

Public Education and Awareness

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TORNADO EDUCATION AND AWARENESS IN THE UNITED STATES

Tornadoes were reported in colonial British North America as early as 1680 and by 1862 the Smithsonian Institution had a network of more than 500 volunteers reporting on tornadoes in the United States (Bradford 1999). The United States government published a study of 600 tornadoes in 1884 that provided an understanding of the meteorology of tornadoes and was a basis for later forecasting of the storms. Reports of 523 tornadoes from 1889 to 1896 and 1,458 deaths raised speculation that the number of tornadoes was increasing but it was found that the proliferation of telegraph lines and daily newspapers brought more of the storms to the public's attention (Bradford 1999). Government forecasts for tornadoes were prohibited during the early 20th century because they were thought to do more harm than good by causing panic. The United States had 4,151 deaths due to tornadoes during 1920-39, including one tornado that killed 695 in 1925. In recent years, the United States has recorded about 1,200 tornadoes per year, with about 150 of those strong or violent (EF-2 or stronger).

The death rate from tornadoes in the United States was about 2 per million per year from 1880 to 1925. After 1925, the death rate fell and is now about 0.2 per million per year (Doswell and co-workers 1999). The decrease is attributed to proliferation of radio and television, rapid dissemination of warnings, new communications, stronger buildings, and preparation through education. A major factor in the sharp decrease in death rates has been public awareness of the tornado hazard and the appropriate actions to take when a warning is issued (Doswell and co-workers 1999).

The first tornado forecasts were issued by the U.S. Air Force in Oklahoma in 1948. In 1952, the U.S. Weather Bureau initiated a tornado forecasting program (Doswell and co-workers 1999). Tornado warnings were issued when tornadoes were identified on radar or by storm spotters who watched the skies during severe weather and reported tornadoes. The Weather Bureau (now National Weather Service, NWS) began printing short (1-4 page) documents about tornadoes and tornado safety, awareness, and planning in the 1960s and this effort continues today. The Federal Emergency Management Agency (FEMA) and the American Red Cross are partners in the development and distribution of the information. Recent updates are given in <http://www.weather.gov/os/Aware/pdfs/09summer-aware.pdf> and <https://www.redcross.org/www-files/Documents/pdf/Preparedness/checklists/Tornado.pdf>.

When meteorological conditions favor tornadoes, the NWS Storm Prediction Center issues a “Tornado Watch” over a region of about 25,000 km² for a period of about 8 hours. This is intended to cause heightened awareness of the hazard but normal daily activities continue. If a tornado is seen and reported or if tornado rotation is observed on radar, the local NWS office issues a “Tornado Warning” for a smaller area (~1,000 km²) for about one hour. The Tornado Warning is intended to cause people to take immediate shelter from the storm threat.

The Tornado Warning is disseminated to the public through a variety of means. Weather Radio (from NWS) broadcasts the warning but few people have or use a Weather Radio. Most people receive the warning by television (Hammer and Schmidlin 2002, Schmidlin and co-workers 2009). Many people, upon hearing the warning, seek confirmation of the threat through observing the sky, calling a friend, or checking other media. Some communities have installed tornado warning sirens that alert residents when a warning is issued. Some warning services send an alert by computer or cellular telephone. The typical lead time between issuance of a warning and the occurrence of a tornado is 5-15 minutes (Bieringer and Ray 1996) and about 10% of tornadoes occur without advance warning (Brotzge and Erickson 2009).

Weather radar was installed at many locations in the United States in the 1950s and the WSR-88D Doppler radar became widespread in the 1990s. The percentage of tornadoes preceded by a tornado warning increased from 35% before Doppler radar installation to 60% after installation. Mean lead time for warnings increased from 5 minutes to 10 minutes. Fatalities and injuries were 40-45% lower after the Doppler radar was installed (Simmons and Sutter 2005).

Public education of the tornado risk and appropriate actions to take when a warning is issued begins in primary schools. Schools hold tornado drills during which teachers direct the students to the school’s tornado shelters. The shelters are usually a bathroom or an interior hallway without windows. The students crouch down and cover their heads until the threat is past. These are practiced once or twice annually in most cases. This practice continues through the secondary school years (age 18 years). Children take this information home and families choose a tornado shelter location in their homes, based on information on the NWS/American Red Cross brochures (web sites above). This is usually in the underground basement or a small interior room in the house.

States with some tornado risk have a “Tornado Safety Week” a few weeks before the peak of the tornado season. The purpose is to raise awareness and remind the public of tornado risks, warnings, and safety procedures. During that week (and throughout the year) the NWS issues tornado safety information that is distributed by television, newspapers, radio, and other media. Tornado safety brochures are distributed at public gatherings and web sites are advertised as sources of information. Businesses, government institutions, and universities designate locations as tornado shelters and remind employees of safety procedures. Public tornado warning devices, such as community sirens, are tested during Tornado Safety Week and throughout the year.

Communications are tested among the NWS, emergency managers, and other public safety offices. Major tornado events are analyzed and studied to expose failures in the processes of warning and shelter and to find best practices that were successful. To keep public awareness at a high level, anniversaries of major tornadoes are noted and used as a reminder of tornado hazards and safety procedures. Some deadly tornadoes are commemorated in books, films, or monuments.

The death toll from tornadoes in the United States is 50-100 annually in a population of about 300 million. These deaths are focused in two high risk populations – those living in mobile homes (weak housing) and the elderly. Tornadoes that occur at night are deadlier than daytime tornadoes. Public education of the tornado risk, tornado warnings, and safety procedures, along with effective government warnings, television, stronger buildings, and rapid communication, has drastically lowered the death rate from tornadoes in the United States since 1925.

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