3A.4 THE GENERAL PUBLIC'S WEATHER INFORMATION-SEEKING AND DECISION-MAKING BEHAVIOR DURING TORNADO OUTBREAKS IN THE OKLAHOMA CITY METROPLEX IN MAY 2013

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1. SEVERE WEATHER INFORMATION AND THE GENERAL PUBLIC

In May of 2013, several devastating tornado outbreaks in Oklahoma attracted national attention. These events drew attention to how people inform themselves about severe weather threats in order to strengthen severe weather preparedness. Previous research about the public's responses during the Alabama 2011 tornado season indicated that television broadcasts were the primary source of information during that event (Mullins, Schultz, Knupp, & Klockow, 2012).

Sorenson (2000) found that the public receives severe weather information through many different media. Furthermore, the presentation style of a warning influenced the type of response members of the public would make. After the May 3, 1999 tornado in Moore OK, Hammer and Schmidlin (2002) used a behavioral response survey to identify response patterns of those affected. They found that 47% of respondents left their home, and of those same respondents, 65% fled to a storm shelter.

As new technology develop, new forms of media are being used to convey severe weather information to public. The present study sought to understand how general public seek severe weather information, and how they make decisions based on severe weather information before, during, and after each tornado events in the May 2013 tornado season. The tornados of interest occurred on May 19 (Little Axe - Shawnee), May 20 (Newcastle - Moore), and May 31 (El Reno - Oklahoma City). Using a behavioral response survey, the researchers questioned residents of the Oklahoma City metroplex about their experiences in May 2013 as well as about which information sources they used and how.

2. METHODOLOGY

2.1 *Survey Design*

The survey encapsulated four distinct sections; participants' weather background (10 questions), sources of information and responses (7 questions), open-ended responses about experiences during severe weather (4 questions), and demographics (8 questions). The survey was administered online as well as through face-to-face methods.

2.2 *Participants*

Participants were recruited from public locations around the Oklahoma City metroplex and via postings on Facebook and emails in July 2013, which is around two months after the Tornado events in May. No compensation for participation was provided. Participants were given the choice to complete the survey in-person or online.

In total, the sample included 124 participants, though some participants only provided partial responses. Of those who responded, 62.5% were female and 37.5% were male (n = 96) and were at least 18 years old. When asked about their geographic proximity to any of the Oklahoma tornadoes in May 2013, 86% of the respondents had been within 5 miles of at least one tornado's path.

Participant demographics varied in terms of family, education, and socioeconomic level. 54.6% of respondents were married and 45.4% were single (n = 97). With respect to children, 45% of the respondents had at least one child living with them in their home (n = 98). In terms of property ownership, 72.2% of respondents owned their own residence, and the remaining

participants rented (n = 97). All participants had a high school education at the minimum.

Though only 5.5% of the participants were associated with a weather-related field such as meteorological science, forecasting, or storm chasing, all participants had some experience in dealing with severe weather. Many participants had lived in a tornado-prone region for more than 25 years (48.6%), though 40.5% had lived in a tornado-prone region for between 6 to 25 years. Few participants had lived in an area with tornados for fewer than 5 years (10.8%), which shows that the majority of the participants ought to have had some time to become familiar with severe weather safety before the 2013 tornado season.

3. RESULTS

3.1 *Sources for Severe Weather Information*

Several questions sought to identify which information sources participants used at different points surrounding the May 2013 tornados. Time points of interest were those leading up to a tornado event, during a tornado event, and after a tornado event subsided.

Results showed that television news sources were the most frequently used medium to access information, followed by tornado sirens and smart devices. The distribution of information source usage before each of the May 2013 tornados is shown in Figure 1. Due to the different locations of the tornado outbreak, the same survey respondents may experience one, two, or all events. That is why we had different sample size for each of the tornado events- n=65 for May 19 event, n=82 for May 20 event, and n=85 for May 31 event.

When asked what the one most important warning or emergency alert was that caused them to take shelter during each of the three tornados, participants responded in a variety of ways, shown in Figure 2. In the May 19 and May 31 outbreaks, the most frequent response was that participants did not take shelter at all (36.9% and 29.4%, respectively, and n = 65 and n = 85, respectively). Out of the participants who did take shelter on May 19, the tornado sirens were cited most frequently as the largest contributing factor (18.5%, n = 65). On May 20, fewer respondents neglected to take shelter, and 26.8% (n = 82) of respondents cited the tornado siren as the primary reason they chose to take shelter. Interestingly, on May 31, an equal number of participants who took shelter attributed their actions either to tornado sirens (18.8%, n = 85) or due to remarks made by television/radio personalities (18.8%, n = 85).

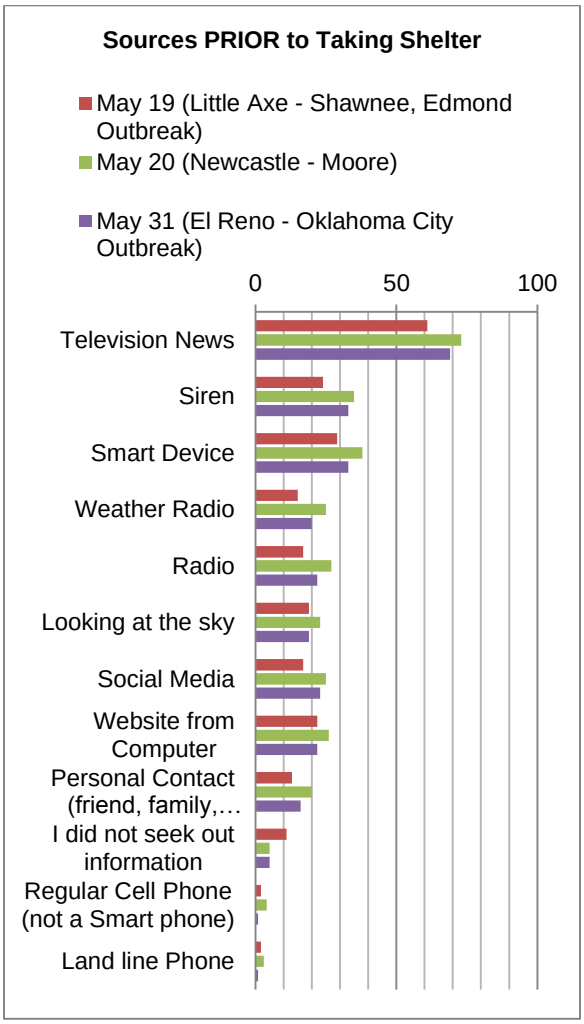

Figure 1. Counts of information sources used before a May 2013 Oklahoma tornado

After taking shelter, participants primarily used television news and smart devices to retrieve information about the weather. In fact, as shown in Figure 3, respondents used smart devices more frequently during the May 31 tornado than television news in either the May 19 or May 31 events. Participants relied less upon sirens after taking shelter.

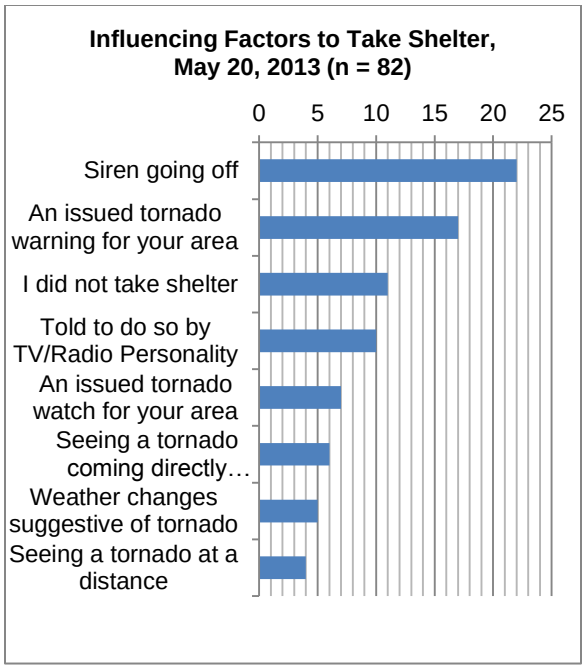

Figure 2. What was the ONE warning/emergency alert that caused you to take shelter?

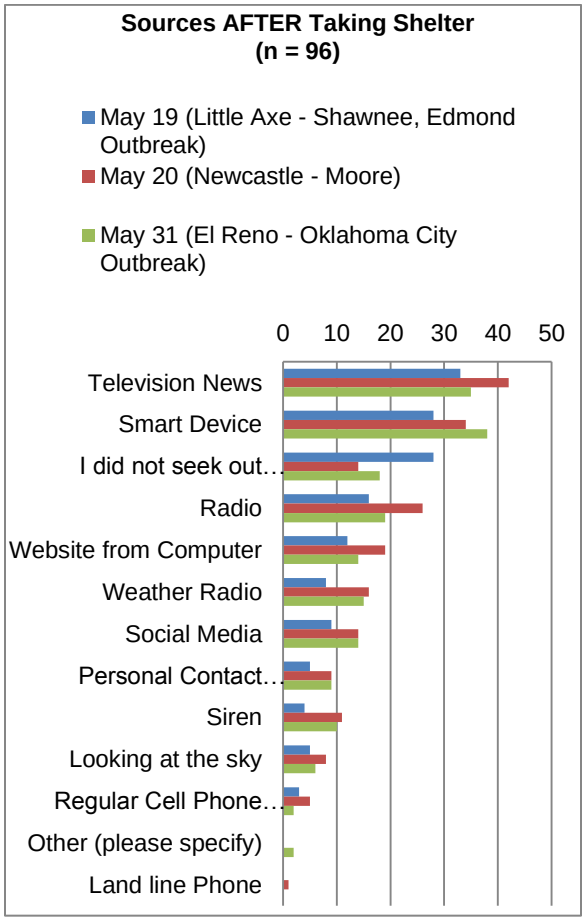

Figure 3. Most common information sources after taking shelter in May 2013

3.2 *Trust in Information Sources*

When asked to rate each information source in terms of how often participants trust them, television news was trusted the most often (μ = 4.59, n = 109). Trust ratings were measured on a 5-point scale ranging from 1 ("not at all") to 5 ("always"). After television sources, participants trusted sirens, radio alerts, and smart device apps most (μ = 4.04, 3.65, and 3.33, respectively). The least-trusted sources were social media, pager/phone warnings, and word-of-mouth (μ = 2.31, 2.52, and 2.69, respectively).

3.3 *Safety Precautionary Behavior*

After determining primary information sources, several survey questions addressed precautionary behavior that participants took during each tornado. Out of the participants who were present in the immediate area of each storm, the majority vigilantly sought out weather reports to stay informed about the event, shown in Figure 4. Particularly in the May 20 tornado, many respondents chose to take shelter in an interior room or closet compared to the other two events.

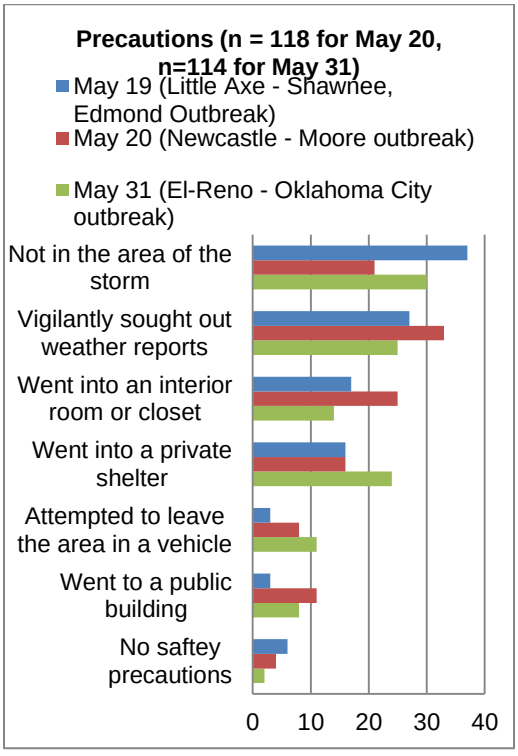

Figure 4. Precautionary behavior taken during each tornado

In addition to precautions taken during each storm, participants responded to questions about the precautions they took leading up to each storm. Figure 5,Figure **6**, and Figure **7** show to frequency of responses regarding how participants reacted to issuances of tornado watches, warnings, and siren alerts.

In response to learning that a tornado watch had been issued for their area, most respondents stated that they vigilantly sought out weather reports during each storm. Some began to prepare their house for a storm and call someone.

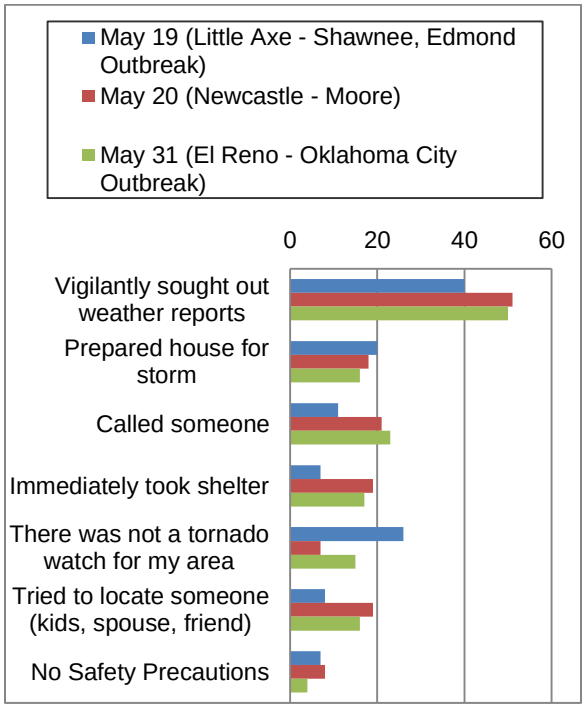

Figure 5. Response to a tornado watch

After learning that a tornado warning had been issued for their area, most respondents continued to seek out weather reports, shown in Figure 6. Of those with a tornado in their area, the second most common response was to take shelter.

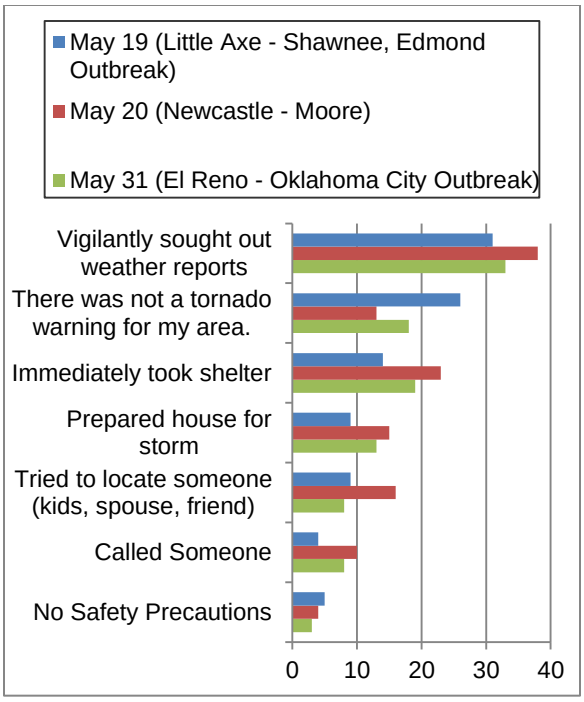

Figure 6. Response to a tornado warning

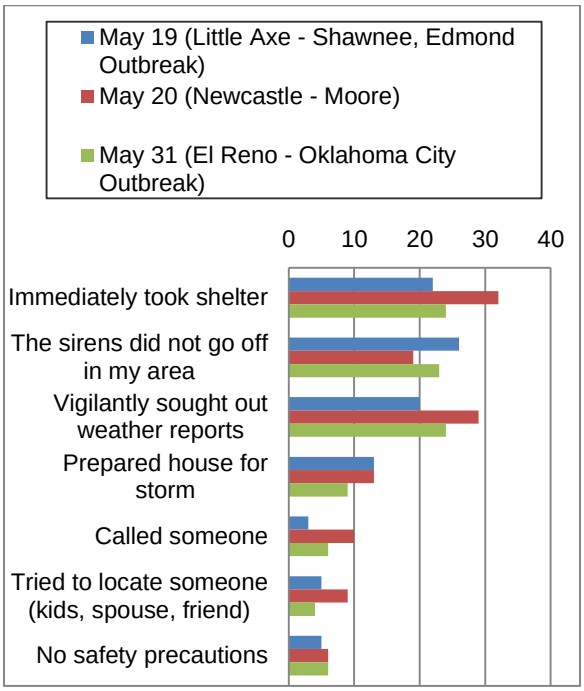

Figure 7. Response to sirens

In response to sirens, many participants took shelter immediately. Particularly in the May 20 event, a large number of participants also stated that they sought of further information when they heard the sirens, as shown in Figure 7.

4. DISCUSSION

The results of this survey present illuminate several trends. Similar to the work of Mullins et al. (2012), the present survey also found that television news sources were the most commonly-used and most trusted mode to receive weather information. Participants in the present study also used and trusted sirens, smart devices, and weather radios. The emergence of smart devices as a source of trusted weather information indicates that mobile applications may be becoming a common channel for weather risk communications.

In terms of weather-related decision-making, the survey results pointed to changes in response over the course of the three tornados. For example, between the May 20 and May 31 events, fewer participants sought shelter in an interior room; on May 20, 26% of respondents in the tornados path went to an interior room, while 17% took the same action during the May 31 tornado. Conversely, the proportion of participants who went to a private shelter increased from 16% to 29% from May 20 to May 31. Though a smaller increase, the number of participants who left the area in a vehicle during the events also increased; on May 20, 8% fled the area in a vehicle, while on May 31, 13% did. This analysis of weather decision-making reflects changes in behavior over the course of the three events.

Participants who fled the area in vehicles were asked for an open-ended response about why they chose to leave (n = 56). Responses varied, but common themes emerged related to fear of the weather (n = 3), lack of a safe room (n = 7), being advised to by a television personality or friend (n = 3). However, when participants who did not flee were asked why they stayed, many cited the belief that it was safer to stay where they were.

The responses regarding how participants reacted to watches, warnings, and sirens indicate that the different alerts influence the public to react in slightly different ways. During tornado watches, participants primarily sought out information about the weather, prepared their residences for the storm, and called someone else. In response to a warning or a siren, participants also commonly prepared their houses for the storm. During tornado warnings, it was most common for participants to seek out further information; this may be related to the current warning system, which is not specific about the storm's location. It is possible that the lack of information about a more specific storm location in a warning message may have influenced the public to seek more information before sheltering. Conversely, when a siren sounded, many participants immediately took shelter. Sirens may put a stronger sense of urgency into the public that influences them to react quickly.

5. CONCLUSIONS

The results of this study highlight the importance of thoroughly communicating weather information to the general public, especially via television sources. The public responded to alerts like sirens and warnings with more urgency than to alerts like watches. Even between warnings and sirens, participants continued to seek information instead of taking shelter, possibly due to lack of specificity in the warning messages. This suggests that providing accurate weather information in terms of storm severity and path is vital to eliciting desired behavior in the public.

6. ACKNOWLEDGEMENTS

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