

Occupational All-Terrain Vehicle Deaths among Workers 18 Years and Older in the United States, 1992-2007

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ABSTRACT. *The objective of this study was to summarize basic information on the characteristics of work-related ATV deaths among civilian persons 18 years of age or older in the U.S. from 1992 through 2007. Work-related ATV death data were obtained through the Bureau of Labor Statistics' annual Census of Fatal Occupational Injuries. From 1992 to 2007, 297 work-related ATV deaths occurred among persons over 17 in the U.S. Ninety-two percent were male, 93% were white, 23% were ages 18 to 34, 51% were ages 35 to 64, and 26% were ages ≥ 65 . Half of the fatal incidents involved overturns resulting in head and chest injuries. Sixty percent of crashes occurred on farms and 20% occurred on highways. The fatality rate among agricultural production workers was significantly higher than the rates in all other industries. While more in-depth analysis of incident and exposure data for this growing problem will more clearly define personal risk and causal factors in the long term, in the short term, stronger emphasis must be placed on the development of prevention strategies, particularly focused on older workers in the agriculture production industry.*

Keywords. *Accidents, Agriculture, All-terrain vehicle, Fatality, Farm worker, Injury.*

Over 10 million all-terrain vehicles (ATVs) were estimated to be in use by 16 million persons in the U.S. at the end of 2008 (GAO, 2010; Garland, 2010). About one-third of these were imported, primarily from China and Taiwan (GAO, 2010). Since their inception, ATVs, designed largely for off-road use, have had three or four wheels, are capable of speeds in excess of 80 mph with engines ranging from 90 to 1,000 cubic centimeters, and currently cost nearly \$14,000 for higher-end models.

The first ATVs manufactured in the late 1960s were designed as farm-to-town vehicles for use in isolated, mountainous areas in Japan (American Honda Motor Company, 2010). In the early 1980s, Honda introduced an ATV in the U.S. for agricultural applications, such as spraying, seeding, and fertilizing (SVIA, 2010). Over the past four decades, ATVs have become increasingly popular recreational vehicles. These

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vehicles, however, did not gain a significant foothold in the U.S. workplace until the last ten to fifteen years. Helmkamp and Carter (2009) noted that “ATVs have filled a valuable niche between truck and farm tractor.” A recent Government Accountability Office report indicated that a 2008 survey of ATV owners found that between 20% and 25% of those surveyed used ATVs for “work or chores” (GAO, 2010). While this report provided little information that quantified the uses of ATVs in occupational settings, it suggested anecdotally that ATVs are found in a variety of occupational settings beyond those related to agriculture, including but not limited to emergency medical response, search and rescue, land management, law enforcement/security, construction, and military applications (GAO, 2010).

Since the 1980s, the U.S. Consumer Product Safety Commission (CPSC) has collected and published annual statistics for fatal injuries resulting from the recreational use of ATVs (Garland, 2010). These data, as well as data from trauma centers and emergency departments, have been the basis of a significant number of studies on recreational ATV-related fatalities and injuries. These studies have shown that common contributing factors for recreational ATV crashes include excessive speeds, not wearing a helmet, no or insufficient operator training, and carrying passengers (Levenson, 2003; Rodgers, 2008; GAO, 2010). The Occupational Safety and Health Administration has asserted that workers who use ATVs during their jobs are exposed to similar hazards (OSHA, 2006). Although the Bureau of Labor Statistics (BLS) previously reported the number of occupational fatalities and injuries resulting from ATV incidents from 1992-2001 (113 and 1,625, respectively; OSHA, 2006), very little has been done to explore occupational ATV-related fatalities in more detail. Given the increasing use of ATVs in the workplace, a better understanding of these deaths is needed.

For this study, a national surveillance system was used to describe characteristics of work-related fatalities resulting from ATV incidents in the U.S.

Methods

Population of Interest and Case Definition

Work-related deaths resulting from ATV incidents were identified from research files from the BLS Census of Fatal Occupational Injuries (CFOI) for the years 1992 through 2007. These files were provided to the National Institute for Occupational Safety and Health by BLS under a Memorandum of Understanding. Collected by all 50 states and the District of Columbia and compiled by the BLS, the CFOI identifies and confirms traumatic fatalities based on multiple federal, state, and local document sources, including death certificates, workers’ compensation reports, medical examiner reports, and police reports (Pegula et al., 2007). To be included in the CFOI, the decedent must have been employed at the time of the event and been engaged in a legal work activity or present at the site of the incident as a job requirement. Fatalities occurring during a normal commute to or from work are excluded from the CFOI. Data are collected for all workers, regardless of worker age or industry. Although CFOI data include fatal work injuries from all 50 states and the District of Columbia, data for 1992-2002 exclude fatalities from New York City. Although the CFOI includes data on workers 17 years of age or younger, the number of ATV-related fatalities for this age group did not meet publication criteria. Thus, the population described in this study was restricted to workers age 18 years and older.

The source of injury in the CFOI identifies the object or substance that directly produced or inflicted the injury and is coded based on the Occupational Injury and Illness Classification System (OIICS) manual (BLS, 2007). Fatalities involving ATVs were identified using the primary source code 841. Characteristics of work-related fatalities are described in terms of worker demographics, injury incidence characteristics, and industry at time of death. Industry is coded based on the Standard Industrial Classification (SIC) manual for data years 1992-2002 (OMB, 1987) and the North American Industrial Classification System (NAICS) for data years 2003-2007 (OMB, 2002). Fatalities occurring in the agriculture production industry are reported separately and were identified using the SIC major groups 01 (agricultural production - crops) and 02 (agricultural production - livestock and animal specialties) and the NAICS major groups 111 (crop production) and 112 (animal production).

Rates were calculated based on population data from the BLS Current Population Survey, a monthly household survey (BLS, 2003). Overall fatality rates were calculated as the number of fatalities divided by the estimated total annual civilian workforce and are expressed as the number of fatal work injuries per 1,000,000 workers per year. Industry-specific rates were also calculated for agriculture/forestry/fishing/hunting as well as for agriculture production. Numbers are reported for all workers 18 years and older; rates are reported for civilian workers only. Poisson regression was used to test if rates per 1,000,000 workers changed significantly over time.

Results

From 1992 through 2007, there were 297 ATV-related deaths to workers 18 years of age and older (fig. 1). These workers died at a collective rate of 0.14 per 1,000,000 workers. Figure 1 shows a dramatic increase in both numbers and rates from 1992 through 2007. The number of work-related deaths involving an ATV increased nearly 275% (from 11 in 1992 to 41 in 2007) while the fatality rate per 1,000,000 workers increased 300% (from 0.07 in 1992 to 0.28 in 2007). A significant increase (slope = 0.12, $\text{Pr} > \chi^2 < 0.0001$) was found in the fatality rates from 1992 through 2007.

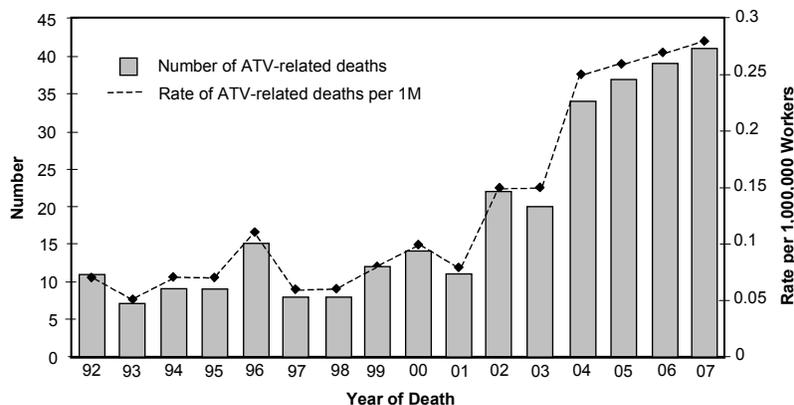


Figure 1. Number and rate of work-related deaths resulting from ATV-related incidents, U.S., 1992-2007. Data for 1992-2002 exclude data for New York City; data for 2001 exclude fatalities that resulted from the September 11 terrorist attacks.

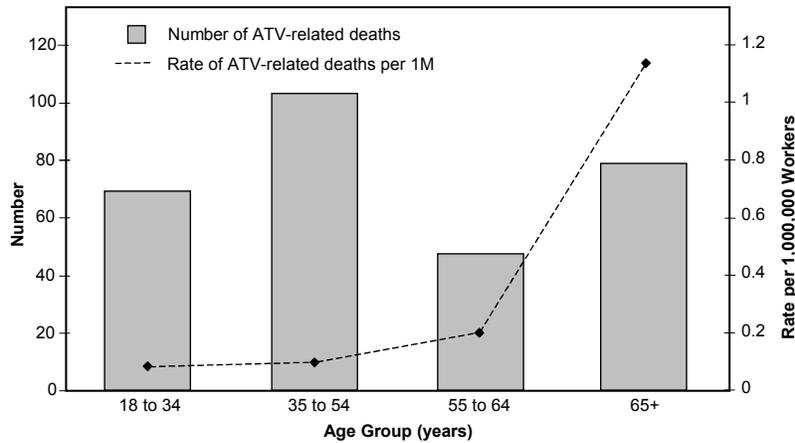


Figure 2. Number and rate of work-related deaths resulting from ATV-related incidents by age group, U.S., 1992-2007. Data for 1992-2002 exclude data for New York City; data for 2001 exclude fatalities that resulted from the September 11 terrorist attacks.

Males accounted for 92% (272 of 297) of the ATV-related deaths and had a work-related fatality rate approximately 8 times the rate for females (0.23 per 1,000,000 workers versus 0.03). Workers in the largest age group, ages 35 to 54, accounted for 35% (103 of 297) of ATV-related workplace deaths, and the oldest group accounted for an additional 26% (78 of 297) (fig. 2). Rates increased with age, from 0.08 per 1,000,000 workers for those age 18 to 34 years to 1.14 for workers age ≥ 65 years. Three quarters of the work-related deaths involving ATVs occurred in the Midwest (39%, 117) and West (37%, 109) regions, while the remaining deaths occurred in the South (22%, 65) and Northeast (2%, 6). The majority of the injuries affected the head (25%, 73 of 297 deaths), the trunk (i.e., shoulder, back, chest, or abdomen) (23%, 69), and neck/throat (10%, 30).

Non-highway incidents were the most common event related to ATV-related deaths (77%, 231 of 297). Most of these incidents (65%, 150 of 231) resulted from overturns. Approximately 14% (41 of 297) of the crashes involved collisions with other motor vehicles or mobile equipment on the highway (10%) or off the highway (3%). Another 14% (40 of 297) of the crashes involved ATVs hitting stationary objects off the highway (12%) or on the highway (2%).

Half of the decedents (149 of 297) were self-employed or worked in a family business, and 45% (134 of 297) worked for pay or compensation. Sixty-eight percent (202 of 297) of those killed in ATV-related incidents worked in the agriculture/forestry/fishing/hunting industry sector, with most of these (180 of 202) in the agriculture production industry. Over two-thirds of the decedents in the agriculture/forestry/fishing/hunting industry sector (139 of 202) were self-employed or working in a family business. Eight of every ten (161 of 202) crash victims in the agriculture/forestry/fishing/hunting sector died in a non-highway event.

For the period 1992 through 2007, the fatality rate per 1,000,000 workers for the agriculture/forestry/fishing/hunting industry sector (4.23) was 100 times the rate for all other industries (0.04); the rate for the agriculture production industry had an even

higher rate (5.73 per 1,000,000 workers). Workers age ≥ 65 years in the agriculture production industry had the highest risk of fatality compared to all other worker groups. Most (67 of 78) of the deaths in this age group occurred in the agriculture production industry. Furthermore, the ATV fatality rate for these older workers in the agriculture production industry (13.5 per 1,000,000 workers) was over 2 times higher than the overall ATV fatality rate for the agriculture production industry.

Although not shown, the remaining 32% of those killed in ATV-related incidents worked in various other industry sectors, with each sector accounting for a substantially lower percentage of the total fatalities compared to agriculture/forestry/fishing/hunting.

Discussion

We believe this study represents the first national analysis of ATV-related deaths among workers 18 years of age and older and clearly demonstrates a growing problem. Unlike tractor-related deaths, which have remained fairly steady (Myers et al., 2009), both the number and rate of ATV-related deaths over the 16-year period have increased dramatically. During the first half of the study period (1992-1999), ATVs, as a causal mechanism, accounted for 0.16% (79 of 49,458 worker deaths) of all occupational deaths in this age group. During the latter half of the period (2000-2007), this proportion, while remaining relatively small, increased 3-fold to 0.48% (218 of 45,563). The proportional increase of 193% in the number of occupational ATV deaths from 14 in 2000 to 41 in 2007 greatly exceeded the estimated 75% increase for all ATV deaths over the same period. This trend may be due, in part, to the increased use of these machines in occupational settings, particularly farms; ATV use on farms increased from approximately 858,000 in 2001 to 1.1 million in 2006 (Goldcamp et al., 2006; NASD, 2008).

This study also demonstrates that workers in the agriculture production industry accounted for the largest number and had the highest rate of ATV-related deaths compared to any other industry sector. This finding may be indicative of the fact that farmers use ATVs in addition to or as a substitute for trucks, farm tractors, and even horses (Becker, 1992; Helmkamp and Carter, 2009). Because ATVs are capable of covering rough, mountainous terrain not otherwise passable by other means, these machines may be used for various agricultural tasks, including carrying and applying fertilizers and chemicals, inspecting and repairing fence lines and irrigation systems, and checking on and herding livestock (Becker, 1992; Lawton, 2000; Helmkamp and Carter, 2009).

The fatality rate observed for the oldest group (1.14) was over 10 times higher than the collective rate among the three youngest groups (0.11). Furthermore, a subset of this oldest group included those engaged in agriculture production work, who died at a rate of 13.5, a rate over twice that of the overall industry. These findings reaffirm previous research that found that the risk of fatal injury increases with age, particularly in the agricultural production industry (Kisner and Pratt, 1997; Myers et al., 2009). Like tractors, ATVs are machines that require skill and ability to operate correctly and safely (Becker, 1992; Helmkamp, 1999; Helmkamp and Carter, 2009). However, while tractor operators are usually seated and often secured by a seatbelt, ATV operators must actively move their bodies (i.e., shift their weight) to maneuver the ATV. A

variety of physical and cognitive issues may place older workers at higher risk of ATV-related injuries. These might include decreased reaction time, visual and hearing impairments, decreased musculoskeletal functioning, and other physical and sensory changes that occur as part of the natural aging process (Ambe and Murphy, 1993; Helmkamp, 1999; Helmkamp and Carter, 2009; Myers et al., 2009). Use of medications may also impact reaction time or produce different crash dynamics than in incidents involving younger ATV operators (Helmkamp, 1999). Myers et al. (2009) reported an increase in the risk of fatal injury with age in the agricultural production business.

Given the growing popularity of ATVs for performing work and the high prevalence of ATV-related deaths among older workers, particularly in the agriculture production industry, efforts to reduce the risk of ATV-related fatalities must include better training and education of workers in this high-risk population. Similar to tractor safety programs, to reach this population, information about safe operation and the inherent dangers of ATVs may be best conveyed through venues such as farm bureaus, farm magazines, and equipment dealers (Helmkamp and Carter, 2009; Myers et al., 2009).

It is worth noting that about one-fifth of the ATV-related deaths in this study occurred on highways and roadways. Given their knobby, low-pressure tires, ATVs are not designed nor recommended for use on paved surfaces, as they can be unstable and hard to handle. Although speeding and carrying passengers is not recommended at any time, excessive speed on paved surfaces can very quickly produce extreme instability. Educational strategies that emphasize the avoidance of ATV operation on paved surfaces and industry policies that discourage or prohibit ATV use on roadways may be effective in reducing this risk factor for workers.

We acknowledge that the rates presented in this study are very low and are based on a denominator that incorporates all workers in the agriculture industry. If the rates had been calculated using just workers exposed to ATVs, then the fatality rates among exposed individuals may have been a great deal higher.

Regulation of ATV use has been generally relegated to the states (CPSC, 2010; SVIA, 2009; GAO, 2010). State ATV safety laws, which almost exclusively pertain to recreational activities, vary greatly and cover a broad range of topics, including registration and licensing, equipment, helmets, training, and age limits, and have, to date, had mixed success in decreasing deaths and injuries (Helmkamp, 2001; Upperman et al., 2003; Keenan and Bratton, 2004; Helmkamp et al., 2009; Winfield et al., 2010). Several state legislative initiatives to prohibit use of ATVs on public roads could help reduce the prevalence of deaths, both recreational and work-related, occurring on highways and roads. Wyoming and Texas have used safety alerts and videos to promote ATV safety at work (Wyoming, 2010; Labor Law Center, 2007). National organizations and federal agencies, including the National Safety Council's National Education Center for Agricultural Safety (NECAS, 2010) and OSHA (OSHA, 2006), offer ATV safety recommendations oriented to the workplace. Many companies also mandate ATV safety training for their employees; some of these companies rely on training courses and videos available through the ATV Safety Institute (ATV Safety Institute, 2010) and materials provided through ATV manufacturers and dealerships, while other companies develop their own training materials.

Strengths and Limitations of Data Sources

The data used in this study are subject to certain strengths and limitations. A primary strength of this study is that the CFOI utilizes multiple sources of information to identify and verify cases (Pegula et al., 2007). The CFOI data have been shown to include a larger number of deaths attributed to work injuries compared to single-source systems. A limitation of the CFOI is a potential undercount of cases due to a lack of multiple sources to verify work-relatedness (Pegula et al., 2007). A second limitation of the CFOI is that these data do not include information on contributing factors, such as the use of helmets, the presence of passengers, machine speed, or operator training and experience. As mentioned earlier, the denominator used for rate calculations represented the total work force for the U.S. and for the agriculture industry and did not represent a true count of workers exposed to ATVs. The use of a population denominator probably resulted in lower rates than if specific exposure data had been used. However, these more specific exposure proportions are generally not available.

Conclusions

This study, reporting the number and characteristics of work-related ATV deaths, is an important first step in assessing the magnitude of the problem of ATVs used in the workplace. A next, more long-term step should include obtaining more detailed incident data to allow more in-depth analyses of occupational incidents involving ATVs, including specific circumstances of the fatal crashes, particularly among older workers in the agricultural production industry. Two nationally representative data systems, the OSHA Integrated Management Information System (OSHA, 2010) and the occupational supplement to the Consumer Product Safety Commission National Electronic Injury Surveillance System (NIOSH, 2010), may provide more detailed exposure data and might be useful to support this effort.

Although the April 2010 GAO report indicated an expanded use of ATVs in many occupational settings (GAO, 2010), our results have clearly shown that an overwhelming majority of fatalities have occurred in the agriculture production industry and that the number of fatalities has increased annually. Thus, in the short-term, farms and other similar entities that use ATVs should be strongly encouraged to develop viable prevention strategies to address this escalating problem. This could be facilitated through contact with local farm bureaus or county extension programs to assist in setting up appropriate ATV training and educational awareness programs.

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