent about 95.9% of all ATVs (3.91 million, se=0.32) owned by households.⁹ Table 11 shows the breakdown of selected vehicle characteristics for three- and four-wheel ATVs.

Wheels and Engine Size

About 21.5% (se=4.2) of the ATVs have three wheels, 77.1% (se=4.2%) have four wheels, and 1.4% (se=0.5) have an unknown number of wheels. Although three-wheel ATVs have not been sold since 1988, they still account for one of every five ATVs owned. (Table 11) About 26.1% (se=5.2) of the ATVs with four wheels have four-wheel drive.

Engine sizes range from about 50 to over 400 cubic centimeters of engine displacement (ccs). Engine size correlates highly with number of wheels. The great majority of three-wheel ATVs (84.4%, se=4.8) have engine sizes of 250 cc or less. In contrast, most four-wheel models (69.4%, se=6.7) have engines with 225 cc or more.¹⁰

Males and females tend to drive ATVs with the same range of engine sizes. However, males are more likely than females to drive the older three-wheel ATVs (19.0%, se=3.8 vs. 8.6%, se=3.4). On the other hand, while the number of wheels on the primary ATV driven is not generally related to the driver's age, engine size tends to rise somewhat with age. For example, the mean engine size increases from 231 ccs (se=13.6) for children under age 16, to 257 cc (se=36.8) for 16 to 24 year olds, and to 273 cc (se=9.7) for drivers over age 24.

While engine size tends to increase with age, few children

⁹An estimated 3.54 million of the 3.75 million ATVs reported upon (94.4%) had been used during the previous 12 months.

¹⁰The mean engine size for three-wheel models is about 198 cc (se=11.2); the mean for four-wheel ATVs is about 266 cc (se=19.5).

ride the ATVs designed for their use. ATVs with engines greater than 90cc are intended for use by adults and are labeled as not intended for use by children under the age of 16. However, almost all children under the age of 16 (95.9%, se=2.02) ride the ATVs intended for adults.

Miscellaneous ATV Characteristics

The model year for almost half of the ATVs (48.6%, se=3.25) was reported as 1990 or later.¹¹ Additionally, almost half (45.9%, se=3.6) had been owned (by the current owner) for under three years. The absence of three-wheel models of recent vintage reflects the impact of the three-wheel ATV stop-sale in 1988.

Just over half (50.6%, se=3.1) of all ATVs were purchased in the secondary market for used vehicles. Additionally, most of the used ATVs (83.9%, se=4.3) were purchased from the previous owner rather than a franchised dealer (15.9%, se=4.3). This means that 42.4% (se=3.3) of all the ATVs in U.S. households were purchased outside of the franchised ATV dealer system.

Owners modified about 58.7% (se=4.7) of the ATVs since purchase. Over one-third (35.6%, se=5.2) have different tires or wheels, 17.1% (se=3.9) have new special exhaust systems, 6.8% (se=2.1) have modified engines, and about 7.6% (se=1.7) have a modified suspension. The proportion of modified three-wheel models did not differ significantly from four-wheel models (64.0% vs 57.7%, respectively).

Warning Labels on ATVs

The survey obtained information on the presence and consumer awareness of ATV warning labels required by the consent decrees. Table 12 shows the results for ATVs of model year 1989 or later vehicles that should have the warning labels.

About 80.9% of the drivers reported the presence of labels on their primary ATV. The most frequently recalled warning labels were (1) against carrying passengers (80.6%), and (2) against riding without a helmet (77.3%). Just over half, 51.2%, recalled a warning against using alcohol or drugs when riding, and 64.4%, who had adult sized ATVs (i.e., ATVs with engines of 90 cc or more), recalled a warning against the use of adult-sized ATVs by children. Less than half of the respondents recalled warnings against driving on public roads (47.4%), driving on paved surfaces (44.9%), or stunt riding (41.7%). The least frequently recalled warning was for riding too fast (32.2%).

¹¹ATVs of a particular model year are introduced into the market during the late summer or fall of the preceding year. Thus, for example, some 1990 model year ATVs would have been purchased in 1989.

Further analysis of responses to the warning label questions suggests that a large proportion of drivers who are aware of specific warnings disregard them. About 65.1% of drivers who frequently carry passengers and 75.9% of those who sometimes carry passengers are aware of the label warning against the practice. Similarly, 40.5% of the drivers who frequently ride on paved roads and 62.9% of those who sometimes do are aware of the label warning against the practice.

DISCUSSION

The results of the exposure survey provide a detailed description of the characteristics and use patterns of ATV drivers and the types of ATVs they use. Additionally, the survey methodology, based on interviews with a national probability sample of drivers from ATV-owning households, allows us to quantify the population of users and ATVs. Based on the survey results, there are an estimated 2.39 million U.S. households that own approximately 3.91 million ATVs. When the survey findings are viewed in conjunction with the results of an earlier ATV exposure survey conducted by the CPSC in 1989 (Rodgers, 1990a), when there were an estimated 2.75 million ATVs in use, the results also reveal some trends in ATV usage patterns.

Drivers and Use Patterns

As shown in Table 13, the profile of drivers has changed somewhat since the 1989 survey. While male drivers still comprise about two-thirds of all drivers, a smaller proportion of drivers are under age 16 (about 14.3% in 1997 vs. 23.2% in 1989). One possible explanation of the declining proportion of ATVs used by children is that the consent decrees, which do not allow sales to (or for the use of) children under age 16, and the concomitant labels and warnings have been helpful in reducing children's usage of adult-sized ATVs.

Alternatively, this finding could reflect some degree of underreporting of children respondents. Some parents may, for example, have been reluctant to acknowledge a child's usage of an adult-sized model, a practice warned against in the warning labels. However, there is no reason to believe that such underreporting represents a substantial bias in the driver estimates. Such a bias, if it exists at all, would also have been present in the 1989 survey, which was conducted about 18 months after the consent decrees were signed and at a time in which ATVs and children's usage of ATVs had received a substantial amount of negative publicity. Moreover, as described in the survey methodology, information on the age and gender of each non-respondent was collected at the end of the survey in order to weight for the possible under- or over-reporting of respondents in the various age-gender categories.

While the available evidence suggests that the proportion of drivers who are children has decreased in recent years, few drivers under the age of 16 actually drive the ATVs intended for

their use. The great majority (95.9%) drive ATVs with engines of more than 90cc, ATVs which are intended for use by adults and are currently sold with labels explicitly warning against their use by children.

The survey results also suggest an increase in the nonrecreational use of ATVs, with activities ranging from yard and garden work to farming, ranching, and commercial activities. The proportion of drivers reporting nonrecreational use of their ATV increased from about 52.5% in 1989 to about 73.7% in 1997, with almost half saying that the ATVs were used in farming or ranching activities. The proportion of aggregate riding time that ATVs were used in nonrecreational applications also increased from just over one-quarter of total ATV use in 1989 to almost one-third of the total in 1997.

ATVs-In-Use

Most (93.6%) of the 3.91 million ATVs owned in 1997 had been used during the previous year. A disproportionate share of unused vehicles (about 42%-50%) were the older three-wheel models. Nevertheless, just over one-fifth of the ATVs in "recent" use are three-wheel models, which have not been sold in the new product market since the consent decrees became effective in 1988. Moreover, when compared to sales data, the results suggest that roughly one-third of the three-wheel ATVs produced and sold through 1987 remain in use.

The large number of three-wheel ATVs still in use attests to their durability as well as their popularity with some drivers. Nonetheless, based upon the vehicle characteristics upon which information was collected in the survey, the wheel and engine characteristics of all ATVs in use today are substantially different than in 1989. From 1989 through 1997, the share of four-wheel models increased from about 45.6% of all ATVs in use to almost 80%. Four-wheel drive models, which currently account for about 26% of all four-wheel ATVs in use, were just becoming popular in 1989 and accounted for a relatively small share of ATVs at that time. Additionally, the mean engine size of ATVs in use increased by roughly 30%, from an average of about 190 cubic centimeters of displacement (ccs) to 250 ccs.

While the market share of four-wheel ATV sales had been rising throughout the 1980s, the large share of four-wheel ATVs now in use is also related to the 1988 consent decree provisions stopping the sale of new three-wheel ATVs. The explanation for the increasing size of engines is less clear, but is related to an upward trend in size of engines for both three- and four-wheel ATVs that began in the early 1980s (Rodgers, 1996). The increase may have also been affected, to some extent, by the increasing sales of four-wheel-drive vehicles (which tend to have large engines) for nonrecreational applications.

The survey results also demonstrate the importance and size

of the secondary market for used ATVs. About half of the ATVs in use were purchased as used vehicles. Moreover, over 80% of the ATVs purchased as used vehicles were purchased from individual owners, as opposed to franchised ATV dealers. Thus, while point-of-sale information and warnings (such as those required by the consent decrees) reach the majority of ATV buyers, they may not reach a significant minority.

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TABLE 1
FINAL DISPOSITION OF SAMPLED TELEPHONE NUMBERS

Disposition	Total	Number
1. Total Screened-in	561	
a. Completed interview		464
b. Screened-in household, unable to complete interview with designated respondent		38
c. Screened-in household, refused interview		59
2. Total Screened-out	17,318	
3. Total Unresolved Numbers	5,451	
a. Busy, no answer, answering machine, general call back after 8 attempts		3,647
b. Hung up during introduction		33
c. Refused before screening interview completed		1,374
d. Language barrier		392
e. Other		5
4. Total Non-Household Numbers	12,902	
a. Non-working numbers		8,439
b. Non-household working numbers		4,463

TABLE 2
DRIVERS AND ATVS PER HOUSEHOLD

Drivers (per household)	Households (thousands)	Percent
1	764.7	32.0
2	723.7	30.2
3	412.8	17.3
4	230.4	9.6
5	124.0	5.2
6 or more	137.1	5.7
Total	2,392.7	100.0
Mean Number of Drivers: 2.44		
Standard Error: 0.18		
ATVs Owned (per household)	Households (thousands)	Percent
1	1,490.9	62.3
2	556.9	23.3
3	230.8	9.6
4	23.8	1.0
5 or more	90.3	3.7
Total	2,392.7	100.0
Mean Number of ATVs Owned: 1.63		
Standard Error: 0.10		
ATVs Used During Preceding Year (per household)	Households (thousands)	Percent
1	1,676.6	70.1
2	386.4	16.2
3	229.5	9.6
4	22.5	0.9
5	77.7	3.2
Total	2,392.7	100.0
Mean Number of ATVs Used: 1.53		
Standard Error: 0.10		

* Totals may not add up to 100.0% due to rounding.

TABLE 3
HOUSEHOLD DEMOGRAPHICS

	Survey Results (%)	1996 Census Data (%)
Geographic Region		
Northeast	5.3	19.5
Midwest	28.6	23.7
South	43.3	35.4
West	22.8	21.1
Population Density		
< 100,000	59.5	22.9
100,000-499,999	14.2	17.4
500,000-1,999,999	15.6	} 59.7
2,000,000 or more	10.7	
Highest Level of Education		
High school or less	28.6	51.9
Trade or Vocational School	4.7	--
Some College	30.0	24.5
College Graduate	27.1	15.8
Attended Graduate School	8.2	7.8**
Unknown	1.4	0
Total Household Income		
< \$15,000	5.1	20.5
\$15,000-\$29,999	14.8	22.5
\$30,000-\$44,999	17.6	18.0
\$45,000-\$59,999	19.3	13.4
≥ \$60,000	26.0	25.7
Unknown	17.2	--

* Totals may not add up to 100.0% due to rounding.

** Advanced degree obtained

TABLE 4
PROFILE OF ATV DRIVERS

Characteristics	Drivers (%)
Age (years)	
≤ 15	14.3
16-17	8.2
18-24	18.7
25-34	22.2
35-44	17.1
45-54	11.5
≥ 55	7.8
Unknown	0.3
Total	100.1
Gender	
Male	65.7
Female	34.1
Unknown	0.3
Total	100.1
Driving Experience (years)	
< 1	4.5
1 to < 3	12.5
3 to < 6	21.0
6 to < 9	9.1
9 to < 12	16.7
13 to < 15	12.0
15 or more	22.7
Unknown	1.6
Total	100.1
Mean Experience	9.6 years
Standard Error	0.6

* Totals may not add up to 100.0% due to rounding.

TABLE 5
MONTHLY ATV USAGE ESTIMATES

Driving Time in an Average Month of Use (hours/month)	Drivers (%)
< 5	8.9
5-9	13.9
10-24	33.8
25-49	14.8
≥ 50	16.7
Unknown	2.0
Total	100.1
Mean	26.9
Std Error	3.0
Median	14.3
Std Error	1.74
Age Group (years)	Mean Monthly Driving Time (hours/month)
< 15	24.8
16-24	43.1
25-34	24.6
35-44	18.5
45-54	17.2
≥ 55	14.8
Gender	Mean Monthly Riding Time (hours/year)
Male	28.2
Female	24.7
Months of ATV Use During Preceding Year	Drivers (%)
≤ 1	7.0
2-4	23.2
5-7	14.7
8-10	7.1
11-12	46.2
Unknown	1.8
Total	100.0
Mean	7.9
Std Error	0.53

* Totals may not add up to 100.0% due to rounding.

TABLE 6
ANNUAL ATV USAGE ESTIMATES

Annual Driving Time (Hours/Year)	Drivers (%)
< 49	31.0
50-99	13.1
100-199	23.2
200-399	10.8
400-599	4.3
> 600	12.5
Unknown	5.0
Total	99.9
Mean	252.3 hours
Std Error	35.3
Median	110.9 hours
Std Error	17.5

Age Group (years)	Mean Annual Driving Time (hours/year)
< 15 years	294.1
16-24 years	351.1
25-34 years	254.2
35-44 years	184.2
45-54 years	140.9
≥ 55	150.0

Gender	Mean Annual Riding Time (hours/year)
Male	266.1
Female	229.6

* Totals may not add up to 100.0% due to rounding.

TABLE 7
DRIVER PRACTICES AND RIDING SURFACES

Driving Practices	Frequency				
	Frequently (%)	Sometimes (%)	Rarely (%)	Never (%)	Unknown (%)
Carry passengers	30.3	23.4	23.3	23.0	0
Do difficult maneuvers	25.3	9.2	7.1	58.4	0
Engage in organized trail rides	30.6	10.5	8.0	50.8	0
Compete in organized racing	3.7	3.0	4.1	89.1	0
Race informally	13.8	11.4	11.1	62.2	1.6
Drive on difficult terrain	56.8	20.6	10.4	12.2	0.1
Ride alone	47.4	24.6	7.5	20.5	0
Check tire pressure	44.4	26.9	9.9	16.1	2.7
Driving Terrain					
Fields, pastures, ranges	50.5	14.6	14.3	20.5	0.1
Forest, woods	60.3	18.2	7.3	14.2	0
Yards, lawns	43.0	13.3	14.4	29.4	0
Desert, sand dunes	13.0	6.6	7.2	73.1	0
Roadways					
On paved roads	9.2	17.1	24.3	49.4	0
Crossing paved roads	22.9	20.1	22.0	34.9	0.1
On non paved roads	73.6	10.6	7.6	8.2	0
Crossing non paved roads	53.4	22.6	11.7	12.3	0
On public roads	11.4	13.0	16.8	58.7	0.1

* Totals may not add up to 100.0% due to rounding.

TABLE 8
SAFETY EQUIPMENT AND CLOTHING

Safety Equipment	Frequency				
	Frequently (%)	Sometimes (%)	Rarely (%)	Never (%)	Unknown (%)
Wearing:					
Helmets	51.8	12.0	3.8	32.3	0
Goggles	38.2	8.4	7.0	46.4	0
Gloves	34.4	21.9	7.0	36.5	0.3
Long sleeved shirts	47.5	35.4	5.8	10.8	0.5
Long heavy pants	78.3	13.0	1.0	7.6	0.1
Ankle length boots	53.4	14.3	5.1	24.2	0
Reported helmet use (Hours out of every 10)	Drivers Who Wear Helmets (%)				
≤1	15.5				
2-3	14.0				
4-5	6.0				
6-7	1.3				
8-9	10.8				
10	52.4				
Total	100.0				
Mean	7.0				
Standard Error	0.6				

* Totals may not add up to 100.0% due to rounding.

TABLE 9
NON-RECREATIONAL ATV USE

Non-recreational Activities (multiple responses possible)	Participation		
	Yes (%)	No (%)	Unknown (%)
Farming or ranching	50.8	49.2	0
Chores, such as yard and garden work	63.0	37.0	0
Occupational or commercial tasks	7.7	92.3	0
Other non-recreational activities	11.4	88.5	0.1
Total (at least one nonrec activity)	73.7	26.3	0

Non-Recreational Use*	
Hours (Out of 10)	Percent (%)
≤1	24.5
2-3	25.1
4-5	16.2
6-7	7.9
8-9	15.9
10	8.3
Unknown	2.1
Total	100.0
Mean	4.42 hours
Std Error	0.30

*For Non-Rec Users

TABLE 10
ATV TRAINING

Part I. For all drivers:	
How drivers learned to operate ATVs (multiple responses possible)	Drivers (%)
Organized training, arranged through dealer as part of ATV purchase	9.5
Other organized training	1.6
Trained by Dealer/Salesperson	11.7
Received training from friend or relative	50.5
Self-taught	66.9
Other	1.2
Part II. For drivers whose households purchased a model year 1989 or later ATV from a dealer, but did not participate in an organized training program:	
Dealer offered "free" training as part of ATV purchase	Drivers (%)
Yes	62.1
No	29.0
Unknown	8.9
Total	100.0
Reason for not taking free lesson (multiple responses possible)	Drivers (%)
Inconvenient location	11.1
Inconvenient time	21.8
Did not need/Already know	32.1
Friend or relative provided	7.6
Other	27.1

* Totals may not add up to 100.0% due to rounding.

TABLE 11
VEHICLE CHARACTERISTICS

Characteristics	Total (%)	Three-wheel (%)	Four-wheel (%)
Number of Wheels			
Three	21.5	100.0	-
Four	77.1	-	100.0
- four-wheel drive	(20.1)	-	(26.1)
- two-wheel drive	(78.2)	-	(73.5)
Unknown	1.4	-	-
Total	100.0	100.0	100.0
Engine Size Groups. (cc's)			
< 90	7.3	8.5	7.0
90-125	12.3	20.9	9.0
160-200	12.0	27.5	7.9
225-250	25.4	27.6	25.2
300	12.5	2.9	15.3
350	14.6	5.6	17.3
400 or more	9.4	1.5	11.6
Unknown	6.6	5.6	6.7
Total	100.0	100.1	100.0
Model Year			
1979 or before	0.2	0.5	0.1
1980-84	12.8	35.0	6.8
1985-89	28.0	46.6	23.4
1990-94	29.3	2.1	37.4
1995 or after	19.3	0	24.8
Unknown	10.4	15.9	7.5
Total	100.0	100.1	100.0
How Acquired			
Purchased New	48.0	31.5	53.4
Purchased Used	50.6	68.5	46.3
- from dealer	(8.0)	(3.5)	(9.3)
- from previous owner	(42.4)	(65.0)	(36.9)
Unknown	1.4	0	0.3
Total	100.0	100.0	100.0
Years Owned			
< 3	45.9	28.7	50.9
3 to < 6	20.5	25.3	19.5
6 to < 9	10.7	9.5	11.2
9 to < 12	16.2	15.7	16.6
≥ 12	4.9	18.3	1.2
Unknown	1.8	2.5	0.6
Total	100.0	100.0	100.0
Modifications (mult. response)			
Different tires or wheels	35.6	44.1	33.9
Special Exhaust System	17.1	18.9	16.9
Suspension Modifications	7.6	7.2	7.8
Engine High Performance Kit	6.8	7.7	6.7
Utility Rack	11.7	13.4	11.4
Gun Rack	5.4	3.4	6.0
Other Modification	24.4	12.4	28.2
Total (at least 1 mod)	58.7	64.0	57.7

* Totals may not add up to 100.0% due to rounding.

TABLE 12
ATV WARNING LABELS*

	Yes (%)	No (%)	Don't Know (%)
Are there warning labels on the ATV?	80.9	19.1	0
ATV has labels warning against: (for drivers who reported the presence of warning labels)			
Carrying passengers	80.6	10.9	8.5
Driving on public roads	47.4	34.7	17.9
Driving on paved surfaces	44.9	36.5	18.6
Driving without a helmet	77.3	14.5	8.2
Riding too fast	32.2	49.3	18.5
Drug and alcohol use when riding	51.2	35.8	13.1
Stunt riding	41.7	46.6	11.7
Use of adult sized ATVs by children**	64.4	21.0	14.6

* Questions asked of the estimated 49.2% of drivers whose primary ATV was produced after the effective date of the ATV consent decrees (1989 or later models).

** Asked if the ATV engine size was 90cc or more.

TABLE 13
SELECTED DRIVER AND VEHICLE CHARACTERISTICS,
1989 AND 1997

Driver Characteristics	Drivers (%)	
	1989	1997*
Age (years)		
<15	23.2	14.3
16-24	16.7	27.0
25 or more	60.1	58.7
Gender		
Male	66.7	65.8
Female	33.3	34.2
Experience (years)		
<1 year	5.3	4.6
1 to <3	21.5	12.7
3 or more	73.2	82.7
Non-Recreational Use (at least some of the time)		
Yes	52.5	73.7
No	47.5	26.3
Vehicle Characteristics	Vehicles (%)	
	1989	1997*
Wheels		
Three	54.4	21.8
Four	45.6	78.2
Engine Size Group (cc's)		
<90	7.7	7.8
90-125	25.9	13.2
160-200	28.3	12.8
225-250	29.0	27.2
300 or more	9.1	39.0
How Acquired		
Purchased New	61.1	48.7
Purchased Used	38.9	51.3

* The percentages for 1997 differ from those in Tables 4 and 11 because the unknown values have been distributed over the known categories for purposes of comparison to the 1989 data.



██
██

PART II
Report on 1997 ATV Injury Survey

██
██

April 1998

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Executive Summary

In 1997 there were an estimated 54,500 emergency department-treated injuries associated with all-terrain vehicles (ATVs) according to a special study of cases reported to the National Electronic Injury Surveillance System (NEISS). This represents a rate of injury of 1.5 injuries per 100 ATVs in use. This rate is substantially lower than the 1985 rate of 5.4 injuries per 100 vehicles in use. The rate of injury for four-wheel ATVs declined from 3.9 in 1985 to 1.4 per 100 in 1997; and for three-wheel, from 5.8 to 1.8.

In 1997 the U.S. Consumer Product Safety Commission (CPSC) staff conducted a special study of ATV-related injuries. All non-occupational ATV-associated emergency department-treated injuries reported through NEISS from May 1, 1997, through August 31, 1997, were assigned for telephone follow-up survey. The survey response rate was 68% resulting in 319 completed cases being used for analysis in the study.

Almost one-half of the injured people in the special study were children under the age of 16. Almost two-thirds of the injuries were seemingly minor injuries such as contusions, abrasions, lacerations, and strains and sprains. However, the overall hospitalization rate for ATV-associated injuries was 13% which is high compared to the overall rate for product-related injuries reported through NEISS (4%).

Head injuries were approximately 20% of all injuries in the special study. A large portion (at least 65%) of those receiving head injuries were not wearing helmets.

Overall, 25% of the injured were passengers and 38% of drivers involved in incidents were carrying passengers. These were slight increases over 1985, when 20% of the injured were passengers and 31% of drivers were carrying passengers.

Drivers under 16 were generally not on smaller vehicles than older drivers. Overall, 95% of drivers under age 16 were on vehicles larger than recommended for their age.

Very few (approximately 4%) of the drivers involved in injury incidents had received any formal training in operating an ATV.

These results were generally consistent with earlier studies when the observed changes in the number of three-wheel versus four-wheel ATVs in use are taken into account.

Introduction

In April 1988 the U.S. Consumer Product Safety Commission (CPSC) entered into Consent Decrees of ten years' duration with the manufacturers and/or distributors of all-terrain vehicles (ATVs) to institute several procedures to make the use of ATVs safer. These included:

- o stop-sale of three-wheel ATVs
- o providing warnings about dangerous riding practices
- o providing a national training program
- o restricting the sale of adult-sized ATVs for use by children under 16
- o developing a voluntary standard to make ATVs safer to ride.

These agreements were based in part on studies completed by CPSC in 1985-1987 (Newman, 1985, 1987; Rodgers, 1986) which found, among other things, that the risk of injury was higher for three-wheel ATVs and that children under 16 years of age on an adult-sized ATV were particularly at risk for injury or death.

In 1989, similar studies of ATV deaths, injuries, and use were conducted (Scheers et al, 1991; Rodgers, 1989). Risk factors were found to have remained the same for 1985 and 1989. Increased risks were associated with males, younger drivers, larger engine sizes, unmodified ATVs, more recreational use, more hours of use, and less driving experience.

As the end of the period of the Consent Decrees approached, factors affecting the risk of injury and death associated with ATV use were again investigated to determine whether they had changed. Historical death and injury data were analyzed, and injury and exposure surveys were conducted in 1997. This report presents preliminary results concerning injuries associated with ATVs.

Methodology

This report includes injury data obtained from two sources: the National Electronic Injury Surveillance System (NEISS) and a special study conducted in the summer of 1997.

NEISS. CPSC's NEISS is a national probability sample of hospitals in the U.S. and its territories which have emergency departments (EDs). The NEISS sample is stratified by size of the ED (number of ED visits) so that all sizes of EDs are appropriately represented. NEISS has been in place since the early 1970's.

The 1997 NEISS data were collected using an updated hospital sampling frame. In this instance, a sampling frame refers to a

listing of the hospitals in the U.S. and its territories from which sample hospitals are selected. Data from 1989 to 1996 had been collected using a listing of hospitals which were in existence in 1985 (the 1985 sampling frame) and a group of hospitals selected from that frame. Since 1985, some hospitals have merged to create larger hospitals, while others, particularly small, rural hospitals, have closed. As a result, the distribution and types of hospitals around the country have changed, so that the sample of hospitals selected from the 1985 frame reflects the number and type of injuries treated in hospital EDs less accurately today than at the time the frame was created. To correct this, a new sampling frame was developed and the sample of hospitals used was updated to represent the new frame. There were 101 hospitals selected from the new sampling frame and used to develop the 1997 injury estimates.

Since the deterioration of the sampling frame is assumed to have occurred gradually over the entire period since 1985, annual estimates from 1997 back to 1985 have been adjusted retrospectively to correct for the deterioration.

The NEISS data collected from these 101 hospitals were used to provide national estimates of the number of ED-treated injuries associated with ATVs. These estimates are presented as weighted estimates, that is, the number of observations has been weighted to account for the NEISS sampling design. Standard errors¹, where reported, are given in parentheses following the estimate: for example, the estimated number of ED-treated injuries associated with ATVs in 1997 was 54,500 ($\pm 5,100$).

NEISS data include age and sex of the injured person, the nature of the injury (diagnosis and body part), and whether the individual was treated and released or admitted to the hospital (disposition).

Special Study. In order to obtain more detailed information about the circumstances under which the ATV-associated injury occurred, a special study of NEISS ATV injuries was conducted in 1997. All non-occupational ATV-associated ED-treated injuries reported through NEISS from May 1, 1997, through August 31, 1997, were assigned for telephone follow-up using a survey questionnaire similar to that used in the 1985 and 1989 injury studies. The injured person was surveyed whenever possible. Other respondents included parents, spouses and other relatives. Information was obtained on the injured person, the ATV driver

¹The interval between the estimate minus 2 standard errors and the estimate plus 2 standard errors is the 95% confidence interval. We can be 95% confident that the quantity being estimated falls somewhere in the interval.

and/or passenger (if different from the injured person), the characteristics of the ATV, and the injury scenario.

The survey response rate was 68%, resulting in a total of 319 completed cases which were used for analysis. See TAB A for a detailed accounting of how 319 analyzable cases resulted from the 487 cases assigned from NEISS. All numbers reported are weighted estimates. In addition to being weighted to account for the NEISS sampling design, the study estimates are also weighted to account for nonresponse to the survey. All tests for statistical significance were performed on the weighted estimates using SUDAAN software (Shah, Barnwell, and Bieler, 1997). A significance level of .05 was used for all statistical tests ($p < 0.05$). Marginal differences ($0.05 < p < 0.10$) are also noted.

Results

The analysis of the injury data provided in this report focused on variables which had been shown to be important risk factors in previous studies or had particular relevance to provisions of the Consent Decrees.

Injury information from NEISS and the special study is presented to answer the following questions:

- o How many people are being injured on ATVs and who is being injured?
- o What types of injuries are occurring and how severe are they?
- o What types of vehicles are involved?
- o What are the interactions between driver, injured person, and vehicle?
- o How are the injuries occurring?

How many people are being injured on ATVS and who is being injured?

Number of Injuries. There were an estimated 55,400 ($\pm 5,500$) injuries to all age groups associated with ATVs for the calendar year 1997 according to NEISS, using the 1997 sampling frame.

Total estimated injuries for the special study period May 1, 1997, through August 31, 1997, were 23,700 ($\pm 2,200$). Based on the distribution of NEISS cases throughout the year, this time period represents 43.5% of the total annual injuries. Therefore, based on the injury study results, the estimated annual number of injuries for 1997 would be 54,500 ($\pm 5,100$). This number is somewhat lower than the NEISS estimate of 55,400 ($\pm 5,500$) because the survey revealed that a few of the cases identified by NEISS were out of scope (some other product, etc.). The special study estimate is taken to be the most accurate.

NEISS estimates of the annual number of ED-treated ATV-associated injuries from 1982 through 1997 are presented in Figure 1 "Annual ATV Injury Estimates" (following page). The upper pair of lines represent injuries for all ages: the lower of the two lines shows estimates which have been adjusted retrospectively for the 1997 sampling frame update; the upper line shows the original estimate based on the 1985 sampling frame. The lower pair of lines on the graph are the corresponding estimates of injuries to children under age 16.

ATV-associated injuries peaked at 106,000 in 1986, declined steadily through 1993 and have remained relatively constant since then. Injuries to children under age 16 followed a similar pattern, also declining from a 1986 peak. In 1986, 45% (47,600) of ATV injuries were to children under 16. In 1993, 36% (17,900) were to children and in 1997, 39% (21,600) of the injuries were to children under age 16.

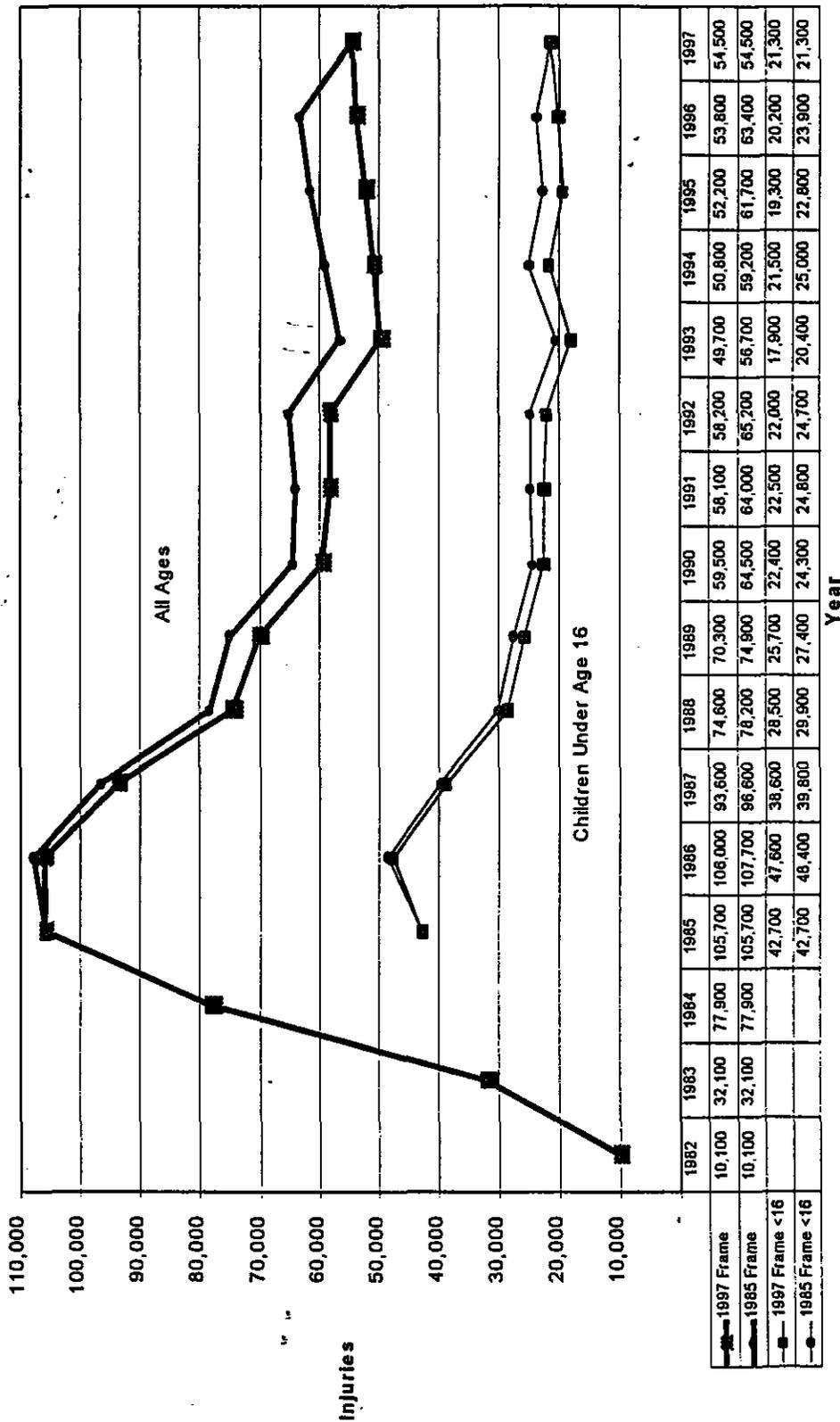
Rate of Injury. Table 1 presents information on ATV-associated injuries, numbers of ATVs in use, and the rate of injury per 100 ATVs in use for 1985, 1989, and 1997. The number of injuries for each time period has been adjusted for 1997 NEISS sampling frame changes and therefore differs from earlier published estimates (Scheers et al, 1989).

Table 1. Rate* of Injury - All Ages

		Total	4 Wheels	3 Wheels
1985	Injuries	105,700	14,300	91,400
	ATVs in Use	1,942,000	366,000	1,576,000
	Rate	5.4	3.9	5.8
1989	Injuries	70,300	35,700	34,600
	ATVs in Use	2,773,000	1,335,000	1,438,000
	Rate	2.5	2.7	2.4
1997	Injuries	54,500	39,900	14,600
	ATVs in Use	3,660,000	2,862,000	798,000
	Rate	1.5	1.4	1.8

* per 100 ATVs in use

Figure 1. Emergency Department-Treated ATV Injuries



Between 1985 and 1997, the overall number of ATVs in use in a given year approximately doubled, while the annual number of injuries dropped by approximately half. As a result, the 1997 overall injury rate was about one-quarter that of 1985.

Four-wheel ATV-associated annual injuries increased approximately threefold, while the number of four-wheelers in use in a given year increased eightfold. As a result, the 1997 four-wheel injury rate was about one-third that of 1985.

Three-wheel ATV-associated injuries in 1997 were one-sixth as great as in 1985, while the number in use in a given year halved, i.e., the number of injuries dropped three times as fast as the number of vehicles in use. The resultant injury rate was one-third that of 1985.

Despite the substantial decline in injury rates, the absolute number of injuries remained at more than 50,000 per year. Moreover, a rate of 1.5 injuries per 100 vehicles in use is high. For comparison, the injury rate for bicycles is 0.88 per hundred vehicles in use (Tinsworth, 1994).

Age and Sex of Injured. Table 2 presents the distribution of injured persons in the special study by age and sex. Overall, 75% of the injured were males, 25% females. This distribution was also found in the NEISS data for the entire year 1997.

Table 2. Sex of Injured Person by Age of Injured Person

Estimate Row % Col %	Totals	Age Group			
		<12	12-15	16-24	25&UP
Totals	23700 100% 100%	5090 22% 100%	6020 25% 100%	6000 25% 100%	6600 28% 100%
Sex Male	17850 100% 75%	3750 21% 74%	3900 22% 65%	4620 26% 77%	5570 31% 84%
Female	5850 100% 25%	1330 23% 26%	2110 36% 35%	1380 24% 23%	1020 17% 16%

In the special study, there were marginally significant differences within the overall age/sex distribution (p=0.0591).