INJURY UPDATE

*A Report to Oklahoma Injury Surveillance Participants**

June 30, 2005

Injuries Treated in Hospitals Following the May 8 and 9, 2003 Tornadoes in Oklahoma City

Tornadoes are known to occur worldwide. The U.S. has the highest number of tornadoes compared to other nations in the world with over 1,000 tornadoes occurring annually. Nearly one-third of tornadoes in the U.S. occur in tornado alley – Texas, Oklahoma, Kansas and Nebraska. Oklahoma has the highest density of tornadoes and ranks second after Texas in the total number of killer tornadoes, followed by Arkansas. Tornadoes take on various shapes, sizes, and intensities including benign waterspouts and dust devils. Tornado severity is ranked on the Fujita Scale according to wind speed and damage; F0 tornadoes are the least severe, F6 tornadoes are the most severe (Figure 1). Nearly 55% of all tornadoes occur from April through June. In the southern U.S., tornadoes typically occur more frequently during March, April, and May, and in the northern U.S., tornadoes occur more frequently during the summer months. Nearly 80% of all tornadoes occur between noon and midnight, with the majority occurring between 3:00 and 9:00 p.m. Tornadoes can travel in any direction and may be indiscernible until they pick up dust and debris. The flying debris created by tornadoes is the most common cause of tornado-related deaths and injuries. While the annual number of tornadoes has been increasing in the U.S. since 1950, tornado-related deaths have been declining. This apparent trend is due to improvements in tornado detection technology and warning systems.

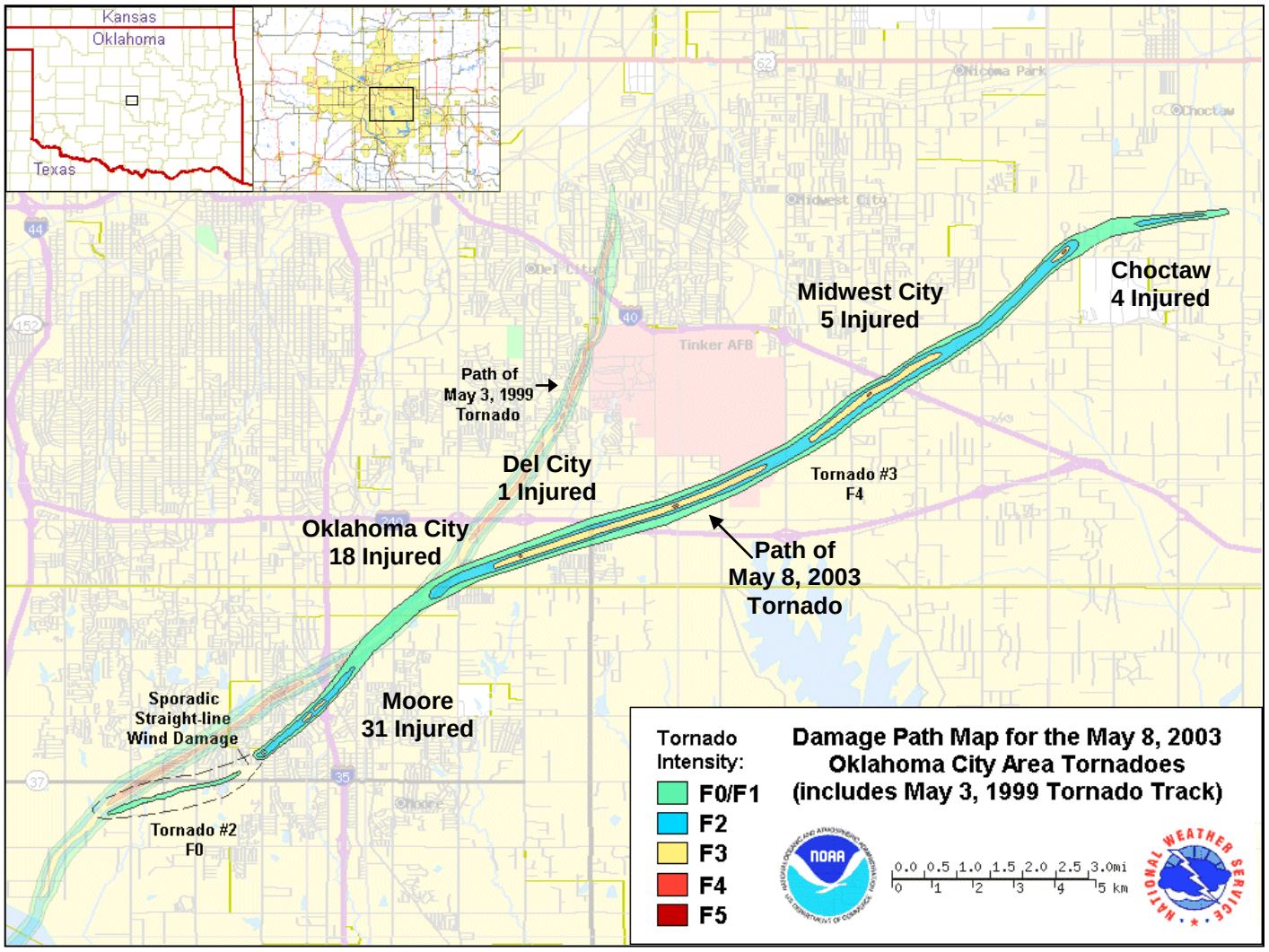
Figure 1. Fujita Scale

Tornado Strength	Wind Speed (mph)	Type of Damage (damage description)
F0	40-72	Chimney damage, branches broken, damages sign boards
F1	73-112	Mobile homes pushed off foundation or overturned (moderate).
F2	113-157	Considerable damage, mobile homes demolished, trees uprooted (considerable).
F3	158-206	Roofs and walls torn down, trains overturned, cars thrown (severe).
F4	207-260	Well-constructed walls leveled (devastating).
F5	261-318	Homes lifted off foundation and carried considerable distances, autos thrown as far as 100 meters; automobile-sized missiles (incredible).
F6	319-379	Missiles such as cars and refrigerators cause serious secondary damage; could be a small area of damage.

Source: Federal Emergency Management Agency

*The INJURY UPDATE is a report produced by the Injury Prevention Service, Oklahoma State Department of Health. Other issues of the INJURY UPDATE may be obtained from the Injury Prevention Service, Oklahoma State Department of Health, 1000 N.E. 10th Street, Oklahoma City, Oklahoma 73117-1299, 405/271-3430 or 1-800-522-0204 (in Oklahoma). INJURY UPDATES and other IPS information are also available at http://ips.health.ok.gov.

Figure 2. Number of Injured Persons* Along the Damage Path of the May 8, 2003 Tornado

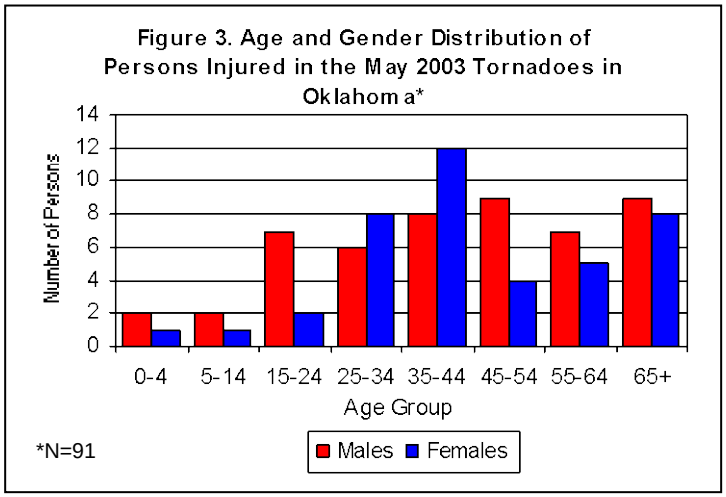


*The geographic location for 21 injured persons was unknown or other locations.

In May 2003, the U.S. experienced a record of 516 tornadoes, the highest monthly total for any given month since 1950. In Oklahoma County, five tornadoes occurred on May 8 and May 9, 2003. These tornadoes resulted in $405 million in property damage, one death, and 90 persons treated for injuries in area hospitals. One of these tornadoes reached F4 intensity and traveled a path of 17.3 miles across central Oklahoma leaving behind damage in Moore, Oklahoma City, Del City, Midwest City, and Choctaw (Figure 2). In response to the tornado disaster, the Oklahoma Commissioner of Health declared tornado-related deaths and injuries reportable conditions. The Oklahoma State Department of Health, Injury Prevention Service conducted an investigation of injured persons treated in area hospitals as a result of the tornadoes.

Data was collected from medical records of persons treated and released in an emergency department or admitted to a hospital. The data included demographics, information on how the injury occurred (preparing for the tornado, directly from the tornado, during search and rescue, during clean up), the types of injuries, and the locations where people were injured. A total of 91 persons were identified who had been injured as a result of the tornadoes. The vast majority of persons (80) were injured in the May 8, 2003, tornado and 11 persons were injured in the May 9, 2003 tornado. Sixty-three persons (69%) were injured directly in the tornado, seven persons (8%) were injured while preparing for the tornado (including one elderly person who died), and for 17 persons (19%) the mechanism of injury was unknown. Four persons (4%) were injured after

the tornado during cleanup, or search and rescue. In addition to the 91 persons who were injured, another eight persons were uninjured but were treated in an emergency department for panic disorders (2), anxiety attacks (1), asthma exacerbation (2) and shortness of breath (1). A bedfast patient was brought to the hospital because his house had been damaged. A 3-month-old infant was brought to an emergency department for medical evaluation because she had been a passenger in a vehicle that was involved in the tornado, and shattered glass pieces were found around the baby. The infant was uninjured.



Forty-five percent (41) of injured persons were female and 55% (50) were male. The mean age was 45 years (range less than 1 - 91 years, median=43 years). Eighty-four percent of injured persons were 25 years of age and older; 22% were 35-44 years of age, and 19% were 65 years of age and older (Figure 3). Fifty-nine persons (65%) were white, 15 persons (16%) were African-American, one person (1%) was Asian, and one person (1%) was Native American. Race was unknown for 15 (16%) persons. Twenty-four persons (26%) were admitted to a hospital, and 67 (74%) were treated and released from an emergency department. The mode of transport to the hospital was known for sixty-eight persons (75%); 50% (34) were transported by ambulance, 46% (31) were transported by private vehicle, 3% (2) walked or were carried, and one person was transported by helicopter. The medical payer status was known for 78 persons. Of these, the medical payer was documented as self-pay for 29 persons (37%), private insurance for 26 persons (33%), Medicaid/Medicare for 18 persons (23%), workers' compensation for one person (1%), and other insurance for four persons (5%).

Soft tissue injuries (cuts, scrapes, bruises) were the most common type of injury. The vast majority of all persons treated (87%) suffered soft tissue injuries, followed by fractures/dislocations (21%), strains and sprains (21%), brain injuries (9%), and foreign bodies (8%). Hospitalized persons suffered proportionally more fractures/dislocations than persons treated and released in emergency departments (46% and 12%, respectively), and proportionally more brain injuries than persons treated and released in emergency departments (17% and 6%, respectively) (Table 1). The causes of injuries were flying/falling debris (39%); vehicular (including crashes and overturning of vehicles) (34%); fall/tripping (3%); being thrown by the tornado (3%); collapsing buildings (2%); and other/unknown causes (19%).

The average length of hospitalization stay was 5.6 days (range 1 - 47 days, median=3 days). Sixty-three percent of hospitalized patients were discharged to home, 17% were discharged to a rehabilitation facility, 8% were discharged to home health care, one person (4%) left against medical advice, and the discharge disposition was not specified for one person (4%). Additionally, one person died one day following admission.

Seventy-nine percent (72) of injured persons were Oklahoma residents and 21% (19) were out-of-state

Table 1. Type of Injuries by Treatment Status, May 2003 Tornadoes, Oklahoma

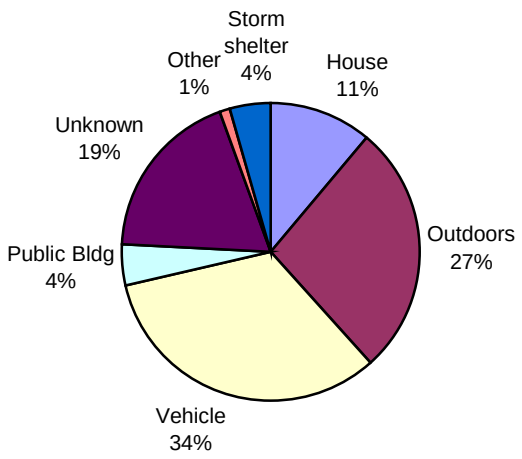
Type of Injury	Inpatient (N = 24) Number (%)*	Outpatient (N= 67) Number (%)*	Total (N= 91) Number (%)*
Soft Tissue Injuries	19 (79%)	60 (90%)	79 (87%)
Fractures/Dislocations	11 (46%)	8 (12%)	19 (21%)
Sprains/Strains	4 (17%)	15 (22%)	19 (21%)
Brain Injuries	4 (17%)	4 (6%)	8 (9%)
Foreign Body	3 (13%)	4 (6%)	7 (8%)
Other**	2 (8%)	3 (4%)	5 (6%)

*Percents do not total to 100% because persons may have had more than one injury
**Other injuries included nosebleed (1), eye injury (1), neurological (1), chest trauma (2).

residents. Other states of residence included Texas (9), Kansas (5), Colorado (1), Louisiana (1), Missouri (1), and Michigan (1). One person was a resident of Mexico.

The geographic location of injury was known for 64 (70%) persons. Of those, the majority (84%) of persons were in Moore and Oklahoma City when they were injured. Eight percent (5) of persons were in Midwest City, 6% (4) were in Choctaw, and one person (2%) was in Del City when injured. One-third (34%) of injured persons were located in vehicles, 27% were outdoors, 11% were inside houses, 4% were in storm shelters, and 4% were inside public buildings (Figure 4). The type of location was unknown for 17 persons (19%). Among the four persons injured in storm shelters, one person was hit by debris that blew into the shelter when the door blew off, one person fell down the cellar stairs, one person slammed the door on his hand, and one person slipped and fell while coming out of the shelter.

Figure 4. Injuries by Type of Location, May 2003 Tornadoes, Oklahoma



Prevention

Tornadoes can occur in many geographic settings. Planning and preparedness are the most effective measures for preventing deaths and injuries, especially in tornado-prone areas such as Oklahoma. Given the excellent weather prediction capabilities available today, there is often sufficient time to get to shelter before the tornado arrives. However, as effective as warning systems are, tornadoes are unpredictable and ample warning time may not always precede a tornado. In the absence of sufficient warning, visible signs of a tornado, including a dark, often green sky, a wall cloud, large hail, a loud roar, a cloud of debris, or an actual funnel cloud, warrant taking immediate safety action.

The path of the May 8, 2003 tornado paralleled that of the devastating May 3, 1999 tornado for some distance (Figure 2). The May 3, 1999 tornado was much more severe, leaving a widespread path of destruction with large areas of F3, F4, and F5 damage. By comparison, the May 8, 2003 tornado had a relatively narrow path of destruction with pockets of F4 damage.

The injury data presented in this report demonstrates that the majority of persons injured in the May 8, 2003 tornado were traveling in vehicles or were outdoors. This may be explained by the time of day when the May 8, 2003 tornado first struck the Oklahoma City area. It went through Moore and crossed I-35 at 5:12 p.m., when many people were getting off work. By comparison, the May 3, 1999 tornado reached the Moore area and crossed I-35 at 7:27 p.m. Most persons who were injured or killed in the May 3, 1999 tornadoes were inside houses. Additionally, the average estimated warning time for the May 8, 2003 tornado was somewhat less than for the May 3, 1999 tornado (15 minutes and 32 minutes, respectively).

In the May 3, 1999 tornado, death rates were highest in mobile homes, apartments, and outdoors, which is consistent with numerous other tornado reports. Leaving these locations before a tornado hits and finding substantial shelter is strongly recommended. Remaining calm while preparing for the tornado is also encouraged to prevent deaths and injuries, especially among the elderly and disabled. In both the May 3, 1999 and May 9, 2003 tornado events, elderly persons died while preparing for the tornado.

Public policies and programs that may reduce tornado injuries and deaths include subsidies and tax incentives for building storm shelters, reinforcing windows, and distributing weather radios. Additionally, individuals may take the following safety precautions to prevent tornado-related deaths and injuries:

Precautions to take before the tornado

- Have a weather radio on hand to receive warnings that may occur at night while sleeping and during power outages.
- Keep an emergency kit with first aid supplies, medications, flashlight, important documents (for identification, financial, and insurance purposes), keys, battery-operated radio, and a whistle to blow for help.
- Have a tornado safety plan including a pre-designated tornado safe place or shelter and a route to it.
- Check on the elderly, children, and pets when a tornado watch has been issued. Tornado watches may turn into tornado warnings within a few minutes.
- Evacuate vehicles and mobile homes in a tornado warning and find shelter in a permanent building until the danger passes.

Shelter and Protection

- Take shelter in a basement, underground storm shelter, cellar, or safe room.
- If there is no storm shelter, take shelter in the lowest level of the building in a centrally located area away from exterior walls and windows such as an interior hallway, closet, or bathroom.
- Protect the head with a bicycle or motorcycle helmet, if available.
- Protect the body from debris with blankets, coats or heavy clothing, pillows, and sturdy shoes.

After the tornado

- Exit damaged areas with care.
- Look for and stay clear of downed power lines, sparks, fires, harmful products, gas leaks, and loose debris.
- Use flashlights to check the damage. Do not use candles.
- Do not enter evacuated areas damaged by the tornado. These areas have been evacuated because they are very dangerous.

Additional safety material can be accessed on the following websites:

- http://www.spc.noaa.gov/faq/tornado/safety.html
- http://www.fema.gov/hazards/tornadoes/tornadof.shtm
- http://www.usatoday.com/weather/resources/safety/wtornado.htm
- http://www.tornadoproject.com

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