

RESEARCH BRIEF SERIES WEATHER READY

This research brief is part of a call designed to help advance knowledge on how diverse community members receive, interpret, and respond to tornado watch and warning messages issued by the National Weather Service, as well as to deepen understanding of complex tornado impacts.

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TORNADOES WITHOUT WARNING: SEVERE WEATHER ALERTS, RISK PERCEPTION, AND PROTECTIVE ACTION DURING AN UNDETECTED TORNADO

OVERVIEW

On August 7, 2023, an EF-2 tornado touched down in western Knox County, Tennessee. This tornado was unique in multiple ways, including that it was the first August tornado on record in the county, the first significant tornado (EF-2 or greater) in the county in almost 60 years, and an undetected tornado.

No tornado *warning*—which indicates that a tornado has been spotted and encourages the public to seek shelter—had been issued. However, the National Weather Service’s Storm Prediction Center had issued a tornado *watch*—an earlier alert which tells the public that the atmospheric conditions can support the development of a tornado—and a series of Severe Thunderstorm Warnings that included “impact-based warning” tags regarding the possibility of tornadoes or destructive damage.

When tornado and severe weather watches and warnings are issued, broadcast media plays an essential role in their dissemination. This mixed methods study included interviews with television weathercasters in Knoxville (n = 4) to understand how they perceived and communicated tornado likelihood to the public, including how they used National Weather Service products. Drawing on a survey of Knox County residents (n = 287), we also examined how available information sources influenced the public’s risk perception and protective action decision-making, especially in the absence of a tornado warning.

This research provides important insights to improve risk communication and public safety during straight-line wind events.



*A collapsed garage after the EF-2 tornado in Knox County, Tennessee.
Source: National Weather Service Tornado Storm Damage Survey, 2023.*

KEY FINDINGS

- Leading up to the event, local weathercasters used daily risk maps from the National Weather Service’s Storm Prediction Center as well resources from the local Weather Forecasting Office to guide discussions of hazards. During the event, they largely focused on their own forecasts.
- Some details in the National Weather Service products were missed by the weathercasters as they juggled their own analysis and incoming information from both federal authorities and the public. Specifically, impact-based warning tags on alerts, such “tornado possible” tags on the Severe Thunderstorm Warnings, were largely overlooked.

- Leading up to the event, communications from both the Storm Prediction Center and the two television stations included in this study included a heavy emphasis on the wind threat; the day before the event, however, both TV stations mentioned “all hazards were possible.” Both emphasized that the public should remain aware of weather conditions and reminded viewers that they were under a tornado watch, meaning conditions for tornadoes were present.
- Local broadcast weathercasters communicated the severity of the severe thunderstorm, but they recognized viewers would likely not shelter without a strong tornado threat.
- Among survey respondents, approximately half (56%) recalled receiving the tornado watch; 82% of whom believed a tornado was unlikely. More respondents (85%) said that they received the Severe Thunderstorm Warning. However, 87% of them said that they thought a tornado was unlikely. This indicates that the impact-based warning tag was not seen or believed by most people who received the warning.
- Results from a logistic regression analysis indicate that those residents who received the watch or warning alert and perceived a high likelihood of a tornado did not have higher odds of taking protective action. In contrast, results from Mann-Whitney U tests suggest that those who received an alert and perceived a tornado as likely took more protective actions than those who did not expect a tornado.



Storm clouds gather during a growing thunderstorm. Severe Thunderstorm Warnings are often strongly associated with tornado potential.
Source: Shutterstock.com, 2026.

RESEARCH IMPLICATIONS

- Past research has shown that the media not only disseminate severe weather warning information, but also add their own interpretations. Weathercasters we interviewed demonstrated autonomy over their forecasts. Many are trained scientists, and several spoke of past events, demonstrating that their accumulated knowledge impacts how they analyze, perceive, and communicate risk.
- Impact-based warning tags provided vital information. However, our work demonstrates that these tags can be missed during the chaos of an unfolding severe weather event. If National Weather Service authorities would like weathercasters to see and communicate the tag, it would be useful to highlight it in the NWS Chat, a product where the National Weather Service discusses their forecasts privately with their partners.
- Results suggests that watches are not as frequently received as warnings. When they are received, they may not influence risk perception.
- Though perceptions of tornado likelihood were low, nearly half of the respondents who received the watch still sought more weather information throughout the day, supporting findings from previous studies that found people were more likely to seek out more information and cancel their plans after receiving a tornado watch in a hypothetical scenario.

AUDIENCE

This research is relevant to the National Weather Service and other forecasting agencies and practitioners working to develop effective, impact-based warning products to communicate the risk of severe weather.

Full report: Ellis, K., Corey, C., Faizer, M., & First, J. M. (2026). *Tornadoes Without Warning: Severe Weather Alerts, Risk Perception, and Protective Action During an Undetected Tornado*. (Natural Hazards Center Weather Ready Research Report Series, Report 23). Natural Hazards Center, University of Colorado Boulder. hazards.colorado.edu/weather-ready-research/tornadoes-without-warning



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