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COMMUNICATING WEATHER INFORMATION TO THE PUBLIC: PEOPLE'S REACTIONS AND UNDERSTANDINGS OF WEATHER INFORMATION AND TERMINOLOGY

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1. Introduction

Forecasts of weather phenomena have become increasingly accurate over the past several decades. While increasingly complex mesoscale models have been developed, ensemble forecast techniques have been improved, and strides in graphical interpretation of weather data for public use have been enhanced, problems still remain within the weather community that hinder progress of the discipline (Mass, 2005). Among these problems arises the necessity to optimally convey weather information to the public in ways that the greatest number of citizens will understand in order to make potentially important decisions regarding life and property. In fact, the US government has prioritized this issue with the "Enhancement of environmental literacy and improvement of understanding, value, and use of weather information and services," and as such, a probable result becomes the mitigation of loss of life, property, and potential reduction of economical damage (NOAA, 2005). Reasonably, a more educated public would more likely make sound weather-related decisions based on information received. However, conveying information introduces new communications problems that must be overcome. Information may be understood in a locally cultural context, and multiple—sometimes conflicting—meanings of weather terminology exist among different groups of people (Pennesi, 2007). For example, among hurricanes, the general public recognizes the cone released by NOAA's National Hurricane Center forecasts for the future track of troipcal cyclones by several names, including "cone of death", "cone of uncertainty", or "cone of death", among several others, and confusion results concerning the actual meaning of these cones (Broad, et al., 2007). In order to improve "environmental literacy" within the general public, one must first decide how to disseminate weather information optimally so that the largest audience, ideally everyone affected, may make correct decisions.

The study reported here focuses on predicting relevant characteristics for understanding and reacting to weather information based on demographic information. With such statistics in hand, methods of releasing weather information to many demographically specific groups may be crafted in order to effectively reach the most citizens. In addition to evaluating the interactions between demographics and public reactions, we will start by examining the interaction between anxiety levels in the general public and response to weather information. Several previous studies have suggested a gender difference in levels of anxiety to a wide variety of stimuli: females consistently tend to show greater levels of anxiety than males and tend to be more prone to anxiety disorders than males as shown in adolescents (Lewinsohn, et al., 1998). Increased anxiety across genders is also documented relating to academic performance (Pomerantz, et al., 2002), and in general as a function of gender while determining a three-way interaction

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between gender, stress, and social support with anxiety (Landman-Peeters, et al., 2005). In addition, individuals with higher levels of anxiety may show tendency to better prepare for weather situations and less tendency to ignore weather information. Citizens in some areas of the country may live in areas more prone to anxiety: levels of anxiety differ between rural and urban environments (Diala, et al., 2003). In either case, people may be targeted accordingly based on predicted behaviors and reactions.

Also, many people fail to accurately understand the meaning of weather terminology used in forecasts, resulting in a misinterpretation of messages that forecasters attempt to relay to the general public. Recently, one-third of New Yorkers failed to correctly identify a 30 percent chance of rain as a probabilistic forecast (Gigerenzer, et al., 2005). If many people fail to define a 30 percent chance of rain, then they will probably also be unable to adequately understand other important weather terminology. In some cases, a misunderstanding could cause a life-threatening situation: for example, if a resident hears a severe weather warning over the radio but confuses the definitions of watch and warning, the individual may endanger themselves while in state of false security caused by misinformation. Obviously, miscommunication between forecasters and the general public may lead to unsound judgments in making critical weather-related decisions: identification of groups that maintain less knowledge of weather terminology may be targeted to improve understanding of forecasts, or terminology may be adjusted so that the largest number of individuals receive useful and understandable information.

As part of a larger study, a questionnaire was given to residents in the southwestern United States regarding how they receive, use, react to, and understand weather information: This paper evaluates people's uses and understandings. Ideally, conclusions obtained through the questionnaire data will ultimately allow for targeting of particular and specific groups in order to effectively disperse and communicate weather information to the largest possible population. The following research questions are advanced for the study:

1) Do gender and other demographic categories affect anxiety relating to receiving weather information, particularly in severe weather situations?

2) How do gender, age, race, state of residence, education level, and level of anxiety affect

a. Trust in weather information received
b. Tendency to ignore weather information
c. Readiness and planning for severe weather
d. Weather information's influence on plans/daily activities
e. Understanding of the difference between a severe weather “watch” and a “warning”

3) What do people think a severe weather “watch” or “warning” means?

The selected demographic information is chosen for analysis due to potential conclusions that may be made from it. Geographically, some regions may contain a larger number of individuals belonging to a certain group that can be specifically targeted. For example, a relatively high density of Asian Americans live in portions of California, and several Native American groups reside in Oklahoma. Some communities may hold an unusually high number of older or younger individuals, or a relatively large number of highly educated individuals. Additionally, behavior may differ based on one's region of residence, regardless of other demographic factors: Where severe weather occurs more frequently, residents may show a greater amount of knowledge relating to weather information and severe weather planning. If for example, individuals in California know less about readiness for severe weather, they may be targeted for education regarding potentially life-saving planning techniques. With enough data, many such conclusions may be made for specifically targeted groups across the area examined in this study.

2. Methodology

a. Sample

769 participants responded to the survey. Due to the exploratory nature of the survey design, students enrolled in a research methods class recruited participants via a snowball sample, mostly in

California, Oklahoma, and Texas. Participants volunteered demographic information including gender, age, race, current state of residence, any prior states of residence, education level, medical insurance status, and listed disabilities if applicable. *Table A1* provides a breakdown of participants by selected demographic categories. Note that percentages may not equal 100% due to some respondents not answering all items.

b. Survey Instrument

The questionnaire was a paper-pencil survey consisting of four sections. The first section contained items concerning ways people react to and use weather information; responses in this section were scaled from 1 (disagree) to 7 (agree). Section Two asked participants how often they received their weather data from various sources in ordinary weather situations and again in severe weather situations. The third section included items mostly involving a relationship between people's senses and weather: how weather affects mood, how well respondents notice changes in weather, and how attached they become to a certain type of weather. Items scales were bipolar from 1 to 5. The fourth section, the only open-ended portion of the survey, provided participants several questions relating to severe weather preparation and terminology and concluded by asking for demographic information.

Section Three items were included from a pre-existing questionnaire focused on weather and emotion (Stewart, 2006). New questions were generated from an initial focus group of 28 university students. Questions were refined through iterative testing by participants unrelated to the study. A pilot test was performed on a revised form of the questionnaire, and further revisions were based on issues of comprehensibility and relevance of items. The final version of the questionnaire was then used in the sample for this study.

Survey items were grouped into several dimensions using factor analysis and composite scores were determined using the dimensions. *Table A2* lists items grouped by factor analysis and applicable reliabilities. All items in each section of the questionnaire were evaluated through factor analysis. A principal components analysis using varimax rotation yielded factor structures based on eigenvalues set at or above 1.0. All items with a factor loading of at least 0.50 on a 50/30 Purity Criteria Index were included in the appropriate dimension. For each participant, scores for each item in a dimension were then summed into a single composite score for that dimension, which was used for analysis. Individuals who did not respond to all items in a dimension were excluded in analysis to avoid artificially low scores: a missing value in a composite score would be treated as a zero if included.

3. Results

Questionnaire data was inputted into a spreadsheet and analyzed in SPSS (Statistical Package for the Social Sciences) v.15.0. Dependent variables match with dimensions obtained through factor analysis, and each dimension contains two to five survey items as seen in *Table A2*. Below lists the demographic information used as independent variables for the analysis. In parentheses are the names of the independent variables as referenced henceforth.

- Independent Variables
  - Gender
  - Age
  - Race
  - State of residence (Geography)
  - Education level (Education)
  - Anxiety level (Anxiety)

Relationships between the aforementioned independent variables and the following dependent traits will be examined: anxiety, readiness for severe weather, trust in weather agencies, ignoring weather information, having plans affected by weather, and understanding of severe weather terminology.

a. Anxiety

Landman-Peeters, et al., indicates that a direct relationship exists between gender and anxiety. Anxiety in severe weather situations will be predicted here by demographic information; however, anxiety may also be used as a predictor of some traits as well. As such, demographic information will be used to predict levels of anxiety, and the trait will be used as an independent variable to predict other traits.

Participants were asked to rate from 1 (disagree) to 7 (agree) their level of apprehension, dread, worry, anxiety when weather becomes severe, and anxiety when extreme temperatures are forecast. The scores were combined into a composite score, with a minimum score of 5, a maximum score of 35, and a resulting neutral score of 20. The lowest quartile in the anxiety dimension scored a mean of 8.6; the mean from the highest quartile was 27.1.

A strong relationship between gender and anxiety was observed ($F(736) = 80.8$, $p < 0.001$). Females reported a mean composite of 20.0 compared to a mean of 15.3 for males.

A model for gender and geography was significant ($F(720) = 18.3$, $p < 0.001$). Effects were observed for the interaction between the two variables ($p = 0.024$). Males from Oklahoma show the least anxiety (m = 14.6) and females in Texas report the highest levels of anxiety (m = 21.3). The effect size was moderate (adj $r^2 = 0.11$). *Table A3* shows means for Gender x Geography. Henceforth, traits predicted by anxiety will evaluate respondents only in the bottom and top quartiles of anxiety scores, and since the total population contains more females than males, a large number of females occupies both quartiles. As such, although gender and geography affect levels of anxiety, the two demographic categories, alone or in combination, should not necessarily be used as predictors of traits directly predicted by anxiety unless such a relationship is observed.

b. Trust

The study examined respondents trust of weather information and their assessment of its reliability. Participants were asked to rate from 1 to 7 on their belief in weather information becoming more reliable and their trust in the National Weather Service. Composite scores were compiled, ranging from 2 to 14, with a neutral score of 8 for the dimension.

Trust in the National Weather Service is quite high among the population (df = 765, m = 5.01). 87 percent of respondents scored a 4 or above on the item, indicating at least neutrality or agreement with the statement. Additionally, 90 percent scored a 4 or above relating to weather information becoming more reliable (df = 763, m = 5.20). Note that these two means involve single items scaled from 1 to 7.

Several main effects were observed between demographics and trust: Participants older than 25 (m = 10.7) showed significantly more trust in weather information than the younger group (m = 10.0). Among racial groups, blacks showed significantly less trust than any other group (df = 25; $\sigma = 2.13$; m = 9.12; *Table A4*).

Geographically, a strong relationship was also noted with trust ($F(736) = 22.7$, $p < 0.001$). Residents of California (m = 9.5) reported much less trust than counterparts in Oklahoma (m = 10.5) or Texas (m = 10.9). Among members of different education levels, trust increases with education: participants with trade school or less (m = 9.7) indicate less than those with a bachelor's degree or higher (m = 10.7).

Anxiety played a significant role with trust as well ($F(410) = 16.9$, $p < 0.001$). Respondents in the lowest quartile of anxiety exhibit less trust (m = 9.8) than people in the highest quartile (m = 10.7).

c. Ignoring weather information

There was also interest in determining the extent to which people ignore weather data. Participants responded to questions involving the dismissal and ignoring of weather information and weather's influence on one's lifestyle. The composite score was combined into a dimension of Ignoring. Although several demographic categories indicate a relationship with the trait, means are comfortably under 12.0, the neutral point on the 3 to 21 scale, and the majority of the entire population (df = 761, m = 10.5) indicates slight disagreement.

Again, several one-dimensional interactions were observed. According to gender, males (m=11.1) ignore weather information more than females (m = 10.0). By age the relationship was strongest ($F(747) = 19.6$, $p < 0.001$): Younger respondents (m = 10.8) dismiss information more than the older demographic (m = 9.5).

Levels of disregarding weather are highest in Oklahoma (m = 10.9) and lowest in Texas (m = 9.5). Additionally, people with high levels of anxiety (m =

9.5) ignore important information less than less anxious individuals (m = 11.1).

A model between age and anxiety was also significant (F(397) = 13.2, $p < 0.001$) with a moderate effect size (adj $r^2 = 0.08$). The effect observed between the variables was significant ($p = 0.007$). Older individuals with a high level of anxiety regarding severe weather are less likely to ignore weather information. Although the model is statistically significant, it mostly reiterates the one-dimensional relationship between age group and ignoring. In fact, younger participants in the upper quartile for anxiety reported a higher mean than older respondents in the lower quartile for anxiety. *Table A5* lists the means for the model.

d. Readiness/Planning for severe weather

Participants' planning for severe weather events was also studied in order to evaluate levels of planning in place for potentially threatening situation. Questions in this dimension involved participants awareness of what to do when severe weather strikes, by asking without any specificity if plans had been developed for severe weather. Items were again scaled 1 to 7. Three questions were included in this dimension; therefore, the composite score scale runs from 3 to 21.

Older individuals (m = 13.9) indicated much more readiness for severe weather than younger citizens (m = 11.8). One-way significance was very high for age (F(746) = 52.4, $p < 0.001$).

Table A6 shows mean Readiness scores across racial groups. Asian participants report lower scores in readiness and planning on every applicable survey item than any other racial group. Mean scores for American Indians and Caucasians are much higher in the dimension.

Geography plays a significant role in readiness (F(736) = 58.0, $p < 0.001$). Participants in California score nearly a full point lower (m = 10.3) than those in Oklahoma (m = 13.5) or Texas (m = 13.3). Additionally, more highly educated individuals (m = 13.4) show increased readiness over less educated people (m = 11.7).

A model was significant between age and gender (F(744) = 19.6, $p < 0.001$). Effects observed between the variables was significant ($p = 0.031$). Women above 25 years old (m = 14.6) showed the greatest level of readiness. Effect size was low (adj $r^2 = 0.07$). *Table A7* provides means for the model. The one-dimensional relationship between age and readiness in most clearly pronounced in the model: in fact, significance for age alone in the model ($p < 0.001$) is far greater than that of gender alone ($p = 0.053$).

e. Plans affected by inclement weather

Survey items asked participants to rate the affect of severe weather on personal and work-related plans and objectives. Three of the questions, from Section 1 of the questionnaire scaled answers from 1 to 7, while two of the items, from Section 3, provided a 1 (never) to 5 (always) scale. Therefore, the lowest possible score in the dimension is a 5, and the highest is a 31. A neutral score is the midpoint, an 18.

State of residence predicts if weather will affect plans. The highest scores were reported from Oklahoma (m = 17.1), and the lowest mean score was reported in California (m = 15.4). Note that both mean scores indicate slight disagreement with the dimension compared to the neutral score.

A very strong relationship is seen between anxiety level and participants' perceptions of weather affecting their plans (F(410) = 50.3, $p < 0.001$). People in the top quartile of anxiety scores (m = 18.0) are much more likely to encounter interruptions in plans due to weather than those in the lower quartile for anxiety (m = 14.7). This separation in means corresponds to a difference of roughly one point on a 1 to 7 scale.

f. Understanding difference between a Watch and a Warning

Participants were asked in open-ended format: “What is the difference between a severe weather 'warning' and a 'watch'?” A watch “is used when the risk of a hazardous weather or hydrologic event has increased significantly, but its occurrence, location, and/or timing is still uncertain. It is intended to provide enough lead time so that those who need to set their plans in motion can do so.” A warning “is issued when a hazardous weather or hydrologic event is occurring, is imminent, or has a very high possibility of occurring.

A warning is used for conditions posing a threat to life or property" (National Weather Service). Respondents who volunteered a response were evaluated on their ability to recognize that a warning represents a more imminent threat than a watch, but also that a watch does not insinuate that no threat is present. If both cases were satisfied, responses were scored as correct. Otherwise, responses were scored incorrect.

Relationship between age group and correctness in the terminology was notable. Participants older than 25 were correct in 73% of cases (df = 230), whereas the younger group was only correct in 57% of responses (df = 526). Race was also prominent in the dimension. Caucasian respondents were correct 66% of the time; all other racial groups are correct in between 47% and 51% of answers.

Geography also determined knowledge of watches compared to warnings. Oklahomans and Texans responded correctly 68% and 70% of the time, respectively; and Californians only answered correctly in one-half of cases. Education was also observed to be a predictor of answering correctly: 69% of participants with bachelor's degrees or higher answered correctly compared to only 54% of participants in the lowest education category.

4. Discussion

a. Anxiety

Consistent with other situations, a clear effect is shown between gender and level of anxiety concerning severe/extreme weather situations. Additionally, anxiety may be used as a predictor of trust, ignoring weather information, and one's perceptions of weather affecting their plans. All are important dimensions that may prove useful for targeting specific groups. Low anxiety individuals are more likely to maintain less trust in weather information and the National Weather Service, and they are in turn more likely to ignore weather information. Such individuals are probably more likely to show signs of complacency in the event that a severe weather event actually occurs. Likewise, high anxiety individuals may be over-prepared or unjustly worried about an unlikely scenario.

Citizens in different portions of the country show varying levels of general anxiety—which may be used to predict a level of anxiety relating to severe weather. Notably however, in the three states involved here, geography does not have an affect on anxiety relating to severe weather, despite more tornadoes occurring in Oklahoma and Texas than any other part of the United States (Brooks, et al., 2003). While demographic information such as gender and state of residence may help target individuals to increase awareness or decrease undue stress about severe weather, areas of high or low anxiety may themselves be targeted to educate people about the need to pay attention to important weather information.

b. Other Variables

A majority of citizens report that weather information is reliable, and a very large majority feel as least neutrally on the subject. Most participants also indicated trust in the National Weather Service. Despite the positive response from the general public, a couple of specific groups may be targeted. Racially, blacks indicate significantly less trust than other groups while still maintaining slight agreement. Residents of California are less likely to trust weather information, as are those with the least anxiety over severe weather.

Respondents were less likely to ignore weather information; however, the behavior was more common among males than females. Sensibly, people with high levels of anxiety are less likely to ignore weather information: females were shown to have higher levels of anxiety. Geographically, Oklahomans are most likely to ignore weather information among the three states surveyed, perhaps due in part to overexposure to weather information. Most significantly, people under 25 years old may be targeted to monitor weather information.

Location is observed as the most important factor for severe weather readiness. People in California are much less apt for planning than counterparts in other states, but likely because the frequency of severe weather is markedly less in California than many locations of the country. Additionally, Asians report the lowest scores for planning; however, about 70% of Asian participants reside in California. Likewise, Native Americans score highest on readiness: over

70% live in Oklahoma, the highest scoring state in the category. Also, older citizens were far more likely to indicate readiness than younger citizens.

As observed for planning, Oklahomans also show more tendency to be affected by severe weather, and Californians appear less affected. Reasonably, high anxiety corresponded to increased effect on personal plans. Again, one must be careful to not confuse a relationship between high anxiety and affected plans with a nonexistent direct interaction between gender and affected plans. Although, gender affects level of anxiety one-dimensionally, the highest quartile of anxiety includes both male and female subjects, and all members of the high quartile group were used to evaluate the relationship between anxiety and affected plans.

c. Understanding the difference between a Watch and a Warning

As might be expected, older participants and more highly educated individuals are more likely to correctly identify the difference between a watch and a warning. Race was significant only in that whites answered correctly more often than any other group. By state of residence, Californians show a significant lack of understanding of the terminology tested compared to people in the other two states. According to age, older respondents correctly answered more often than younger ones.

Of all participants surveyed, only 58% correctly identified the difference between a watch and a warning, and 36% were incorrect. Note that results from the entire population are probably biased by the large number of younger participants in the survey. The content of responses varied widely: some individuals gave general but correct definitions concerning the definitions. For example, one participant wrote, “Warning-severe weather is imminent. Watch- be aware of possible severe weather.” Many others, particularly respondents in Oklahoma or Texas provided very specific examples to tornadoes, including, “Watch-possibility of severe weather. Warning-tornado has hit, it's happening.” One response gave a correct definition for a hurricane watch and warning, and had also responded to another open-ended question that she would be most likely to evacuate from a hurricane. Many others, particularly from Texas, mentioned evacuation in their definitions of warning, likely referring to a hurricane warning.

The diversity among incorrect responses was even greater. 95 individuals, about one of every eight participants, completely reversed the definition of a watch and a warning. Another 99 respondents simply stated that they did not know the difference. Most of the other answers scored incorrect mentioned that a watch was unimportant and meant nothing would happen. The responses may indicate a problem in either the naming system of a watch versus a warning or the education of the public about the meaning of these official advisories. Of the 194 people aforementioned, 191 provided their age: about three-quarters of the group are no older than 25 years, indicating a strong need to educate younger residents. Still, one-quarter of the group is from the older demographic, indicating confusion among all age groups.

One recurring problem seemed to involve the term “watch”. Many respondents used the word “watch” or a reference to it in their definition. Provided below are a few examples of responses:

“Warning- Is less severe it means its possible. Watch-means its pretty close and will really happen and is being watch closely.”

“Warning is just telling you a storm is possible. A watch is watching the actual storm.”

“Watch- Meteorologists have sighted severe weather. They usually ask for listeners to take action immediately.”

“Warning is a warning. Watch is live footage.”

The responses indicate a clear confusion caused by the term “watch”. In many cases, participants answer that a watch supersedes a warning thinking that a *watch* involves a *visual* confirmation. Likely, some respondents who answered that a watch means “It's happening,” think in similar ways.

Many of the correct answers suggested that a warning absolutely confirms the presence of severe weather. One such response stated that a warning indicates “definite severe weather”. While such a response indicates readiness to react to a severe weather situation, severe weather may in fact not always affect every person within a warning. Such false alarms may induce complacency within the public concerning severe weather, a continuing concern of forecasters (Sheets, 1985). Knowledge and expertise affect public views of trust and credibility of sources of environmental risk communication (Peters, et al., 1997). As such, false alarms could decrease the public's perception of expertise of the National Weather Service and thus reduce some individuals' levels of trust in the organization. In the past, the National Weather Service issued warnings by county boundary, resulting in the warning of many unaffected residents. More recently, forecast offices have incorporated a more sophisticated computer system capable of issuing warning polygons not bounded by county borders (Waters, et al., 2005). As such, false alarms may be decreased to many unaffected citizens; however, false alarms may still occur under the improved system. Some warnings do not verify: no severe weather occurs. During a tornado warning, even if a tornado occurs, it will only affect a small swath of the entire warning polygon. Thus, the public must be informed that a warning does not guarantee severe weather, but does involve increased risk and imminent threat, in order to avoid growing a sense of complacency among any resident. In their 2005 strategic plan, NOAA recognizes the need to release trusted products. Considering trust an important issue in risk communication of weather situations (Morss, et al., 2007), solidifying citizens' trust in the National Weather Service will become important in effectively disseminating information. Educating the public on weather terminology may, in this case, aid in understanding the cause of some false alarms and thus reduce complacency and increase trust.

Of the population studied, nearly two of five did not correctly identify the difference between a watch and a warning. Likely, the public would incorrectly identify other weather terminology as well. Obviously, education of the public in such matters would increase the ability of people to make sound and potentially life-saving situations in severe weather situations. In 2006, 892 severe weather watches were issued across the country (Storm Prediction Center). However, until the general public better understands what a “watch” represents, many of these advisories will remain ignored or misunderstood.

d. Limitations and Implications

A couple of limitations prevented additional data analysis. Foremost, nearly three-quarters of the sample was Caucasian, preventing any two-dimensional modeling involving race. As such, only main effects could be observed involving race. Additionally, a little over two-thirds of the population was 25 years old or less, potentially biasing some results toward the younger age demographic. Nonetheless, sample size for the older demographic was large enough to undergo meaningful statistical analysis, but the lack of age distribution prevented the creation of more than two age categories. Also of interest but not analyzed in this study are the behaviors of several age groups of individuals over 25: reasonably, an average 70 year old may not act similarly to a typical 25 year old.

This study is part of a larger project that will examine many aspects of communicating weather information to the public. Other work includes determining sources through which individuals receive weather information (e.g. TV, Internet, newspaper, radio). Such information could be vital to determining means of communicating with specifically targeted groups in order to apply information gained by this study to effectively convey important information. Additionally, questionnaire data may be used to examine the effects of weather on emotional areas such as mood or attachment to a certain type of weather. Finally, the information gained indicates the need for targeting specific demographic groups to compile data in a similar analysis with greater sample size. Racial groups need targeting in order to increase sample sizes, and older individuals not reached in this sample need to be surveyed as well. Behaviors may also be examined in other areas of the country given sufficient sample sizes, potentially providing information relating to the public's use and understanding of data regarding other meteorological events such as hurricanes, floods, or winter weather. Such work would build a more complete and comprehensive national profile of the way citizens react to weather information in various regions.

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Appendix A: Survey Data

Table A1: Demographic information for the population examined in this study.

Gender	Male	N	312
		%	40.6
	Female	N	447
		%	58.1
Age	25 yrs. or less	N	526
		%	68.4
	Older than 25	N	230
		%	29.9
Race	American Indian/Alaska Native	N	21
		%	2.7
	Asian/Pacific Islander	N	46
		%	6.0
	Black	N	27
		%	3.5
	Hispanic	N	66
		%	8.6
	White	N	575
		%	74.8

State of Residence	California	N	230
		%	31.7
	Oklahoma	N	347
		%	47.3
	Texas	N	132
		%	17.9
	Other	N	13
		%	1.7
Highest Education Level Completed	Trade school/High school or less	N	193
		%	25.1
	2-year program or some college	N	296
		%	38.5
	4-year program, or graduate school	N	262
		%	34.1

Table A2: Factor analysis on survey items. Listed are the dimensions determined, including the survey items falling into each factor, their factor loadings, and their reliabilities.

Factor Analyses and Reliabilities

Survey Item	Factor Loading	Reliability
Factor: Anxiety		
Level of anxiety when severe weather enters area.	0.85	
Level of worry when severe weather enters area.	0.85	
Level of dread when severe weather enters area.	0.82	
Level of apprehension when severe weather enters area.	0.76	
Increased anxiety when extreme temperatures forecast.	0.52	
Reliability: Anxiety		**0.85**
Factor: Trust		
Great deal of trust in the National Weather Service	0.72	
Weather forecasts and warnings are becoming more reliable.	0.58	
Reliability: Trust		**0.55**
Factor: Ignoring weather information		
Change the channel when weather advisories come on the air.	0.73	
Tendency to ignore severe weather warnings.	0.70	
Other people are more influenced by weather information than me.	0.51	
Reliability: Ignoring		**0.53**
Factor: Readiness/Planning		
False alarms do not affect my decision to act during a severe weather warning.	0.67	
Developed specific plans for severe weather.	0.64	
I am certain what to do when severe weather hits my area.	0.50	
Reliability: Readiness		**0.63**
Factor: Plans affected by inclement weather*		
Section 1		
Severe weather affects my job.	0.71	
Severe weather affects my social plans.	0.62	
Section 3		
Weather conditions routinely affect my ability to perform tasks at school or work.	0.83	
The work that I do is affected by daily weather conditions.	0.83	
I plan my daily routine around what the weather may bring.	0.51	
Reliability: Plans Affected		**0.62**

*Two items in Section 1 on a 1-7 scale and three items in Section 3 on a 1-5 scale factored into this category. Due to the obvious relationship between the items, they are grouped as one factor. Factor loadings shown are those with factor analysis in the individual sections.

Table A3: Means for an anxiety model based on the interaction between geography and gender. Significant values are in bold. Note that a clear one-dimensional relationship between gender and anxiety is observed.

	Men	Women
California	16.3	19.1
Oklahoma	**14.6**	20.3
Texas	15.2	**21.3**

Table A4: Interaction between race and trust. Blacks show less trust than any other racial group.

	Mean Trust
American Indian	10.3
Asian/Pacific Islander	9.9
Black	**9.1**
Hispanic	9.7
White	10.4

Table A5: Interaction between Age and Anxiety level with respect to ignoring weather information. Older anxious individuals are less likely to dismiss weather information.

	Lower Quartile	Upper Quartile
Up to 25 years old	11.2	10.9
Older than 25	10.3	**7.7**

Table A6: Racial differences in readiness and planning. Asian respondents consistently score lowest in this category. Whites and American Indians, however, score highly.

	Mean Readiness
American Indian	**12.9**
Asian/Pacific Islander	**9.9**
Black	11.3
Hispanic	10.8
White	**12.9**

Table A7: Model for age and gender interacting with readiness. Older women score highest on planning; however, in both genders, older respondents report greater levels of readiness for severe weather.

	Men	Women
Up to 25 years old	11.8	11.7
Older than 25	13.3	**14.6**

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