Middletown, USA: Perceptions of the Severe Storm Threat

An Honors Thesis (HONRS 499)

by

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Abstract

This study examines public perceptions of the severe thunderstorm threat and knowledge regarding preparedness for severe convective storms within the rural American Midwest. The study instrument is a survey designed to assess respondents' knowledge regarding severe thunderstorms through the use of both Likert scale and binary response questions. Results of this research may be an important consideration when constructing Severe Thunderstorm and/or Tornado Warning messages, as well as in planning public education endeavors regarding severe weather. Potential users of this information include the National Weather Service, broadcast media, and emergency management personnel.

The locational setting for this study is Muncie, Indiana and surrounding rural areas of Delaware County. Reasons for this are based on the identification of Muncie as “Middletown U.S.A.” by social scientists searching for a single city representative of the entire American Midwest region. As a result, the information gained from this research may be valid for many rural communities within the Midwestern United States.

Results of the survey suggest that: 1) residents of Muncie believe flash flooding presents the least of all severe weather threats despite statistics that suggest the opposite; 2) severe straight-line winds are much less a threat than tornadoes, even though they are much more common; 3) an overpass provides the best shelter when out on the road, which has been shown not to be the case; and 4) that people should not attempt to drive away from a storm as it approached. Stratification of survey results suggest some of these perceptions are dependent upon respondents' age, gender, and residential location (city versus rural environment).
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Introduction

Severe thunderstorms produce a variety of significant weather events ranging from “straight-line” winds to flash flooding, hail, lightning, and tornadoes. Since the goal of the majority of those involved with severe weather preparedness is to disseminate severe weather information to the public, it would be a distinct advantage to better understand the knowledge of that audience. For this reason the present study seeks to gather information regarding perceptions and knowledge of severe weather by citizens of Delaware County, Indiana through the use of a survey instrument.

Muncie, Indiana is located within Delaware County, considered to represent the ‘average’ city of the central United States (Lynd and Lynd, 1929). Assuming this to be the case, attitudes of its citizenry might very well represent a good proportion of Midwest residents in general. For this reason the results of the study are likely applicable to most middle-sized cities within the Midwestern United States.
Methods

a. Survey Development

The survey instrument is designed to determine respondents’ knowledge regarding frequency of severe thunderstorms and appropriate actions to take during these events. Most question types used in the survey are based on Likert scales (Orlich, 1978) ranging from one to five. Other binary “yes” or “no” questions are also posed. A variety of multiple-choice questions are also included to stratify respondent responses based on demographic information.

Within the demographic section of the survey are questions regarding respondents’ gender, age, zip code, and numbers and ages of children living at home. The age ranges are divided into 10-year classes beginning with 20 and ending at 59. Categories of ‘19 and below’ and ‘60 and above’ are also included. The age range of children living at home is divided into groups spanning four years, beginning with 3 and ending with 18. Categories of ‘No children’ and ‘Under 2’ categories are also provided. The regions defined by zip codes are all located within Delaware County, Indiana.

There are four sections of Likert scale questions, each containing five ordinal questions with answer values ranging from one to five. The first set addresses the respondent’s perception of the frequency of each severe thunderstorm threat type; i.e., “straight-line” winds, flash flooding, hail, lightning, and tornadoes.

The next three sets are used to determine respondents’ levels of concern regarding each severe thunderstorm threat. The first of these three deals with their concern when at home, the second when outside, and the third when in an automobile.
A set of multiple-choice questions are also developed to determine respondents sources of weather information during severe thunderstorms, as well as the time of day they believe severe thunderstorms are most likely to occur.

The selection possibilities for sources of severe weather information are television, radio, Internet, and NOAA Weather Radio, with the option of writing in the specific station or web page from which they obtain their information. There are four selection options for diurnal time periods during which the respondents believe thunderstorms most frequently occur based on six-hour increments beginning at midnight.

The questions that follow this section address actions that participants should or should not take when their county is under a severe thunderstorm or tornado warning. These questions are grouped according to respondent location; i.e., inside their homes, out of doors, or in a car.

The final six questions address the respondent’s knowledge of the Delaware County outdoor warning siren system and appropriate actions to take when the severe thunderstorm threat has passed.

b. Survey Administration

With the assistance of the Delaware County Emergency Management Agency, 500 copies of the survey instrument and cover letter were printed, along with mailing labels of randomly selected county addresses. Each survey was given a unique number that matched up with a specific address for tracking purposes. The survey was mailed through the United States Postal Service in envelopes containing a cover letter, survey form, and self-addressed stamped return envelope.
Upon completion and return of the surveys, the results are entered into an Excel spreadsheet. For questions that were not answered, or when a respondent provided multiple answers to a question, a null score is given. Once completed, the spreadsheet is then submitted to the University Computing Services for statistical analysis.

c. Statistical Analysis

The statistical analysis compares respondent responses based on zip code, gender, age, and age range of children living at home, through use of Analysis of Variance (ANOVA) tests ($\alpha = 0.10$).

The descriptive statistical analyses list the sample size, mean, standard deviation, and standard error for each demographic group by question. The two questions that allow for multiple responses are excluded from the descriptive analysis. The ANOVA test involves separating sample data into subsets to test for independence between demographic groups (Earickson and Harlin, 1994).
Results and Discussion

Results from the Delaware County residents appeared to be somewhat dependent on demographics. This is conspicuous in the Likert scale question responses as well as the more specific survey questions. Examples include perceptions of how to respond when outside during a storm, the perceived threat of lightning, and knowledge of the outdoor warning sirens. As a result, it appears the type of severe weather information provided may need to be adjusted according to individual audience types.

Gender may also be a significant factor in responses since men and women perceive and react to situations differently (Eitzer and Geiger, 1996). The respondents in this sample tended to be dominated by females with almost a two to one ratio (Figure 1). It also appears results may be biased toward respondents in the middle age and older groups since more than two-thirds of the sample is aged above 40 years, with many of the respondents '60 and above'. In contrast, only one respondent marked his or her age as '19 and below', with ten individuals between '20 – 29' years of age.

While the question regarding children living at home allowed for multiple responses, the majority of respondents (61%) indicated they had no children living at home. This does not necessarily mean that the respondents had no children since some may be now grown and

![Fig. 1. Number of survey responses received according to gender.](image-url)
independent. Of those that indicated they had children living at home, there was an even
distribution across the range of ages (Figure 2).

Recognizing the media source from which the respondent receives severe weather
information during an event is an important consideration in designing a severe weather

![Figure 2. Number of survey responses received according to the age
ranges of children living at home.](image)

awareness program. In this survey, the two sources receiving a majority of the responses are television (85%) and radio (57%). The other options, Internet (13%) and NOAA Weather Radio (3%), seem to be used much less frequently.

There are three primary zip code zones in which a majority of the respondents report to live: 47302, 47303, and 47304 (Figure 3). Seven other zip codes are reported, but the largest number of responses for any one of these zones is four (Figure 3). The three zip codes with the greatest response rates are located within the city of Muncie, while the others are found in rural Delaware County. There were very few respondents with zip codes of 47305 and 47306, which represent downtown Muncie and the campus of Ball State University respectively. This is due to both a lack of surveys sent to these areas (7), as well as a lack of responses from those that did receive them.
Fig. 3. Delaware County, Indiana divided by zip codes (solid lines). The hatched line delineates the corporate city limits of Muncie, Indiana, and the parenthetical numbers below the zip codes note the number of responses received from that zip code. The 47306 zip code (Ball State University) is divided into two areas, so the number of responses was placed between the two areas.
The first set of Likert scale questions is used to determine perceived frequency of each thunderstorm threat type. With the mean response for each threat provided on a scale of one to five, the greatest perceived threat is lightning (3.37), followed by “straight-line” winds (2.45), tornadoes (2.21), hail (2.15), and flash flooding (1.98) (Figure 4). While lightning is a significant threat with severe thunderstorms, it is also common with non-severe thunderstorms as well. This might help explain why it is perceived as more significant than any of the other threat types.

Tornadoes are perceived to be more frequent than either hail or lightning, but this may be the result of media coverage that doesn’t focus as much attention on the other event types.

The next sets of questions are designed to gauge the level of concern regarding safety of the respondent and his or her family. Examining each individually, the most significant perceived threat appears to be tornadoes. The mean level of concern for inside the home is 3.05, outside 3.55, and in a car 3.37. Each of these mean values is above the medium level of concern (3.00), meaning respondents are most concerned with tornadoes, especially when outside of their homes.

Responses to the threat of lightning differ based on location. The concern for lightning when outdoors (3.64) is the greatest of all threat types and locations. In contrast, when residents are inside their homes the threat score is 2.76, and while in a car it is 2.84. Most respondents are
correct in their perception that the safest location during a thunderstorm is indoors, with outside being the least safe.

A mean threat response score of 2.90 was noted for severe straight-line winds when residents are out of doors, a location where people would be at greatest risk. This suggests the public is only marginally concerned with this event type. The straight-line wind threat is perceived as even less significant when traveling by automobile (2.69), and when residents are inside their homes (2.36).

This lack of concern for severe straight-line winds, especially when compared to the mean threat response scores for tornadoes, is a very significant discovery. Although tornadoes are perceived as the greater threat, severe straight-line winds are capable of damage equivalent to a weak tornado on the Fujita damage scale (Grazulis, 1993; Pryor and Kurzahl, 1997). In fact, most tornadoes are rated at the low-end of the F-scale (Kelly et al., 1978), and straight-line wind damage occurs more frequently than do tornadoes (Speheger et al., 1990) in Indiana (Figure 5).

The mean responses for the hail threat reveal a large difference in perception relative to location. Scores ranged from 1.98 when inside the home, compared to 2.77 outside, and 2.88 while within a car. It is understandable why a home or other comparable structure may be
perceived as a safe environment from the impact of hail, unless hailstones are of extraordinarily large size. The reason for greater concern outdoors may be related to the direct exposure to falling hail, with similar concerns in a car attributed to the added danger of driving on balls of ice, as well as damage that may occur to the windows and car body. For example, it is well known that storm chasers often experience damage to their vehicles due to falling hail.

The final threat, flash flooding, received the lowest score of all the threat types for each location. Its highest level (2.69) is for cars, followed by out-of-doors locations (2.28), and within the home (1.81). The perceived threat of flash flooding is higher when inside a car since one potentially encounters more flooding simply by driving on roadways. In addition, it takes only about a foot and a half of water to carry away a vehicle, especially when there are unseen currents in the water (www.nws.noaa.gov/os/water/tadd/Buoyancy.shtml). The White River is the main water body in Delaware County, so those living nearby are more prone to experience the effects of flooding.

Following the Likert scale sections is a series of binary “yes/no” questions that address actions respondents can take during severe thunderstorm events. There is also a set of multiple-choice questions regarding outdoor warning sirens in Delaware County.

Unlike the previous questions that dealt with perception of threats, there are correct answers to these questions. The majority of the questions (65%) result in an overwhelming response in favor of the correct answer, although 35% represents a notable number of responses that are incorrect. This rather significant number of incorrect responses warrants further future investigation.

Seeking shelter while inside the home is an important concern when preparing for severe weather. Respondents were asked whether or not crouching beneath a sturdy piece of furniture is
an appropriate action to take when in a severe thunderstorm. Although 57% of the respondents choose the correct answer (yes), 33% selected “no”. One explanation for the large number of incorrect responses may be found in the wording of the question itself, since one might not take this action under a severe thunderstorm warning, but would if under a tornado warning.

Interesting results are also found within the section addressing actions taken if outside when a severe thunderstorm or tornado warning issued. Question 37 suggests the action of lying as flat as possible on the ground in an open field, while Question 39 deals with residents crouching down on their feet while covering their heads. Seventy-eight percent of the respondents believe that it is correct to lie flat in a field, while 14% believe it is not. On the other hand, only 22% of the respondents think it is a good idea to crouch on their feet and cover their heads, while 65% felt it is not.

When outdoors, the primary thunderstorm threat is lightning (www.lightningsafety.noaa.gov/). To avoid being struck by lightning, authorities advise that one should crouch on the balls of his or her feet rather than lying flat on the ground. This is because lightning could strike the ground within the general vicinity of the person and travel through the ground to where he or she is located. This scenario is more likely to affect a person who is lying down since more surface area of their body is in contact with the ground, opposed to a person crouched on the balls of their feet.

Question 41 asks whether or not the respondent should stop under an overpass while in a car if a severe thunderstorm or tornado warning is issued for their county. There are an equal number of yes answers and no answers to this question. Those respondents that answered yes may have been influenced by video that was shot by a camera crew seeking shelter underneath an overpass in Kansas during the early 1990s. In this video an approaching tornado was caught
on tape while the crew and some civilians climbed under the girders of an overpass. This footage has been aired on television as a part of many severe weather specials to support the idea of using an overpass as shelter. In truth, this provides greater danger since wind speed within a tornado increases with height, and the overpass itself creates a ‘wind tunnel’ effect. The reason that the camera crew survived in this case is because the tornado was weak (FO on the Fujita scale), and it did not pass directly over their position. Those who did not think it was a good idea to seek shelter under an overpass may have been influenced by the efforts in the weather community to dispel the false sense of security the overpass seemingly provides based on this video.

Question 42 is used to determine whether respondents feel they should attempt to drive away from an approaching storm. Those that think they should (25% of the responses) are clearly in the minority compared to those that don’t (67%). While the subject of whether or not the public should be advised to drive away from tornadoes remains under debate. Many in the meteorological community believe it is an idea worth pursuing further (Schmidlin and King, 1996).

The Question 46 action ‘Once the outdoor warning sirens stop, the severe weather threat has passed,’ is chosen correctly by 75% of the respondents, while only 20% chose the incorrect response. The outdoor warning sirens operate when there is a tornado on the ground, if an imminent threat of a tornado exists, or if strong downburst wind events are expected. This siren only sounds for 30 seconds unless purposely repeated in the case of a particularly serious event.

The two other questions regarding outdoor warning sirens (45 and 47) provide even more interesting results, not the least of which is that a large proportion of respondents did not even respond to these questions (20% for each). The largest proportion of respondents that failed to
indicate an answer to any previous question is 13% (Question 39). One factor that could explain the lack of response to Question 47 is that many respondents indicated they are unable to hear the outdoor warning sirens. Another possibility is that the respondents are not aware of the correct answers, so they chose not to respond.

Respondents omitted other questions as well, with the exception of those more demographic in nature. The mean null response rate beginning with Question seven is 6.4 per question, based on 102 completed surveys. In comparison, the mean null response rate for the Likert scale questions is 3.2 per question, while the rate for the other questions is 9.0. Respondents seem to feel more comfortable and have a better understanding of the Likert scale questions as opposed to the other question styles since there were fewer null responses with them.

The responses were further analyzed using ANOVA tests based on a significance level of \( \alpha = 0.10 \). These analyses revealed that statistically significant differences exist between groups based on age, gender, and zip code for 11 of the 44 questions. The majority of these differences are found between age groups.
The first of the statistically significant differences is found in Question 44, revealing that when in a car, women favor stopping on the side of the road and lying in a ditch if the county is under a severe thunderstorm or tornado warning. The male respondents, however, did not feel this to be an appropriate action. Further investigation is needed to determine why such differing opinions exist.

For the question dealing with appropriate actions when outdoor warning sirens are activated (Question 45), respondents are provided four possible answers: the area is under a tornado watch; the area is under a tornado warning; there is an imminent severe weather threat and shelter should be sought immediately; and the severe weather threat has passed. Of the choices provided, women feel outdoor warning sirens mean an imminent severe weather threat existed and they should seek cover immediately. Men, on the other hand, believe that sirens mean the area is under a tornado warning. Both answers are technically correct, but the answer most commonly selected by women is the preferred choice since the alarms are often sounded before a tornado warning has been issued, and in some cases when no tornado warning is issued at all.

There are several significant differences found when making comparisons between differing age groups; especially when focusing on the '60 and above' sector. Figure 5 depicts the mean response scores for the four hail-related questions stratified by age group. For each of the questions, the '60 and above' age group exhibited the lowest mean response score. In fact, this group’s response score for hail

<table>
<thead>
<tr>
<th>Decade</th>
<th>&gt; 0.75 in.</th>
<th>&gt; 2.00 in.</th>
</tr>
</thead>
<tbody>
<tr>
<td>1970 – 79</td>
<td>4</td>
<td>0</td>
</tr>
<tr>
<td>1980 – 89</td>
<td>5</td>
<td>0</td>
</tr>
<tr>
<td>1990 – 99</td>
<td>13</td>
<td>1</td>
</tr>
<tr>
<td>2000 – 03</td>
<td>13</td>
<td>1</td>
</tr>
</tbody>
</table>
frequency, when outside, and when in a car, is only 50% of the response provided by the '29 and below' and 50 – 59’ age groups.

The low response scores for hail by the '60 and above’ group in the three locations are most likely tied to the low response scores for the perception of hail frequency by this group. One possible explanation for this perception is that the '60 and above’ age group has a larger temporal frame of reference when considering the threats discussed in the survey. Table 1 reveals the number of severe hail events (larger than .75 inches) and extreme hail events (larger than 2.00 inches) reported by decade in Delaware County. The 1990s through early 2000 period has experienced a much higher number of severe hail reports, as well as including the only reports of extreme hail in the past 33 years. This suggests that the younger age groups are more affected by recent hail events, especially those that are more extreme.

Question 32 asks whether respondents should crouch beneath a sturdy piece of furniture while in the home if their county is under a severe thunderstorm or tornado warning. The '60 and above’ age group exhibited the lowest mean response to this question (Figure 6), tending to believe that seeking shelter beneath a sturdy piece of furniture is not an appropriate action to take. The mean response of the three age groups ranging from 30 to 59 years is more than double that of the '60 and above’ age group, meaning they tend to believe this response is appropriate.
Conclusions

This study examines perceptions of severe thunderstorm threats, preparedness, and knowledge by the general public in Delaware County, Indiana through the use of a survey instrument. The survey is designed to gauge respondents’ perceptions through both Likert and binary “yes/no” question types. This research is important since it provides valuable information to the media, local emergency managers, and others in the meteorological community regarding public perception and knowledge of severe weather threats.

The study focused on Muncie, Indiana and surrounding Delaware County, Indiana because of its similarities to other communities in the Midwestern United States. This area is considered to be similar to other small cities in the Midwest because of its designation of ‘Middletown, USA’ by social scientist Robert Lynd (1929).

Primary results from this study suggest the public has a reasonably accurate perception of straight-line wind frequency, but expresses less concern for straight-line winds compared to tornadoes. In reality, straight-line winds occur much more often, and their magnitudes can be comparable to those of low-end tornadoes. Results of this study also indicate that even with the rapid growth and popularity of the World Wide Web, television and radio are still the preferred sources of severe weather information over the Internet.

Further research is needed to determine reasons behind the lack of concern for straight-line winds as compared to tornadoes. It would also be valuable to determine why differences in perceptions occur between age groups, as well as between genders. This can be accomplished through personal interviews with the respondents. It is also recommended that the study sample size be increased, with respondents from both urban and rural locations.
References


Appendix A: Survey Packet

This is the cover letter and survey instrument that was mailed to each of the Delaware County residents randomly selected by the Emergency Management Agency. The cover letter was signed by both persons listed, and copied on one side of a single sheet of white paper. The survey instrument was copied double sided onto light blue paper and stapled. A self-addressed stamped envelope was also included in the survey packet.
Dear Muncie Resident:

The Ball State University Honors College and Department of Geography, in cooperation with the Delaware County Emergency Management Agency and Ball State Storm Chase Team, are conducting a study to assess the community’s knowledge of severe thunderstorms and preparedness activities associated with these storms.

Enclosed is a questionnaire designed to carry out this study. Please understand that completion and return of this survey in the enclosed envelope grants the research team permission to use the data for a statistical analysis in which collective summary results will be employed to determine information included in a severe weather safety guide. Individual responses to this survey will be held in confidence and will remain accessible only to the research team.

In order to participate, mark the appropriate response for each item and when completed place it in the enclosed (self-addressed stamped) envelope, seal it, and place it in your mailbox. All responses will be handled confidentially.

We hope to complete the study by November 14, 2003. Your cooperation will help us a great deal. If you would like a copy of the severe weather information guide and would like to participate in any follow-up studies, please indicate so on the questionnaire and we will include you in further activities with this project.

Sincerely yours,

Mr. Nathan M. Hitchens
Principle Investigator
Honors Undergraduate Fellow

Dr. David L. Arnold
Associate Professor
Operational Meteorology and Climatology
Department of Geography

Enclosure: Questionnaire
Return envelope
Survey of Severe Weather Preparedness and Knowledge

DIRECTIONS

Please read each question and either mark or circle your answer. Choose only one answer for each question, unless instructed otherwise.

1. What is your gender?
   - Male
   - Female

2. What is your age range?
   - 19 and below
   - 20 – 29
   - 30 – 39
   - 40 – 49
   - 50 – 59
   - 60 and above

3. What is the age range of any children currently living with you? (mark all that apply)
   - No children
   - Under 2
   - 3 – 6
   - 7 – 10
   - 11 – 14
   - 15 – 18

4. What is your zip code?
   - 47302
   - 47303
   - 47304
   - 47305
   - 47306

5. Where do you obtain your weather information during a severe thunderstorm event?
   - Television
   - Radio
   - Internet
   - NOAA Weather Radio

6. During which times do you believe severe thunderstorms are most likely? (mark all that apply)
   - 12:00 midnight – 5:59 am
   - 6:00 am – 11:59 am
   - 12:00 noon – 5:59 pm
   - 6:00 pm – 11:59 pm
How frequently does each severe thunderstorm threat affect your area?

<table>
<thead>
<tr>
<th>Threat</th>
<th>Very low frequency</th>
<th>Low frequency</th>
<th>Medium frequency</th>
<th>High frequency</th>
<th>Very high frequency</th>
</tr>
</thead>
<tbody>
<tr>
<td>7. “Straight-line” Winds</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
</tr>
<tr>
<td>8. Flash Flooding</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
</tr>
<tr>
<td>9. Hail</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
</tr>
<tr>
<td>10. Lightning</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
</tr>
<tr>
<td>11. Tornadoes</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
</tr>
</tbody>
</table>

When **in your home**, what is your level of concern regarding each severe thunderstorm threat?

<table>
<thead>
<tr>
<th>Threat</th>
<th>Very low</th>
<th>Low</th>
<th>Medium</th>
<th>High</th>
<th>Very high</th>
</tr>
</thead>
<tbody>
<tr>
<td>12. “Straight-line” Winds</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
</tr>
<tr>
<td>13. Flash Flooding</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
</tr>
<tr>
<td>14. Hail</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
</tr>
<tr>
<td>15. Lightning</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
</tr>
<tr>
<td>16. Tornadoes</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
</tr>
</tbody>
</table>

When **outside**, what is your level of concern regarding each severe thunderstorm threat?

<table>
<thead>
<tr>
<th>Threat</th>
<th>Very low</th>
<th>Low</th>
<th>Medium</th>
<th>High</th>
<th>Very high</th>
</tr>
</thead>
<tbody>
<tr>
<td>17. “Straight-line” Winds</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
</tr>
<tr>
<td>18. Flash Flooding</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
</tr>
<tr>
<td>19. Hail</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
</tr>
<tr>
<td>20. Lightning</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
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<tr>
<td>21. Tornadoes</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
</tr>
</tbody>
</table>

When **in a car**, what is your level of concern regarding each severe thunderstorm threat?

<table>
<thead>
<tr>
<th>Threat</th>
<th>Very low</th>
<th>Low</th>
<th>Medium</th>
<th>High</th>
<th>Very high</th>
</tr>
</thead>
<tbody>
<tr>
<td>22. “Straight-line” Winds</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
</tr>
<tr>
<td>23. Flash Flooding</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
</tr>
<tr>
<td>24. Hail</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
</tr>
<tr>
<td>25. Lightning</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
</tr>
<tr>
<td>26. Tornadoes</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
</tr>
</tbody>
</table>
27. What is the difference between a watch and a warning?
   a. A warning means that the conditions are favorable for severe weather within the specified area, while a watch means that severe weather is occurring or about to occur in the specified area.
   b. A watch means that the conditions are favorable for severe weather within the specified area, while a warning means that severe weather is occurring or about to occur in the specified area.
   c. They both mean that conditions are favorable for severe weather within the specified area, but nothing is occurring yet.
   d. They both mean that severe weather is occurring or about to occur in the specified area.

If your county is under a severe thunderstorm or tornado warning while you are **in your home** you should...

28. Go outside and look at the sky  
Yes  No
29. Seek shelter on the lowest level away from windows  
Yes  No
30. Look out your windows  
Yes  No
31. Use the telephone  
Yes  No
32. Crouch beneath a sturdy piece of furniture  
Yes  No
33. Listen to the radio for severe weather information  
Yes  No
34. Do nothing, it's probably just a false alarm  
Yes  No
35. Seek shelter in a basement if possible  
Yes  No

If your county is under a severe thunderstorm or tornado warning while you are **outside** you should...

36. Attempt to seek shelter in a sturdy building  
Yes  No
37. Lie as flat as you can on the ground if in an open field  
Yes  No
38. Seek shelter under a tree  
Yes  No
39. Crouch down on the balls of your feet and cover your head  
Yes  No
40. Do nothing, odds are against anything happening to me  
Yes  No

If your county is under a severe thunderstorm or tornado warning while you are **in a car** you should...

41. Stop under an overpass  
Yes  No
42. Attempt to drive away from the storm  
Yes  No
43. Stop on the side of the road and get out to look  
Yes  No
44. Stop on the side of the road and lie in a ditch  
Yes  No

45. If you hear the outdoor warning sirens in your location it means:
   a. The area is under a tornado watch.
   b. The area is under a tornado warning.
   c. There is an imminent severe weather threat and you should seek shelter immediately.
   d. The severe weather threat has passed.
46. Once the outdoor warning sirens stop, the severe weather threat has passed.  True  False

47. Which day and time each week are the local outdoor warning sirens tested?
   a. Wednesdays at 11:00 am  
   b. Wednesdays at 5:00 pm  
   c. Fridays at 11:00 am  
   d. Fridays at 5:00 pm

48. When is it safe to leave your place of shelter?
   a. After the outdoor warning sirens stop sounding.  
   b. When the storm sounds like it has slowed down.  
   c. Once authorities cancel the warning for your location.  
   d. When you can see sunlight.

49. After a severe thunderstorm has passed, if you see downed lines you should...
   a. Approach them to see if they’re active power lines.  
   b. Avoid them and report their location immediately.  
   c. Go ahead and drive over them if you’re in a vehicle.  
   d. Try to move them only if they’re blocking your path.

50. After a severe thunderstorm has passed, if you see damage to buildings or roads, or observe trees or large limbs down you should...
   a. Ignore them because it’s someone else’s problem.  
   b. Get a closer look at the situation.  
   c. Report the location of the damage to authorities.  
   d. Try to move anything that’s in your path and keep going.

Would you like to receive a severe weather information guide based on the results of this questionnaire, as well as to participate in any follow-up studies associated with this questionnaire?
   o Yes, I would like to receive the severe weather information sheet and participate in any follow-up studies.  
   o No, thank you.