

Hospitalized and Fatal All-Terrain Vehicle-Related Injuries in Oklahoma, 2007

What is an ATV?

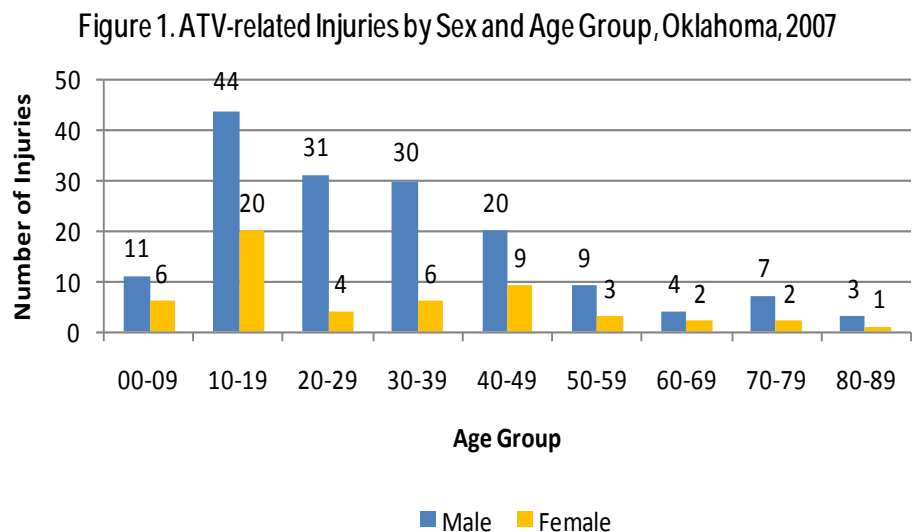
ATVs, or all-terrain vehicles, are off-road, motorized vehicles that have three or four low pressure tires. Since manufacturing and distribution of three-wheeled ATVs was discontinued in the late 1980s, virtually all ATVs in use today are the four-wheeled variety. ATVs have a straddle seat and handlebars for steering control. Other off-road motorized vehicles with bench or bucket seats (e.g., golf carts, dune buggies, "Rhinos," "Gators," and similar makes of utility vehicles) generally are not considered to be ATVs. ATVs typically are designed for one rider (the operator); however, certain models do allow for passengers (e.g., 1-up versus 2-up ATVs). ATVs come in a range of sizes and include both adult and youth models. Adult-sized ATVs have engines larger than 90cc, with an average range of 229-649cc. Manufacturers recommend that children under the age of 16 not operate an adult-sized ATV and that children younger than six not ride on ATVs at all. ATVs weigh 400-800 pounds and can travel at speeds well over 70 miles per hour.

Why focus on ATV-related injuries?

ATVs are designed to be off-road vehicles and require interactive riding (the ability of operators to shift their weight freely in all directions). However, off-road terrain and conditions are often unpredictable and changing. In this environment, ATVs can easily roll or become difficult to handle. Safety training and riding experience are critical to staying safe on an ATV. Many people view ATVs as toys when in fact, they are powerful and potentially dangerous vehicles. From 1982-2007, the Consumer Product Safety Commission received reports of 9,223 ATV-related fatalities in the United States (U.S.). In 2007 alone, there were over 150,000 emergency department-treated injuries across the U.S. due to ATVs. Recognizing the potential hazards associated with ATV use, 44 states have passed some form of ATV safety legislation, ranging from age and usage restrictions to helmet laws and safety course requirements.

How were hospitalized and fatal ATV-related injuries identified?

Oklahoma's 2007 inpatient hospital discharge database includes all discharges during the calendar year from state licensed, acute care, non-federal facilities. From this database, discharges with an external cause of injury code (E code) of E821 (*International Classification of Diseases, Version 9, Clinical Modification*, nontraffic accident involving other off-road motor vehicle) were selected. Medical records were then requested and reviewed for the selected discharges. If the injury circumstances involved an ATV, using the definition of an ATV listed above, detailed information was abstracted from the chart. If another type of off-road vehicle was involved in the injury, the case was excluded. Vital statistics and medical examiner data were used to identify fatalities that occurred outside of an inpatient hospital setting. Vital statistics death data were searched for the underlying cause of death code V86 (*International Classification of Diseases, Version 10*, occupant of special all-terrain or other motor vehicle designed primarily for off-road use, injured in transport accident). Detailed information was abstracted from medical examiner reports where an ATV was involved in the fatal injuries. Hospital and death data were entered into a secure database and analyzed. Both Oklahoma residents and nonresidents who were hospitalized or died in Oklahoma were included.



Are all ATV-related injuries included?

While the majority of severe injuries are likely included, the information in this report is not a comprehensive assessment of all ATV-related injuries. A much larger, but unknown, number of people have injuries treated in emergency departments, urgent care clinics, and doctors' offices, or seek no medical attention at all. There is currently no system in place in Oklahoma to gather information on these cases. In terms of fatalities, Oklahoma residents that died out-of-state were not included because of limited known information. According to vital statistics data, three residents died in other states from ATV-related injuries. It is unknown how many Oklahomans may have been hospitalized or treated for nonfatal injuries out-of-state. Another limitation is that the number of in-state hospitalizations for nonfatal injuries likely underestimates the true number of total hospitalizations. By using only E821 as the means of case identification, traffic-related ATV incidents were missed, as were any other records that were miscoded or lacked documentation of the ATV. Although ATVs are not meant to be driven on paved roads or in/near traffic, these events and resultant injuries do occur. The *International Classification of Diseases* coding system does not include a dedicated code for ATV-related injuries, which impedes complete identification.

How many hospitalized and fatal ATV-related injuries occurred in Oklahoma in 2007?

Of the 297 potential cases identified (deaths and hospitalizations coded E821 occurring in Oklahoma), 212 were ultimately included as actual cases. Eighty-five records (29%) were excluded either because the vehicle involved was not an ATV (e.g., motorcycle, tractor, golf

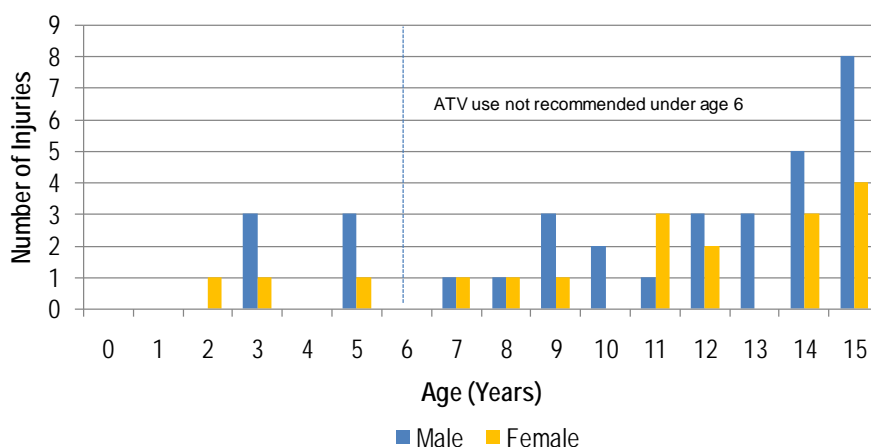
cart, dune buggy, etc.) or the record was a follow-up visit for a previously counted injury. Of the 212 cases, 89% were Oklahoma residents; the remaining 24 injured people were residents of Arkansas, Arizona, California, Kansas, Maryland, Missouri, or Texas. Four-wheeled ATVs comprised the majority of ATVs involved (88%); only one record documented a three-wheeler. The remaining 24 records (11%) did not include clear documentation on the number of wheels. No information was available on the size of the ATV in order to determine if children were using properly sized vehicles.

Overall, the majority of the 212 individuals injured in an ATV-related incident were male (75%). Ages of those injured ranged from 2 to 88 years (Figure 1). One-third of the injuries were among children (0-17 years); of which, 13% were less than six years old (Figure 2). Beyond the 10-19 year age group, the number of injuries generally decreased with age, excluding a small increase in the 70-79 year age group. Since ATV usage recommendations vary by age, injuries will be further characterized by age group in the following sections – 0-5 year olds (the group not recommended to ride ATVs), 6-15 year olds (the group recommended not to use adult-sized ATVs), and everyone else (ages 16 and over).

A brief overview of the total 212 injuries is presented in Table 1. Fourteen people died as a result of their injuries (7% case fatality rate). These deaths resulted in 636 years of potential life lost (before age 75). Whites of all ages and American Indians 6-15 years of age were slightly overrepresented in the number of injuries sustained (Table 2), as were males in general (49% of the total population; 76% of injuries). Although one-third of the injuries had missing information, Figure 3 illustrates the distribution of injuries by county where the incident occurred. The most

injuries occurred in Woods, Tulsa, and Rogers Counties. Distributions changed for injuries by county of residence (Figure 4). No Woods County residents were hospitalized or died from an ATV-related injury despite having the most injuries within the county. The sand dunes at Little Sahara State Park, just south of Waynoka in Woods County, is one of the most popular sites in the state to ride ATVs, which explains the high number of injuries. The highly populated areas of Tulsa, Oklahoma, and Cleveland Counties had the largest numbers of injured residents. In over one-half of the cases, the specific

Figure 2. ATV-related Injuries by Sex and Age, 0-15 Years, Oklahoma, 2007



location of injury was unknown (not documented in the medical record). Of those with a known location, 37% occurred at home, 32% on a roadway (including 8% city street, 8% county road, 5% highway, 4% gravel/dirt road), 18% at a state park, and the remainder on various public and private lands, such as pastures, fields, woods, and near rivers and creeks. Spring and fall were the seasons with the most injuries, particularly the months of May, September, and October (Figure 5). Fewer injuries occurred during the traditionally coldest and hottest months of the year.

Injuries among 0-5 year-olds

As mentioned earlier, the use of ATVs is not recommended by manufacturers for children younger than six years of age. There were nine children (ages 2-5 years) who were hospitalized with an ATV-related injury (six boys, three girls). All survived, but hospital stays ranged from 1 to 20 days (median two days). The majority of the children were passengers on the ATV; however, two 5-year-olds were reported to be operators. Four children (44%) were wearing a helmet. In one of these cases, the helmet broke and in another, the helmet flew off the child's head. In one-third of the cases, the ATV rolled over. One case involved the child being struck or crushed by the ATV itself. Collision status was divided equally – one-third of the injuries involved a collision with a fixed/stationary object (tree or fence post); one-third involved no collision; and one-third had unknown circumstances or collision with an unknown object. Fractures were the primary reason (principal diagnosis) most children were hospitalized (including facial bone, cervical vertebra, clavicle, humerus, and radius/ulna). The other principal diagnoses were acute respiratory failure and a spleen injury. Medicaid and private insurance paid for the majority of hospital care; however, two children were listed as uninsured.

Injuries among 6-15 year-olds

Forty-two young people 6-15 years of age sustained an ATV-related injury in 2007 (average age 12 years). Four of these children did not survive. This 10% case fatality rate was slightly higher than the rate for all ages combined. Of the 38 survivors, all but one were discharged home after an average hospital stay of four days (range 1-10 days). There were 15 injured females (36%) and 27 (64%) males. Sixty-two percent (n=26) of the children were known to be ATV operators at the time of the crash, while 19% were passengers and 10% were unspecified occupants. Only six individuals (14%) were

documented to be wearing a helmet. Nearly one-half of the injuries (n=20) involved an ATV rollover; nine people were struck or crushed by the ATV. Of those injuries with known circumstances (n=25, 60%), 44% did not involve a collision; 44% collided with a fixed/stationary object (fence, mailbox, tree, or trash can); and 12% collided with a moving object (another ATV or other vehicle). One 15-year-old was drinking alcohol prior to his injury. Fractures

Table 1. Characteristics of ATV-related Injuries by Sex, Oklahoma, 2007

	Male	Female	Total
Total injuries	159	53	212
Survived	147 (92%)	51 (96%)	198 (93%)
Died	12 (8%)	2 (4%)	14 (7%)
Residence			
Oklahoma	142 (89%)	46 (87%)	188 (89%)
Other state	17 (11%)	7 (13%)	24 (11%)
Race			
White	138 (87%)	47 (89%)	185 (87%)
Black	6 (4%)	2 (4%)	8 (4%)
American Indian	7 (4%)	1 (2%)	8 (4%)
Asian	1 (1%)	1 (2%)	2 (1%)
Unknown	7 (4%)	2 (4%)	9 (4%)
Hospital stay (in days)			
Mean	5	4	5
Median	4	3	4
Range	1-27	1-13	1-27
Work-related			
Yes	8 (5%)	0 (0%)	8 (4%)
No/unknown	151 (95%)	53 (100%)	204 (96%)
Discharge disposition			
Home	123 (77%)	44 (83%)	167 (79%)
Rehab, SNF*, other hospital	15 (9%)	5 (9%)	20 (9%)
Home health care	7 (4%)	1 (2%)	8 (4%)
Died (in hospital/at scene)	12 (8%)	2 (4%)	14 (7%)
Left against medical advice	2 (1%)	1 (2%)	3 (1%)
Position			
Operator	125 (79%)	33 (62%)	158 (75%)
Passenger	12 (8%)	9 (17%)	21 (10%)
Occupant, unspecified	9 (6%)	6 (11%)	15 (7%)
Pedestrian/bystander	1 (1%)	1 (2%)	2 (1%)
Unknown	12 (8%)	4 (8%)	16 (8%)
Helmet used (known occupants)			
Yes	21 (13%)	5 (10%)	26 (13%)
No/unknown	125 (86%)	43 (90%)	168 (87%)

*SNF=skilled nursing facility

were again the chief reason for ATV-related hospitalizations (45% of principal diagnoses were fractures). The most commonly fractured body regions were skull, femur, and ankle. Other leading types of injuries included concussions and other traumatic brain injuries and gastrointestinal tract injuries, which included laceration/injury to the colon, pancreas, liver, kidney, and spleen. Forty-five percent of hospitalizations had costs covered by private insurance; Medicaid paid for another one-quarter of the stays. Nearly one-quarter of injured patients were uninsured.

Injuries among individuals 16 years and older

Among individuals 16 years of age and older, 10 people died (6%) and 151 were hospitalized (94%) due to an ATV-related injury. This group had a lower case fatality rate than the 6-15 year olds (6% vs. 10%, respectively). Males comprised the large majority (78%) of injuries. Hospitalized patients spent 1 to 27 days in acute care with an average of 5 days. Most patients were discharged home (81%), but 17% required additional medical care (inpatient rehabilitation, home health care, or skilled nursing care) and 2% left the hospital against medical advice. Eighty-one percent of injured people were operating an ATV at the time of the injury; 5% were passengers; 6% were unspecified occupants of an ATV; and two individuals were pedestrians/bystanders struck by an ATV (the remaining 11 were unknown). Helmet usage was least likely in this age group with 10% documented to be wearing one. A rollover was involved in 84 injuries (52%). Over one-third of individuals were struck or crushed by the ATV. Two-thirds of injuries with known circumstances did not involve a collision of the ATV with another object. Over one-quarter crashed into a fixed/stationary object (mainly trees, fences, and curbs), while 7% hit a moving object (two-thirds of those crashes were with a second ATV). Thirty individuals (19%) were drinking alcohol prior to their injury; 13 were using drugs (8%, including cocaine, marijuana, opiates,

amphetamines, and benzodiazepines). Sixty-three percent of the principal diagnoses for hospitalized injuries were fractures. Other leading types of injuries included internal injuries to the thorax, abdomen, or pelvis (15%) and intracranial lesions (9%). Forty-six percent of hospital patients were covered by private health insurance, while 27% were uninsured.

What can be done to prevent ATV-related injuries?

First and foremost, the powerful nature of ATVs must be respected and manufacturers' recommendations be taken into account when selecting and operating an ATV. Parents should enforce age restrictions and provide adequate supervision to children. An ATV is only as safe as its rider. Operators should attend a rider training course (courses available through the ATV Safety Institute www.atvsafety.org or local dealers) and become familiar with the ATV by reading the owner's manual and practicing their skills in an open off-road area free of obstacles. Operators must interact with the ATV while riding (by shifting and balancing weight in all directions) in order to turn and traverse inclines safely. Therefore, operators must ride within their skill sets; only with experience can more rugged terrain be handled. ATVs are designed for off-road use only and should not be operated on hard surfaces, such as pavement and concrete, particularly due to the difficulty in turning. Carrying passengers also makes ATVs harder to maneuver, so passengers should only ride on ATVs designed to accommodate more than one person. Safety gear is critical to preventing injuries. All operators and passengers should wear a properly fitted, securely fastened helmet that meets or exceeds safety standards (i.e., certified by the Department of Transportation, the American National Standards Institute, and/or the Snell Memorial Foundation). If the helmet is not equipped with a face shield, then goggles should be worn for eye protection. Additionally, proper clothing should be worn, including boots, gloves, and long pants and shirts. Riders on

extremely rugged terrain should consider wearing off-road racing gear, which is padded for additional protection. Finally, as with any other type of motor vehicle or machinery, ATVs should never be used while under the influence of drugs or alcohol.

Table 2. Proportion of Population and ATV-related Injuries by Race and Age Group, Oklahoma Residents*, 2007

	0-5 Years		6-15 Years		16 Years and Older	
	Population	Injured	Population	Injured	Population	Injured
American Indian	9.77%	0.00%	11.55%	13.16%	8.26%	2.13%
Asian	2.21%	0.00%	1.94%	0.00%	1.97%	1.42%
Black	12.24%	11.11%	11.41%	2.63%	7.71%	4.26%
White	75.79%	77.78%	75.11%	76.32%	82.05%	90.07%

*Excludes injured out-of-state residents and seven residents with unknown race

What are the ATV laws in Oklahoma?

Oklahoma's ATV safety legislation became effective November 1, 2007. In addition to statutes regarding registration and taxes, legislation in Oklahoma on ATV usage states that drivers and passengers under 18 years of age must wear a helmet when riding an ATV on public lands (parents, legal guardians, or the ATV owner are held responsible; privately owned property is exempt). Furthermore, drivers of any age on public lands may not carry passengers unless the ATV is designed specifically

by the manufacturer to accommodate others besides the operator. ATVs may only be operated on public streets and roadways to make a direct crossing from the end of one trail to another (during daylight hours only). The road must have a posted speed limit of 35 miles per hour or less and the ATV operator must have a valid driver's license and come to a complete stop before entering the roadway. Other usage on turnpikes or highways is prohibited. Descriptions of the legislation passed in other states can be found on the Consumer Product Safety Commission's ATV safety website: www.atvsafety.gov.

Figure 3. ATV-related Injuries by County of Injury,* Oklahoma, 2007

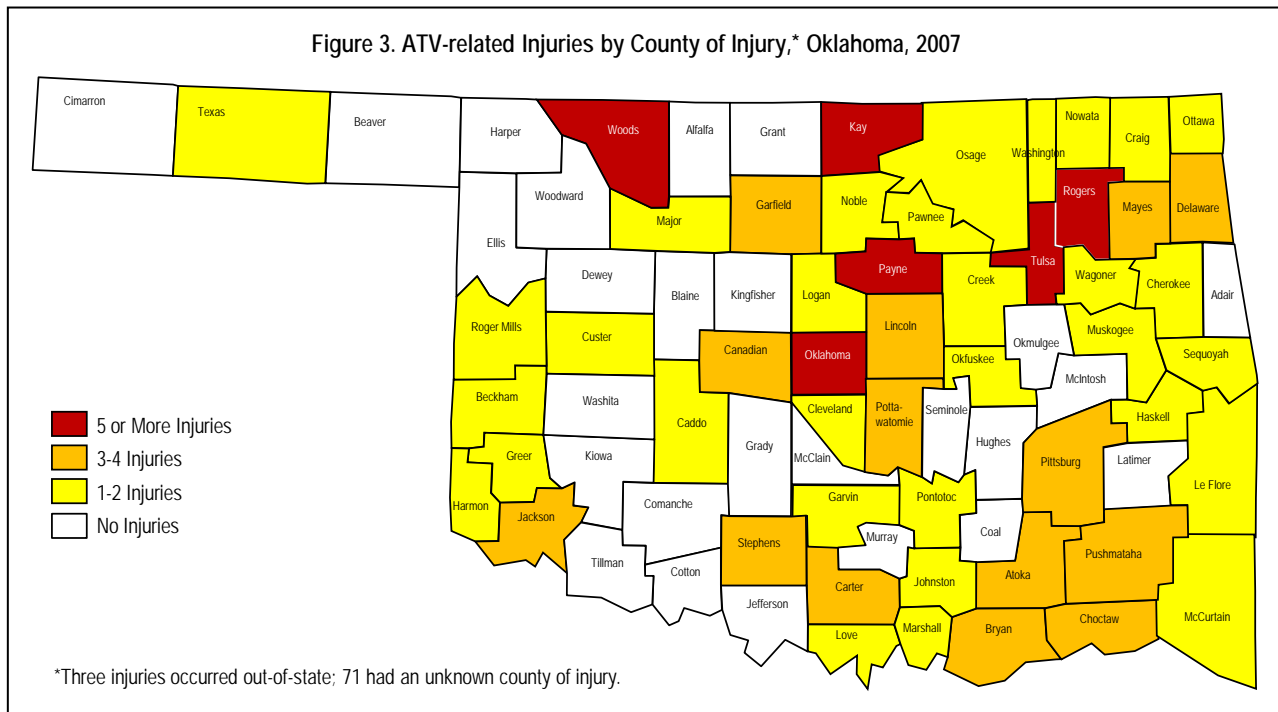
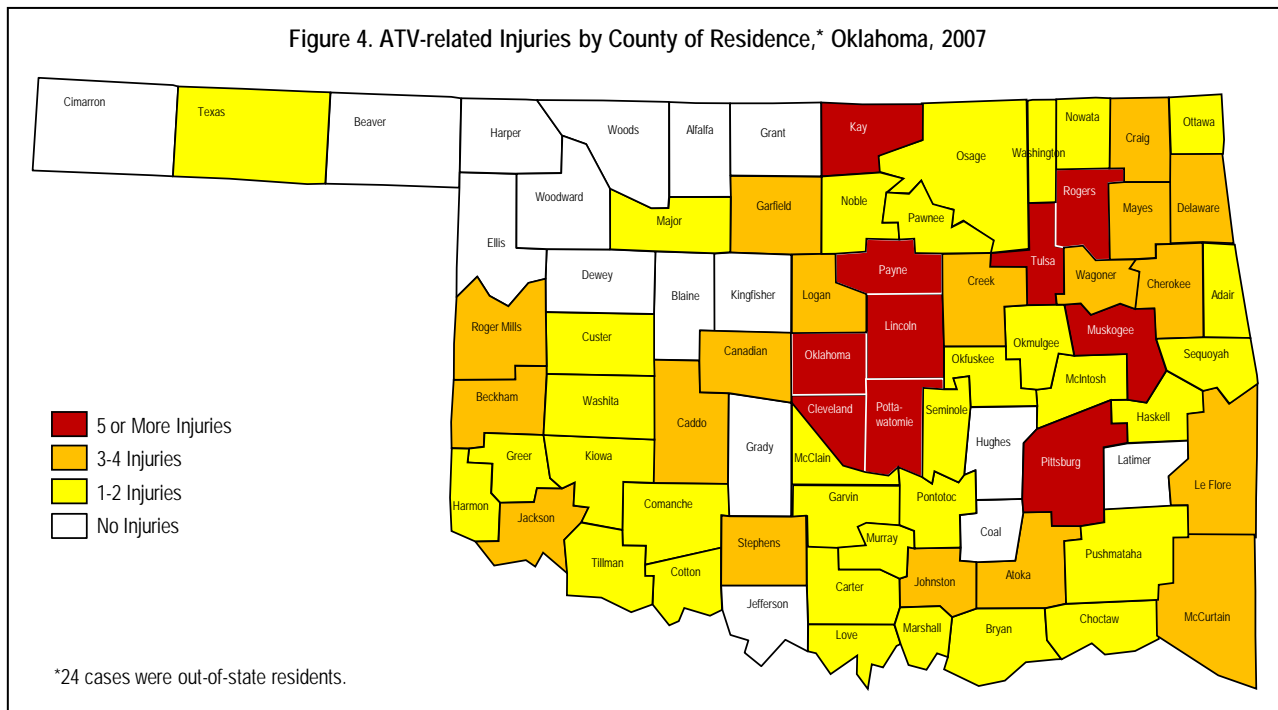


Figure 4. ATV-related Injuries by County of Residence,* Oklahoma, 2007



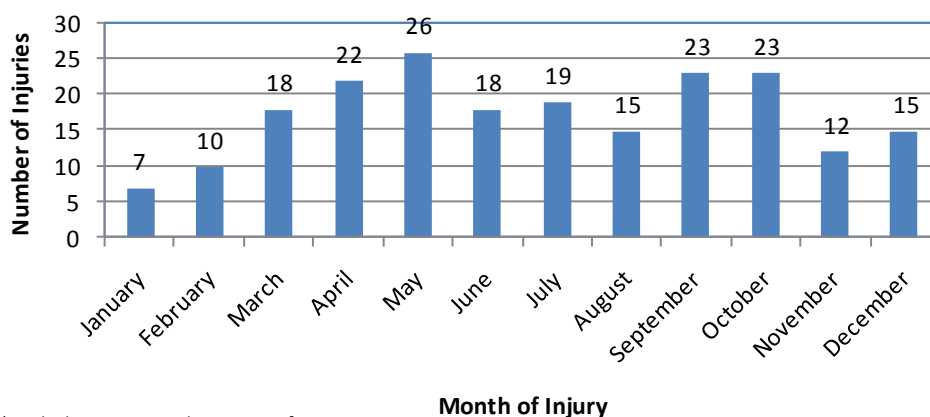
How did some of the injuries occur?

- A 31-year-old male was injured during an ATV rollover. The patient was under the influence of drugs and alcohol while riding an ATV at full speed standing up. He hit the brakes and the ATV rolled end-over-end, causing him to fly off the vehicle. Not wearing any safety gear, he suffered a lung contusion with acute respiratory failure, a concussion with loss of consciousness, and a fractured clavicle. After 11 days in the hospital, he left against medical advice.
- A 71-year-old male was in Oklahoma visiting some friends. After drinking some alcohol, the patient decided to ride an ATV for the first time. He was driving the ATV while following a friend on a motorcycle down a city street. When the friend looked back to check on the patient, he was not there. The man was found lying in the roadway and the ATV was flipped. The patient died shortly after arriving at the emergency room. His blood alcohol level was twice the legal limit (0.16%).
- A 54-year-old female was riding an ATV at the sand dunes of Little Sahara State Park. She hit a trench going approximately 30 miles per hour. The ATV rolled over and fell on top of her. She was not wearing a helmet or any other protective equipment. The patient spent two days in the hospital with a fractured clavicle.
- A 3-year-old male was riding with his mother on an ATV (sitting on her lap). He reportedly reached out and gunned the throttle. His mother attempted to brake, but the pair was ejected over the handlebars and into a barbed wire fence. No protective equipment was in use. The boy had severe neck lacerations with acute respiratory failure. He was discharged home after 20 days in the hospital.
- A 12-year-old female was driving an ATV with a passenger. The front wheels of her vehicle got caught on the back of another ATV, causing her ATV to flip. She was not wearing any safety gear. In addition to open wounds and contusions on her face, the patient sustained a concussion and lost consciousness for an unknown length of time. It was reported that she had recently been given the ATV.
- A 48-year-old male was helping his children with an ATV they received for Christmas. While reportedly "testing it out," the patient's pants got caught in a wheel, causing the ATV to roll over his right leg. He spent three days in the hospital with a fractured ankle and tibia.
- A 60-year-old female was with her husband and friends at a ranch. She took her husband's ATV and drove up a rocky hill along with some of the friends. The ATV rolled over backwards and the patient sustained multiple injuries to her face and chest. She was not wearing a helmet. She was airlifted to the hospital and pronounced dead in the emergency room. The patient had a blood alcohol level that was double the legal limit (0.16%).
- A 16-year-old male was driving a friend's ATV down an unfamiliar dirt road. Seeing the road ended with a metal fence, the patient stuck his leg out in an attempt to stop the ATV. The ATV collided with the fence and he spent two days in the hospital with a broken leg.
- An 8-year-old female was driving around her backyard on an ATV with her 5-year-old brother as a passenger. The patient's father reportedly had just "fixed" the ATV. The ATV struck a fence and flipped over onto the patient. Her brother jumped off prior to the crash.

The patient, who spent a week in the hospital, was not wearing any safety equipment and sustained multiple skull and facial fractures. The children's parents were in the kitchen cooking and did not witness the event.

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Figure 5. ATV-related Injuries by Month of Injury,* Oklahoma, 2007



*Excludes 4 cases with missing information