P1.4 THE RESPONSE OF UNIVERSITY STUDENTS TO SEVERE WEATHER WATCHES

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1. INTRODUCTION

In 1966, the term "watch" was first used to describe the forecasts of tornadoes and severe weather issued by the Severe Local Storms Unit (SELS) (Galway 1989). Today, severe weather watches are a part of a series of products issued by the Storm Prediction Center (SPC) that are used to alert forecasters, emergency managers, the media, and the public of the likelihood of the occurrence of severe weather. What makes severe weather watches important is their ability to help improve public safety and help save lives as they make people aware of the potential danger of severe weather within their area in the hours immediately following the issuance of the watch. This allows them time to prepare in case the weather were to become a threat. This study focuses on the general public as a primary group of users of severe weather watch products. Doswell et al. (1999) noted that public awareness and preparation is a very important contributor to a decrease in the number of tornado related fatalities. Therefore, making sure the public knows what severe weather products are, is made aware of them when they are issued, and knows what to do to prepare when they learn of them is an important part of maintaining public safety.

Watches are issued when the SPC forecasters think that the weather conditions are favorable for organized convection that may become severe within the next couple of hours. They usually cover an area of about 25,000 square miles, although some are larger and some are smaller. They go into effect as soon as they are issued and usually last about 4 to 6 hrs, but can be cancelled or reissued as needed, depending on what the weather ends up actually doing. Once a watch is issued, it is up to the National Weather Service (NWS) Weather Forecast Offices (WFO) to issue warnings when any severe weather actually occurs. There are times when the severe weather warnings precede the issuance of a severe weather watch, but the goal is to have a watch out at least an hour before the severe weather first occurs in order to give people time to prepare for it.

The SPC issues two types of watches: Severe Thunderstorm Watches and Tornado Watches. The criteria for issuing a Severe Thunderstorm Watch is that there are expected to be at least six hail events with penny sized hail or larger over at least a 2-hr time span, or a wind event with damaging winds of at least 50 knots (58 mph). Tornado Watches are issued when multiple tornados are expected, or any tornado with at least EF2 damage (National Weather Service). Keeping those criteria in mind, watches are not always issued for every single severe weather event. There are many factors that are considered before deciding to issue a watch, including meteorological factors, the time of day that the watch may take place, the social impacts that the severe weather may have, and also what the individual NWS forecast offices within a proposed watch area may want (personal communication with Richard Thompson).

The most accurate watch issued by the SPC is not as effective as it could be if people do not use it or are unaware of it. This study looks at what some members of the general public, specifically university students, know about severe weather watches and how they respond to them. University students from both Northern Illinois University in DeKalb, Illinois and the University of Oklahoma in Norman, Oklahoma were surveyed and asked questions regarding their knowledge of and response to severe weather watches. The students' responses were then analyzed to see what they knew about watches and how they responded to them.

2. METHODOLOGY

2.1 *Survey Instrument*

The survey that was created for the purpose of this study was 27 questions long and was comprised of two main sections. The first section

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included questions about what the students knew about watches and how they responded to them. Several of the questions asked about watches in general, while many of the other questions had the students refer back to the last watch they could recall being under in order to get more specific and concrete answers about what they actually did. The second portion of the survey asked the students for information unrelated to watches specifically. These questions requested information about their personal experience with severe weather, their current living situation, their knowledge of their geographic area, and their demographics, such as their age, gender, school, area of study, and the geographic region in which their perceptions of severe weather were formed. Before the survey was put into its finished form to be administered to the university students, it was given to several people to make sure that all of the questions made sense and would be understandable to the people who would be taking the survey.

2.2 *Choosing a Survey Population*

University students were chosen as the subjects for the study mainly due to the time and budget constraints under which the study was performed. They are generally relatively easily accessible and low cost as convenience samples for performing studies such as this one. The drawback to using them, however, is that they cannot be used to make generalizations about the general public. University students typically have a higher level of education, come from higher income backgrounds, and are younger than much of the population (Landis and Kuhn 1957). However, they are a good place to start and to use as a subset of the general public for an exploratory study such as this one, even if the information that they give can only be applied to university students within their regions (Ferber 1977).

The University of Oklahoma (OU) and Northern Illinois University (NIU) were chosen as the universities to survey since they were both within regions that receive a decent amount of severe weather in addition to being reasonably accessible to the researchers. The research facility was located at OU, and the researchers had contacts there, so it was relatively easy to contact the departments and instructors for permission to survey their students. The researchers also already had connections at NIU which made it easier to get permission there, as well. Another reason they were chosen for the study was that both universities receive a reasonable amount of severe weather each year, so students at both would have had the potential to have had a substantial amount of experience with severe weather watches, although Oklahoma typically receives more (Dean and Imy 2006).

2.3 *Distribution Methods*

Most of the respondents to the survey were contacted through an email sent to them through their department or instructor at their respective school. The email provided a brief description of the study and a link that they could follow to access and complete the survey online. Other students had the survey administered to them in their classrooms in paper form. Although the online survey had the benefit that it was able to be distributed to many more students, the response rate was much lower than for the paper, in-class survey since it was easier for them to ignore an email in their inbox than a paper survey that was handed to them and for which the time to take was already allotted for them.

2.4 *Possible Sources of Data Bias*

The data that was collected through the survey may be biased in several different ways. One possible source of bias is non-response bias which has to do with whether or not the students that are given the opportunity to take the survey actually take the time to do so. This probably had a much larger impact on the data received from the online surveys than the paper surveys since the response rate for the paper surveys was one hundred percent and none of the students who were given an opportunity to take the paper survey turned it down. However, the number of students to which the email invitation to take the online survey was sent was much higher than the number that actually responded, meaning that there were some students who chose to take the survey while a substantial number of them did not. One factor that may have had an influence was the students' interest in weather. If they saw an email in their inbox that invited them to take a survey that had to do with weather, they may have been more likely to make the time to take it since it was something that was significant to them. If they had an interest, they may also have had a greater knowledge of weather and weather products, including severe weather watch products, and it may have influenced their answers.

Another possible source of data bias is known as response bias, and it is related to the honesty

with which the respondents answered the questions in the survey. Even though the survey was performed in an anonymous manner, and the students were asked to be as honest as possible prior to being given the survey, the students may not have been completely honest when answering the questions if their truthful answer was socially unacceptable or they knew that it was the "wrong" answer. This would make the survey results seem better and more in line with how things should be than with how they actually are.

In an attempt to minimize undercoverage, or the underrepresentation of some members of the university student population, the departments within the universities to which the survey questionnaire was sent were chosen in order to try to include as many different disciplines and levels of education as possible within the survey sample. Due to the time constraints that the study was under, the likelihood of the departments to respond and provide permission to survey the students, and also the ease with which they could be contacted through various connections were also factors that were considered when selecting which departments to survey. Some of the departments agreed to send the email out to all of the students enrolled within their department, while others agreed to let individual instructors decide whether or not to send the email out to their students or to allow the survey to be administered to the students in their classes. The students that were given a chance to participate in the survey included undergraduate students, graduate students, and doctoral students, so there was a range of ages and educational levels included in the responses in addition to a wide variety of disciplines.

2.5 *Data Analysis and Quality Control*

The data that was collected using the survey was entered into a spread sheet and then analyzed using descriptive statistics. The responses given by meteorology students were eliminated from the data so that they would not bias it due to their greater knowledge of weather and weather products than the general student population. Before the data could be analyzed, it had to be checked for errors and to insure internal consistency within the students' responses. Some of the answers given by the students demonstrated confusion as to what they actually knew about watches. After the data was analyzed for quality, the relative frequencies of the answers associated with each of the questions were compiled and analyzed using charts and descriptive statistics.

TABLE 1. Demographic Information

Number of Respondents

	n	%
All Respondents	144	100
NIU	36	25
OU	107	75

Gender

	All Respondents		NIU		OU	
	n	**%**	**n**	**%**	**n**	**%**
Male	63	44	18	50	44	41
Female	81	56	18	50	63	59

Age

	Mean	Median	Mode	Std. Dev.	Range	Minimum	Maximum
All Respondents	26.50	23	21	8.64	33	18	51
NIU	23.97	22.5	21	6.16	28	19	47
OU	27.41	23	21	9.21	33	18	51

3. RESULTS

3.1 *Survey Sample*

There was a total of 144 respondents to the survey from both universities, with 107 of the respondents attending OU and 36 attending NIU. There was one respondent who did not answer which university he was attending and also did not answer a majority of the second half of the questionnaire. Additional demographics of the survey respondents can be found in Table 1. It is interesting to note that, even though there were about three times as many respondents from OU as there were from NIU, the proportions with which they answered many of the questions were very similar. Not all of the respondents answered all of the questions, however, so it is possible that not all of the questions will have responses that add up to the total number of respondents for the entire survey.

3.2 *Knowledge of Watch Terminology*

One question that was asked in the survey was whether or not the students believed that they themselves knew what a "Tornado Watch" was. Ninety-four percent of them answered that they did, while only 6% answered that they did not think that they knew (Figure 1). The students were then asked to provide a brief explanation of what they thought a Tornado Watch was to determine if they actually knew and did not just think that they did. The responses were counted as being correct if they mentioned that a Tornado Watch meant that conditions are favorable for the formation of tornadoes, and especially if they mentioned that tornadoes were not an imminent threat. The separation of the answers into correct and not correct was a subjective process, and there were several about which the decision was particularly difficult to make and which were put into their own "difficult to tell" category. In the end, it was decided that 83% of the respondents actually seemed to know what a watch was, while 6% definitely did not know, about 6% were difficult to discern, and 5% of the survey respondents had provided no attempt at an answer (Figure 2).

The relative frequencies for the answers from the previously mentioned two questions can be misleading since not all of the respondents who said that they knew what a watch was corresponded to those who actually did seem to know. When the results from the first question were compared to the respondents' description of what they thought a watch was, 119 out of the 135 students who had answered the that they knew what a watch was did in fact seem to know. However, nine of the respondents who had thought they knew put down a wrong answer when asked to explain it, four had answers that were too difficult to discern, and three did not provide an answer when asked to give a definition. Similarly, of the nine who had answered that they did not think they knew what a Tornado Watch was, three of them actually did seem to know while two definitely did not know and four did not provide an attempt at a description of a watch.

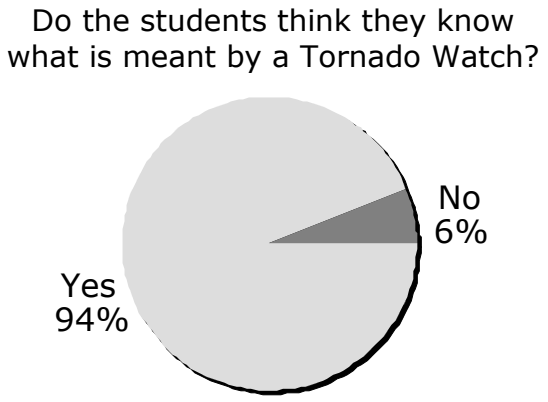

Figure 1. The students were asked if they thought they knew what was meant by a Tornado Watch and a large majority answered that they did.

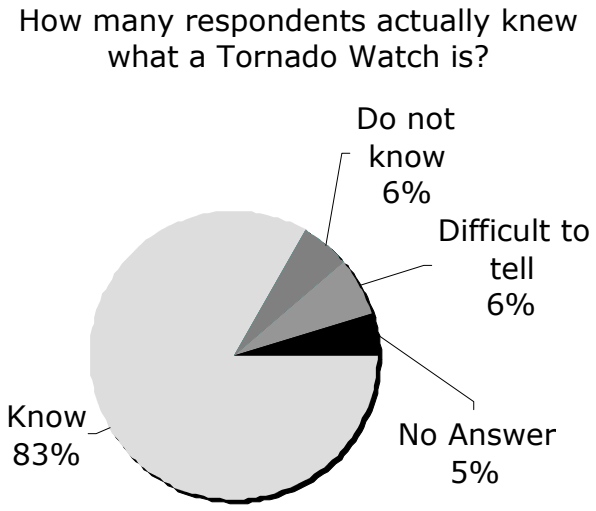

Figure 2. The students gave a brief description of what they thought a watch was, and those answers were then analyzed and separated into those that seemed to know and those that did not know. There were also several that were too difficult to distinguish and some that did not answer the question.

While many of the respondents did seem to know what a watch was when asked to give a brief explanation, some of their answers to later questions seemed to indicate that there was still some confusion about what it was. When the students were asked to indicate how they first learned of the last watch they could recall being in, some provided answers that would not have made sense if they were referring to an actual watch issued by the SPC. These included answers such as that they learned of it by driving through it or by watching the sky and feeling the atmospheric change.

Another question that was asked of the students was whether or not they believed that the people they knew understood the difference between a watch and a warning. The answers were split evenly, with 47% saying that they did think that most people they knew were familiar with the difference and another 47% said they did not. About 5% responded that they did not know and one person failed to answer the question. Even though most of the respondents thought that they themselves knew the definition of a watch, only about half of them were willing to give other people they knew the same credit.

3.3 *Watch Awareness*

Many of the questions in the survey asked the students to think back to the last time they could recall being under a severe weather watch and answer based upon that experience. One strategy that was briefly considered involved sending a survey out immediately following an instance in which a severe weather watch was issued in the students' area in order to find out whether or not the students were actually aware of it. However, because of the time limitations on the study and the difficulty of timing the distribution of the survey, it was decided to instead ask the students if they thought they would be aware of a watch if one was issued. Twenty-two percent of the respondents replied that they definitely would be aware of one, about 69% said that they most likely would, about 8% said that they most likely would not be aware of one, and none of the respondents thought that they definitely would not know of an issued watch (Figure 3). These answers are based solely upon the students' own speculation, however, and may not be accurate as to what would happen in a real situation in which a watch was issued.

3.4 *Information Sources*

Where the students get their information about severe weather watches was a topic that was of interest to the researchers to see where the focus should be when alerting the public to the possibility of severe weather. The students were asked what information source they used to first become aware of the watch and then what sources they used to stay updated, if they did so, during the time of the watch.

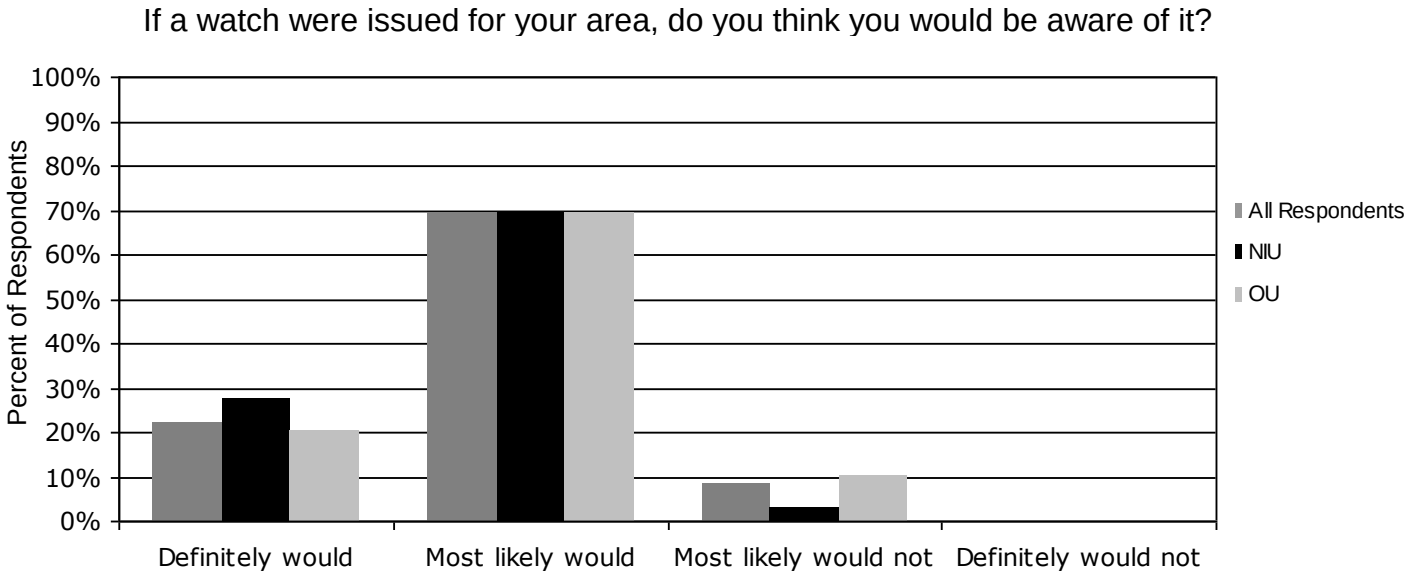

Figure 3. A majority (69%) of the survey respondents thought that they would most likely be aware of a watch. None of the respondents answered that they definitely would not be aware of one.

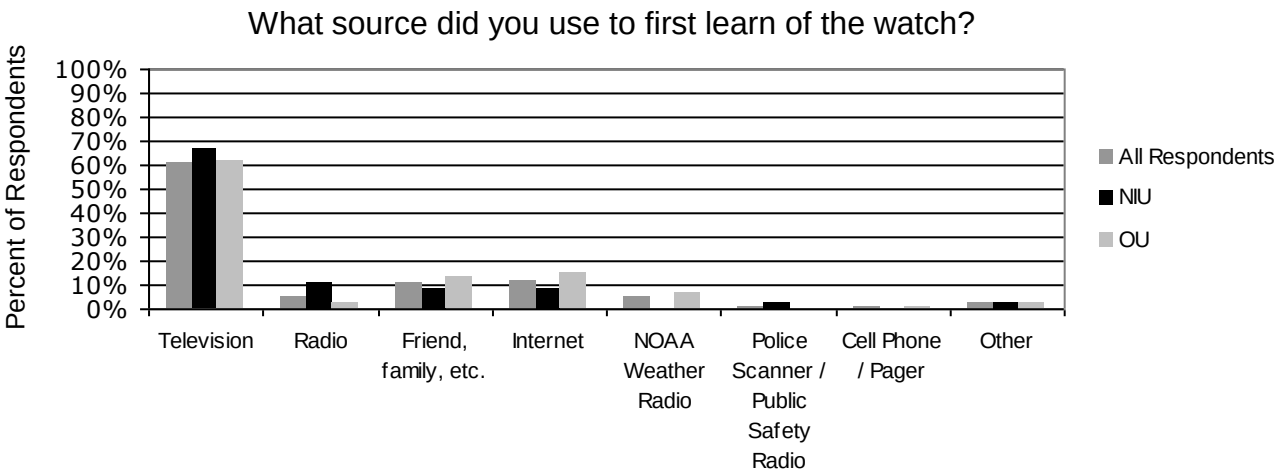

Figure 4. The survey respondents indicated the source of information that they used to first become aware of the watch. Most indicated that they used the television (61%), many said they learned of it from the internet (12%) or a friend, co-worker, neighbor, or family member (12%), some used the radio (5%), and others used a NOAA Weather Radio (5%). Only one respondent indicated having learned of the watch using a police scanner or public safety radio and only one indicated using a cell phone or pager. A few of the respondents indicated using other sources that would not make sense if they were truly talking about using a watch product, such as that they were driving through it or watching the sky and feeling the atmospheric change.

About 61% of the respondents reported using television as their first source of information about the watch, making it the top response. The second most used source was the internet since it was used by 12% of the respondents to first learn of the watch. Eleven percent of the students who responded reported learning of the watch from a family member, friend, neighbor, or co-worker, and about 5% said that they learned of the watch from the radio. Only 5% of the respondents said that they had learned of the watch using a NOAA Weather Radio. A couple of the students put down other responses and provided explanations for their other source, which, as mentioned earlier, did not always make sense given that the watches are issued by the SPC and cannot be learned of just by experiencing the weather (Figure 4).

The students were then asked to indicate all of the sources that they had used to stay updated during the time of the watch. Only 3% of

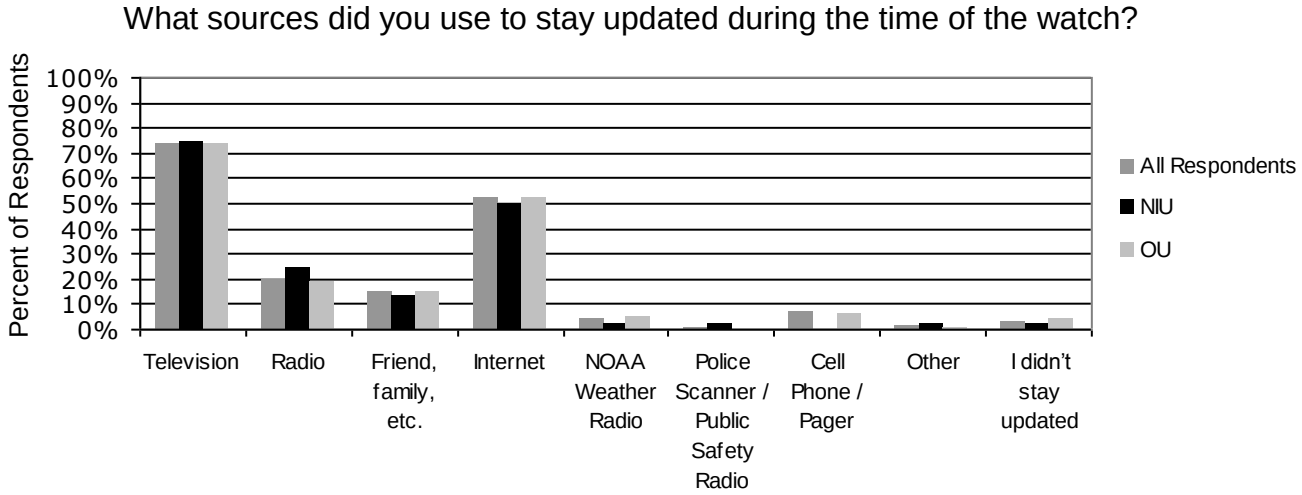

Figure 5. The students provided all of the information sources that they used to stay updated during the time of the watch. Television was used by the most respondents (74%), followed by the internet (52%). The radio was used by 20% of the respondents and a friend, co-worker, neighbor, or family member was used by 15%. Only about 4% used a NOAA Weather Radio for their updates while 7% received updates through their cell phone or pager. One respondent indicated staying updated on the situation with a police scanner or public safety radio and two of the respondents also said that they watched the sky for changing weather. Only a few (3%) said that they did not stay updated at all.

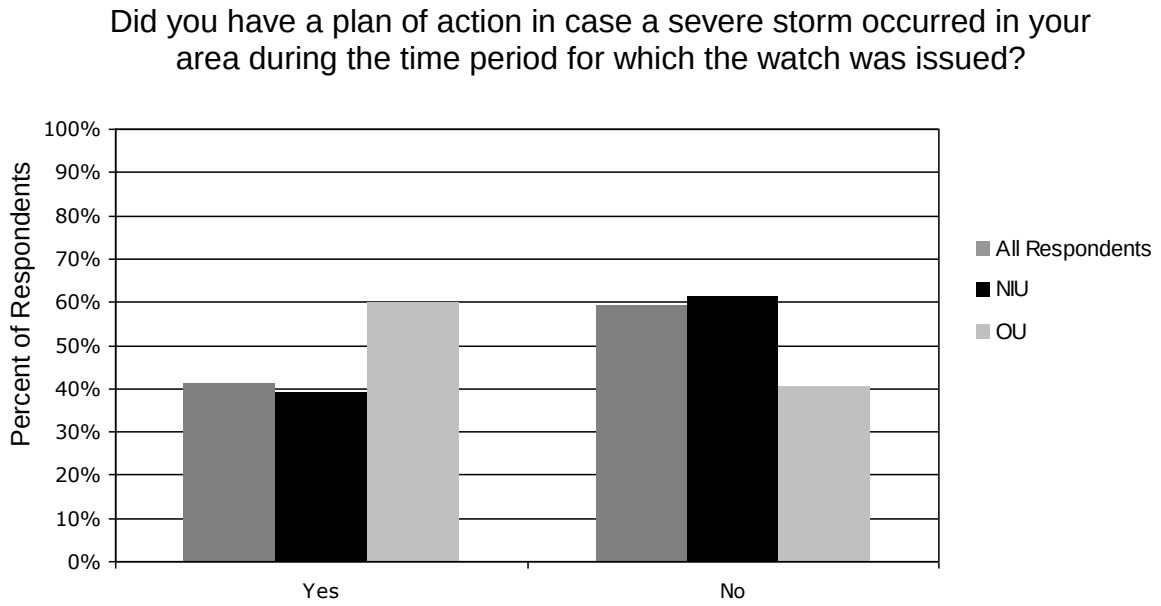

Figure 6. A greater percentage of the students who responded from the University of Oklahoma indicated that they had a plan of action than the students who responded from Northern Illinois University.

the students that responded indicated that they had not stayed updated at all. Once again, television was the most used source of information about the watch, being used by about 74% of the survey participants. The internet was also used by a large portion of the respondents, with 50% saying that they had used it. A fifth (20%) of the respondents indicated that they had used the radio to stay updated and only 4% said that they used NOAA Weather Radio. Other responses that were given for the question included looking out the window and watching the sky (Figure 5).

3.5 *Plan of Action*

One of the questions in the survey asked the students if they had a plan of action in case severe weather actually occurred in their area during the time of the watch. The respondents from OU had a higher positive response to the question, with approximately 60% of the respondents from OU saying that they had a plan of action, while only 39% of the respondents from NIU said that they did (Figure 6). The chi-squared test was used to examine whether or not the difference between the amounts of responses from the two schools was due to chance or if it was due to some other factor. Since the p-value associated with the calculated χ^2 of 4.756 was less than 0.05, the difference between the proportions of the students who answered that they had a plan of action at the two universities is significant and the null hypothesis that the difference was due to chance can be rejected with at least a 95% confidence level. Since the differences between the two values are probably not due to chance, they may be due to the higher level of severe weather awareness that seems to be prevalent in Oklahoma as compared to Illinois.

Many of the comments that were given by the respondents when they were asked to briefly describe their experience with severe weather also seemed to reflect the fact that people in Oklahoma expect severe weather just because they live in Oklahoma. Several of the respondents from the University of Oklahoma mentioned that living in Oklahoma means that they've pretty much experienced it all when it comes to severe weather. As one respondent said, "I have lived in OK all my life. You name it, I've experienced it when it comes to severe weather." When describing their own experience, another said that it has been "Typical Oklahoma weather – the gamut of conditions."

The students were asked if they were familiar with tornado safety procedures, and most seemed very confident with their knowledge. Seventy-five percent of the respondents answered that they were familiar with tornado safety procedures, 21% said that they were somewhat familiar with them, and only one of the 144 respondents said that they were not at all familiar with them (Figure 7). These answers seemed to be confirmed by the answers given when the students were asked to

describe their plan of action in case of severe weather. Many of the respondents that had replied that they had a plan of action included in their description of that plan going to a safe place in there house, usually a central room away from doors and windows. Others had a storm shelter nearby that they planned on going to if necessary. Overall, the answers that were given indicated preparedness and knowledge of tornado safety. However, just because they had a plan in mind does not mean that they would follow it were severe weather to actually occur.

3.6 *Changing Plans*

Another question that was asked in the survey was, "Did you change any of your planned activities after you learned of the watch?" It would have been nice to have been able to know more detail with regards to the answers that the students gave to this question. If the respondents had already planned to be indoors, they probably would not have changed their plans because of the possible danger of severe weather anyway since they were already in a somewhat safe shelter. However, if they had an outdoor activity planned, such as having a barbeque or swimming, a change or cancellation of plans would have been more significant. Knowing more about the plans that the students changed, cancelled, or kept the same would have been more meaningful than just knowing whether or not they made any changes to those plans.

3.7 *Informing Others*

Part of the information that the researchers wanted to know about the university students' responses to the severe weather watches was whether or not they usually pass on the information about the watches after they are aware of them. In the questionnaire, the students were asked if they inform friends, neighbors, family, or co-workers when a watch is issued. A tenth of all the respondents replied that they do so all the time, 26% reported that they do so most of the time, 43% said that they do so sometimes, and 21% said that they never do.

3.8 *Geographic Awareness*

Since watches are issued publically based upon counties, the students were asked a couple of questions to get a feel for how familiar they were with their geographic area and whether or not they may be aware if they were located within or close to a watch area. They were first asked how knowledgeable they were about the counties in their area, and the students who responded

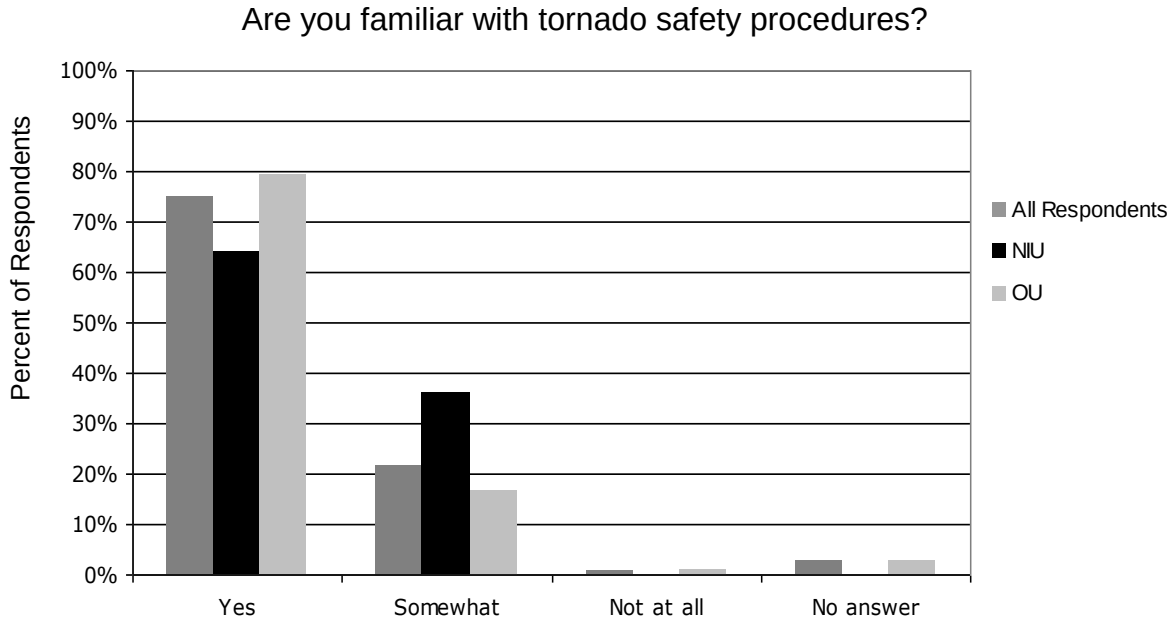

Figure 7. Most of the survey respondents indicated that they thought they were familiar with tornado safety procedures. Overall, the students from the University of Oklahoma seemed more confident in their knowledge than the students who responded from Northern Illinois University.

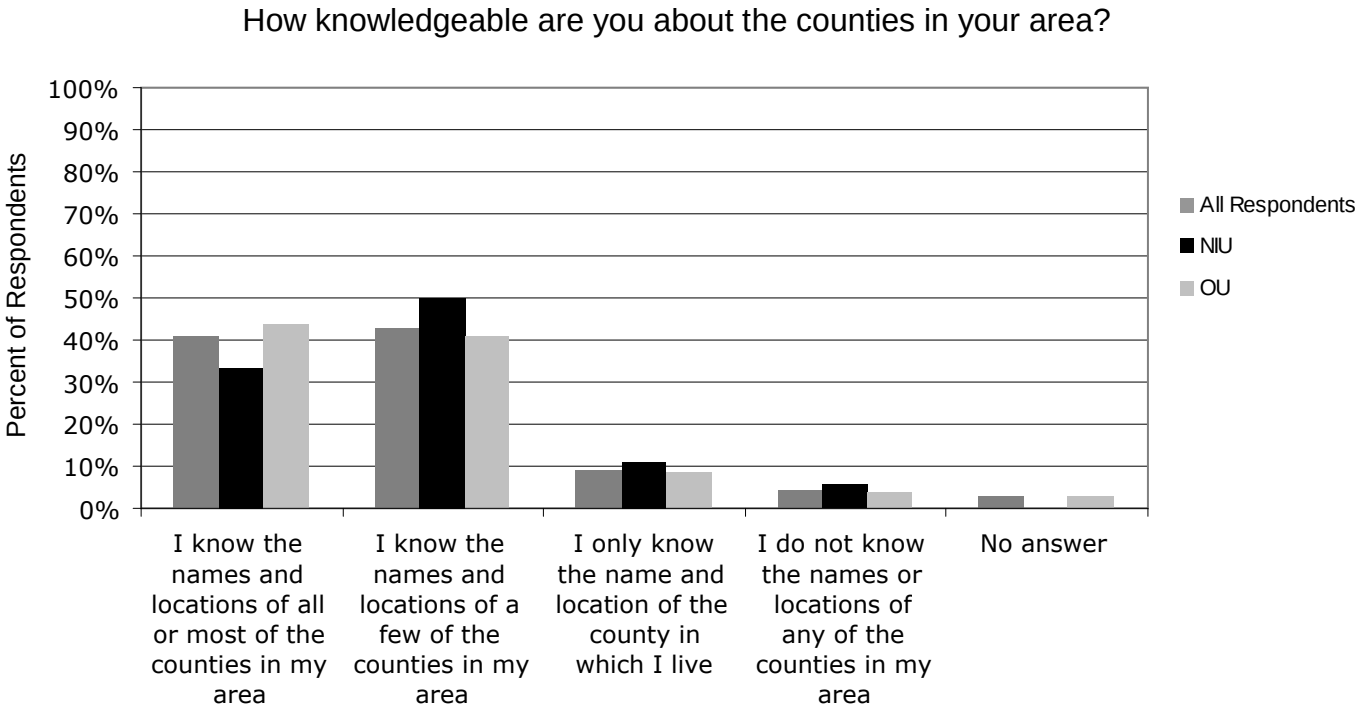

Figure 8. Most of the survey respondents thought that they knew the names and locations of at least a few of the counties in their area.

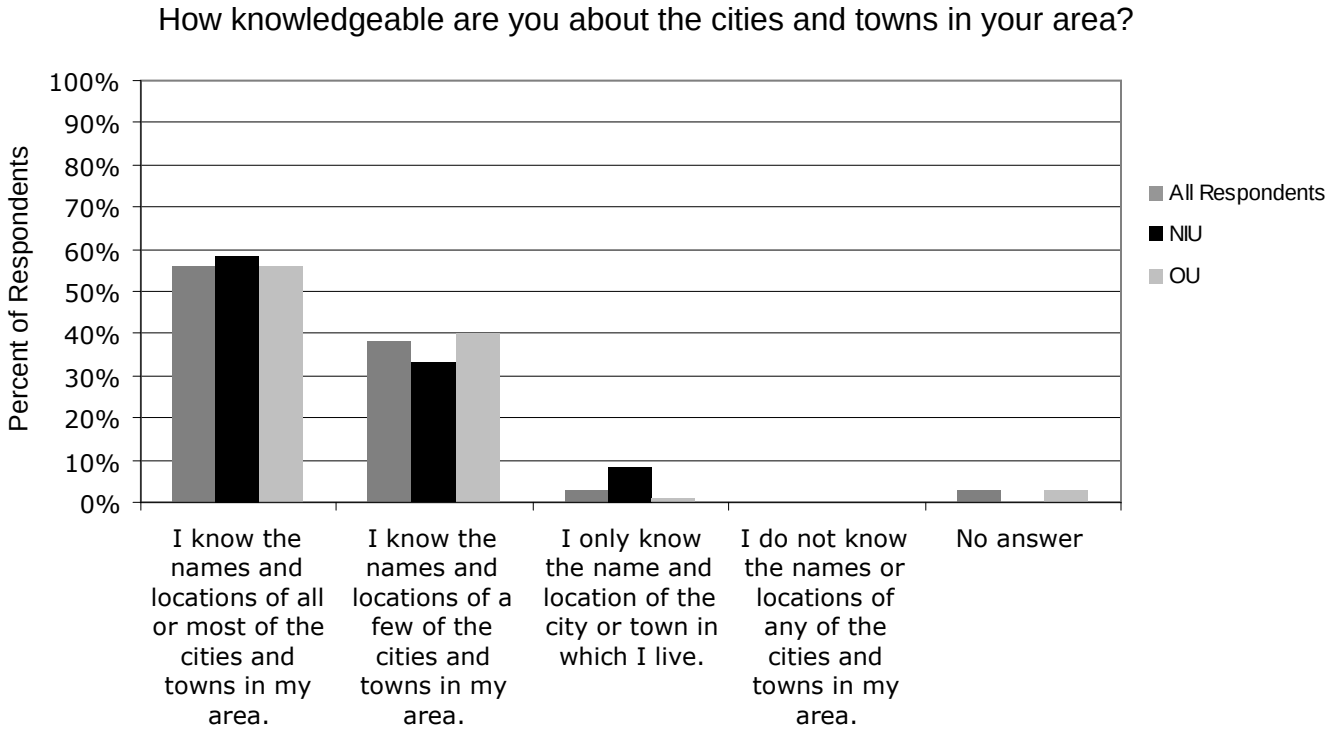

Figure 9. Most of the survey respondents thought that they knew the names and locations of at least a few of the cities and towns in their area and none of them said that they did not know any of them.

seemed to think they knew a fair amount. Eighty-four percent indicated that they knew the names and locations of at least a few of the counties, with 41% claiming to know the names and locations of all or most of the counties in their area. Nine percent said that they knew the name and location of only the county in which they themselves lived and 4% indicated that they did not know the names and locations of any of the counties in their area, including their own (Figure 8).

The results from the question asking the students how knowledgeable they were about the names and locations of the cities and towns in their area seemed to be even better than their responses to the question about the counties. A total of 94% of the students responding to the question said that they knew at least a few of the cities and towns in their area. Thirty-eight percent said they knew all or most of the cities and towns around them, and about 3% said they only knew their own (Figure 9).

These results seem to be very positive, but it has to be kept in mind that the answers to this question only provide the students' own perception of themselves and may not reflect what they really know. This seems to be confirmed by an unpublished study that Matthew Biddle performed in 2003 in which he asked college students from Oklahoma, Texas, and Kansas to pick out their home county as well as the counties contiguous to it. About two-thirds could choose their own home county, but more than half of the respondents (55%) could not choose any of the counties connected to it, 32% could only choose a few, and only 13% could choose all of them. These results suggest that, even though a majority of the students think they know their counties, their perception of what they know may be different than their actual knowledge.

4. CONCLUSIONS

Overall, the results from this study appear to fairly positive since a majority of the students seemed to know what a watch was and how to respond to one. However, the responses that were provided by the students are based solely upon what the students believe they would do, but are not necessarily representative of what they would actually do in a real life situation. More data needs to be collected and analyzed and more statistical tests performed on that data before conclusions can truly be drawn. This study is only a starting point and more studies should be done to discover what the public actually knows about severe thunderstorm watches and how they respond to them.

5. ACKNOWLEDGEMENTS

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