THE INFLUENCE OF TORNADO KNOWLEDGE AND PERCEPTIONS ON THE SAFETY ACTIONS TAKEN AMONG UNDERGRADUATES

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1. INTRODUCTION

With an estimated 21.8 million students currently attending universities, it is important to understand tornado warning response among undergraduates. Recent studies (Hoekstra-2012; Nichols-2012) separately show how K-12 and university administrators respond and relay critical information during tornado warnings. Few studies show exactly how students at universities respond to this critical information.

2. METHODS

In the fall of 2012 a survey was given to 613 undergraduate students in introductory science courses. General questions included home state or country, number of years lived in Nebraska, source of previous tornado knowledge, and source for warnings. The tornado knowledge score was composed of questions such as: difference between tornado watch and warning, likelihood of different geographic areas being affected by tornadoes, directions that tornadoes could potentially move, typical wind speeds, and others. The tornado safety score components were: having a safety plan in place, percent of warnings responded to, specific ways last warning was reacted to, safety actions taken if caught outside, and the safest location in basement. Four hundred surveys have been coded for analysis thus far, with the geographic distribution of home state and country among respondents shown in *Figure 1.*

3 - Korea
1 - China
1 - Japan
1 - India
1 - Malaysia
1 - Philippines
1 - Mongolia
1 - United Arab Emirates
1 - Mexico

Figure 1: Distribution of respondents from the U.S. and international countries.

Knowledge and safety scores were calculated based on how thoroughly each participant answered questions. These scores were discarded when more than 30 percent of the questions contributing to those scores were left blank. One question was discarded due to lack of understanding among respondents. The surveys were coded separately by 2 people. Initially there was a nearly 88 percent inter-coder agreement, and after comparison and discussion there was full agreement. Results of the preliminary analysis are presented with focus on possible relationships between the source of previous tornado knowledge, source of tornado warnings, perceptions of the dangers of tornadoes, and the safety actions taken in severe events. Geographical differences in knowledge and safety actions were also investigated.

3. RESULTS

Table 1 shows that students from the Great Plains and Midwest had higher knowledge and safety scores than students from other U.S

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regions and international countries. Knowledge and safety scores were recorded out of a possible score of 1.00. International students had low knowledge scores overall. However, they surprisingly took better safety actions than American students from outside the Great Plains as shown in the last two safety rows in *Table 1*. This might be the result of international students following the appropriate safety measures, and following signs posted, without understanding the full danger posed by tornadoes.

Location	Number of Students	Knowledge	Safety
Nebraska	282	0.38	0.64
Great Plains/Midwest	56	0.37	0.59
Other U.S.	20	0.33	0.46
International	7	0.27	0.55

Table 1: Regional effects on knowledge and safety scores.

Knowledge and safety scores as a function of knowledge source are shown in *Table 2*. Out of students for which knowledge and safety scores were retained (356 students), nearly 60 percent received their knowledge primarily from school, with an average knowledge score of 0.36 and a safety score of 0.61 Nearly 22 percent of students received the majority of their knowledge from television or news, with an average knowledge score of 0.39 and a safety score of 0.63. A little over 14 percent of students received their knowledge from parents or family, with knowledge and safety scores of 0.40 and 0.67 respectively. Students who reported to be self-taught, using common knowledge, or learning from friends and acquaintances had the lowest knowledge scores. Their safety scores were widely varied, but this likely resulted from the low sample size in these last three categories.

Knowledge Source	Number of Students	Knowledge	Safety
Elementary School	197	0.36	0.61
TV/News (unspecified)	77	0.39	0.63
Parents/Family	52	0.40	0.67
High School/College	13	0.40	0.62
Self-Taught	10	0.33	0.63
Friends/Others	4	0.34	0.45
Common Knowledge	3	0.34	0.69

Table 2: Knowledge and safety scores as function of knowledge source.

Figure 2 shows the warning response rate as a function of warning source. This graph shows only the first warning source reported. The majority of students provided three or more sources. Over 52 percent of the participants received their warnings primarily through television and news sources. This group had an average response rate of 61 percent. The highest average response rate, 84 percent, was from 4 people receiving their warnings from building intercoms. The lowest response rate, 48 percent, came from participants who received their warnings from direct phone calls. Regardless of warning source, about 46 percent of students self-reported to respond to 80 percent or more of tornado warnings.

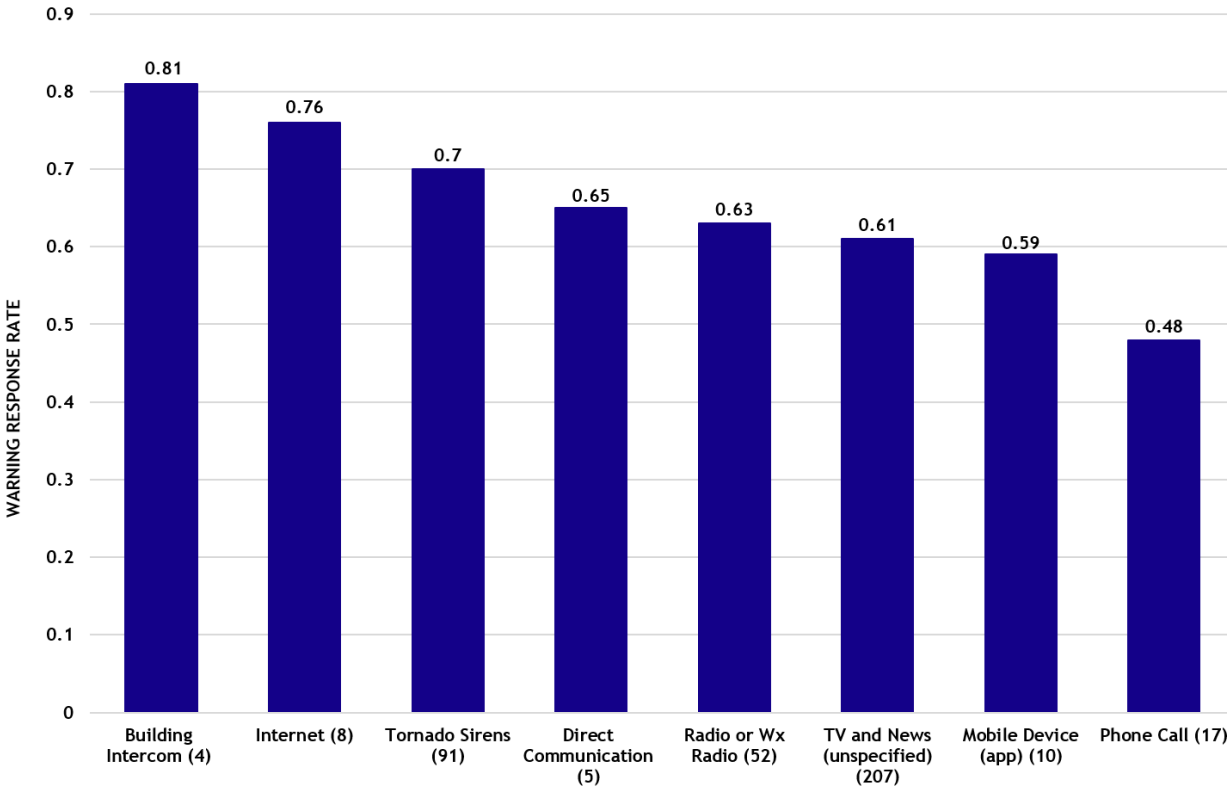

Figure 2: Warning response rate as a function of warning source.

Students who thought the current city in which they lived was less vulnerable to tornadoes than the surrounding area responded to fewer warnings than those who thought their city was equally or more vulnerable. This is shown in *Table 3*. The moderate response rate from students who said 'I don't know' may show students erring on the side of caution with regards to safety. *Figure 3* depicts tornado tracks near Lancaster country from 1950 to 2012, showing Lincoln's susceptibility.

Lincoln, NE vulnerability	Warning Response Rate
More	0.74
Equal	0.66
Less	0.61
'I don't know'	0.64

Table 3: Warning response rate as function of perceived vulnerability.

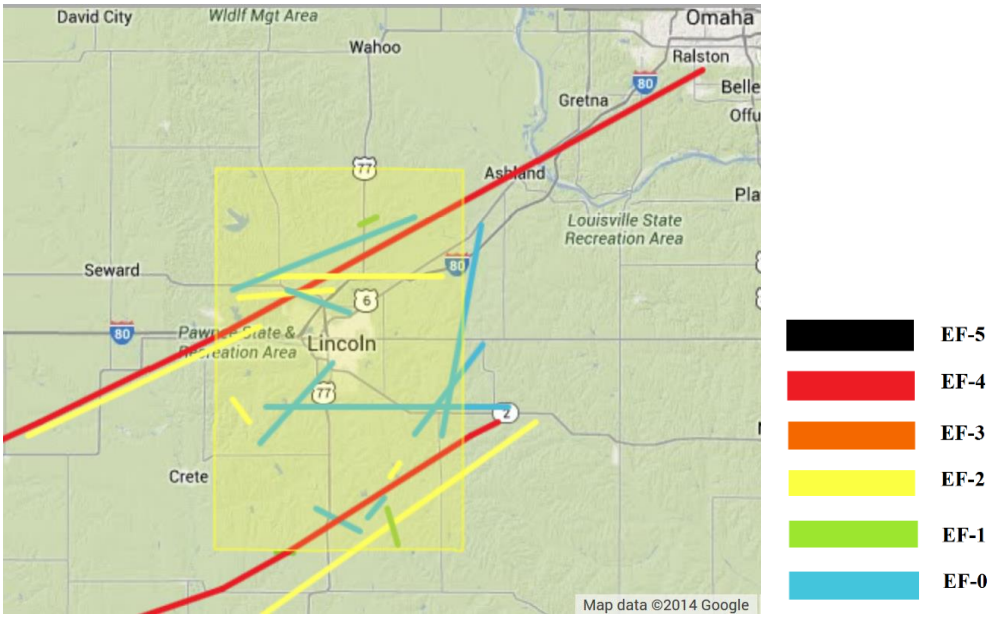

Figure 3: Strength and paths for all tornadoes from 1950 to 2012 in Lancaster CO, Nebraska.

Table 4 shows various safety questions, and the percentage of good, moderate, and poor responses for each. During the most recent tornado warning the majority of students said they 'went to the basement'. No information on what specific room in the basement was chosen, the duration of time they sheltered, or whether or not they took extra supplies. For the scenario in which the respondent was caught outdoors with a tornado approaching, the most prevalent response was 'get into a ditch.' Less than 10 percent mentioned protecting their head from debris. *Table 5* shows various myths, and the percentage of students who believe them. The most prevalent myths were that hills and small bodies of water offered protection from tornadoes. Also, 32 percent believed that overpasses were safe shelters, 25 percent believed that opening windows before a tornado arrived was appropriate, and 20 percent believed that Lincoln's 'bowl' shape decreased the likelihood of being affected by a tornado.

Safety Question	Poor Response	Moderate Response	Good Response
How did you respond during the most recent tornado warning?	14.5%	45%	31.5%
What should you do if caught outdoors?	20%	70%	9%
Do you have a tornado safety plan in place at home?	NO: 20%		
At school or work?	NO: 32%		

Table 4: Various safety questions, with percentage of good, moderate, and poor responses.

Myth	Percent that believe it
Hills affect tornadoes	55%
Rivers affect tornadoes	51%
Overpasses are safe	32%
Should open windows	25%
Lincoln's 'bowl' shape affects tornadoes	20%

Table 5: Various myths with percentage who believe them.

4. CONCLUSIONS

Students from the Great Plains and Midwest had higher knowledge and safety scores than students from other U.S regions and international countries. International students had low knowledge scores, but took better safety actions than American students from

outside the Great Plains. Students who received the majority of their knowledge from their parents and family had relatively high knowledge and safety scores. Students who received their warnings from building intercoms, the internet, and tornado sirens had the highest response rate. Unfortunately, many myths about tornadoes still remain, showing the need for more education on tornadoes and tornado safety. Future work will involve adding the results of the remaining 213 surveys to this dataset. Then the questions will be revised with the aid of a social scientist to produce a new survey. These new surveys will be web-based, and will be distributed to a wider audience to gain better geographic diversity. Individual interviews will also be done to gain more in-depth knowledge about actions taken during tornadoes.

4.1 Acknowledgements

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4.2 References

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