Hazard Simplification Project:

Generalizable Survey for Excessive Heat and High Winds

Final Report

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Executive Summary

The National Weather Service (NWS) provides weather, hydrologic, and climate forecasts and warnings to the United States to protect life and property. This is accomplished by issuing ***watches, warnings, advisories (WWA)***, and other information products to communicate the threats posed by hazardous weather situations. With previous studies acknowledging that many members of the general public may not understand the distinctions between the watch, warning, and advisory terminology, the NWS embarked on an extensive research endeavor (called the **Hazard Simplification Project)** to begin addressing some of these concerns. With initial efforts on this project dating back to 2011, the infusion of social science engagement in 2013/2014 ignited further inquiry into the status of the WWA system. As a result, several projects have emerged that have sought to better understand the knowledge and use of the WWA system among all end users. Until this point, a majority of the research efforts sponsored by the NWS have been devoted to understanding the WWA system from the perspective of their partners and stakeholders. While these research projects were an important first step, it is also imperative to obtain the general public's perspective on any and all proposed changes to our weather warning system. As a result, the following research report describes and documents an evaluation of our current WWA language and proposed alternative weather warning language among a generalizable sample of the public.

Through funding provided by the National Science Foundation's (NSF) Graduate Research Internship Project (GRIP), **the following report offers an extension of Eastern Research Group's (ERG) research efforts on the Hazard Simplification Project by investigating additional hazards (i.e., excessive heat – warm regions, excessive heat – cold regions, and high winds).** Although a separate research endeavor, this report should be treated as a companion piece and as such considerable effort was given to remaining uniform in the development and implementation of these generalizable surveys.

Methods:

In collaboration with various NOAA social scientists, ERG, the NWS, and previous research efforts, a generalizable survey was designed that assessed the following:

- Several easy demographic questions: State of primary residence, primary residence type, environment near residence, number of adults in household, number of children in household.
- General risk and weather-related questions: perceived susceptibility, perceived severity, risk perception as affect, previous hazard experience, adaptive behaviors, gathering capacity, and subjective norms.
- Current WWA knowledge[1]
- A first prototype testing scenario
- A second prototype testing scenario
- Weather information habits: how do individuals receive weather information, frequency of receiving weather information from various sources, etc.

[1] The surveys developed in this separate research project did not specifically ask about current WWA knowledge; however, additional questions were included that are able to provide some information on this topic.

- Finally, several additional demographic questions were asked: gender, race, age, educational background, Hispanic origin, and annual household income.

The main goal of this survey was to test alternative language to the current WWA system; therefore, four prototypes were developed that sought to examine alternative WWA headlines in comparison to the current system. In all, the generalizable survey assessed five prototypes - current system plus the four newly developed prototypes. Table ES-1 provides a breakdown of the five prototypes, and the goals of each prototype can be described as follows:

- **Current System:** Gathering data on the public's understanding of the current system.
- **Prototype 1: Outlook, Warning, Warning, Warning:** This prototype was used for theoretical purposes. Specifically, we wanted to test whether people anchor to headlines *or* information. Thus, we used the *same* "Warning" headline for every level, but only changed the information we gave them. This prototype also allows for testing a new headline for "Watch" – "Outlook."
- **Prototype 2: Notice, Alert, Warning, Emergency:** This prototype follows a similar pattern to our current system; however, allows us to change the headlines for "Watch" and "Advisory" as previous research has found these headlines in the current system to be problematic.
- **Prototype 3: Possible X Event, (Minor), Moderate, Severe, Extreme Warnings.** This prototype is a larger overhaul of the system. It changes the word for "Watch" to "Possible X Event," where X is the hazard (e.g., Possible Winter Weather Event). The headline "Warning" is maintained while using adjectives to convey different levels of risk.
- **Prototype 4: Possible X Conditions, Level Orange, Level Red, Level Purple Warnings.** This prototype is also a larger overhaul of the system. It changes the word "Watch" to "Possible X Conditions," where X is the hazard (e.g., Possible Winter Weather Conditions). The word "Warning" is maintained while using colors to denote different levels of risk.

Table ES-1. Five Prototypes Assessed in the Generalizable Survey

Level	Current System	Prototype 1	Prototype 2	Prototype 3	Prototype 4
Watch level	X Watch	X Outlook	X Notice	Possible X Event	Possible X Conditions
Advisory level	X Advisory	X Warning	X Alert	Moderate X Warning	Level Orange X Warning
Warning level	X Warning	X Warning	X Warning	Severe X Warning	Level Red X Warning
Emergency level	X Emergency	X Warning	X Emergency	Extreme X Warning	Level Purple X Warning

Thinking specifically about the hazards tasked by this research endeavor, it was decided in collaboration with the NWS that the surveys and prototypes would address the following:

Excessive Heat (both regions):

- The current WWA messages (i.e., Excessive Heat Watch, Heat Advisory, and Excessive Heat Warning) would constitute the current system prototype.

- The excessive heat prototypes would be split into two surveys: Excessive Heat – Warm Regions and Excessive Heat – Cold Regions. This would allow us to account for the use of headlines across different geographical areas, with different issuance criteria.
- The excessive heat prototypes would only retain the "Advisory" headline and "Warning" headline.
- The excessive heat prototypes would only progress linearly and would not account for downgrades. Therefore, respondents saw a continuance of the "Advisory" level condition to keep the number of prompt levels consistent across all hazards.
- The excessive heat prototypes would account for the upcoming consolidation efforts by dropping "Excessive" from the new prototype headlines.
- Details about the prototypes associated with the excessive heat surveys can be found in Table ES-2.

Table ES-2. Prototypes Assessed in the Excessive Heat Surveys (Warm and Cold Regions)

Level	Current System	Prototype 1	Prototype 2	Prototype 3	Prototype 4
Watch level *("Advisory," except Current System)*	Excessive Heat Watch	Heat Warning	Heat Alert	Severe Heat Warning	Level Orange Heat Warning
Advisory level *(Continuance of the "Advisory")*	Heat Advisory	Heat Warning	Heat Alert (Cont.)	Severe Heat Warning (Cont.)	Level Orange Heat Warning (Cont.)
Warning level	Excessive Heat Warning	Heat Warning	Heat Warning	Extreme Heat Warning	Level Red Heat Warning

High Wind:

- The current WWA messages (i.e., High Wind Watch, Wind Advisory, and High Wind Warning) would constitute the current system prototype.
- Two scenarios would be used: Advisory with an Upgrade and Warning with a Downgrade.
- The high wind prototypes would account for the upcoming consolidations efforts by dropping "High" from the new prototype headlines.
- Details about the prototypes associated with the high wind survey can be found in Table ES-3.

Table ES-3. Prototypes Assessed in the High Wind Survey

Level	Current System	Prototype 1	Prototype 2	Prototype 3	Prototype 4
Watch level	High Wind Watch	Wind Outlook	Wind Notice	Possible Wind Event	Possible High Winds
Advisory level	Wind Advisory	Wind Warning	Wind Alert	Moderate Wind Warning	Level Orange Wind Warning
Warning level	High Wind Warning	Wind Warning	Wind Warning	Severe Wind Warning	Level Red Wind Warning

To effectively evaluate the newly-designed prototypes and the current system, it was determined that it would be best to have members of the general public walkthrough a real-world weather scenario that was hypothetically threatening them and their family. Therefore, these surveys included two[2] possible scenarios:

- **Advisory with an Upgrade (AU) –** NWS issues an advisory and then upgrades the situation by issuing a warning in a subsequent message.
- **Warning with a Downgrade (WD) –** NWS issues a warning and then downgrades the situation to an advisory in a subsequent message.

The survey asked about the actions that respondents would take in response to four prompts associated with the scenarios. All participants began with a "Baseline" prompt that only provided weather information, and then progressed through different prompts (i.e., Watch, Advisory, and Warning) based on their randomly assigned scenario (i.e., Advisory with an Upgrade or Warning with a Downgrade). Respondents could select from five actions (1) nothing, (2), monitor, (3) prepare, (4) take some action, and (5) take protective action. The specifics of each action differ by hazard. In addition to their overall action taken, respondents were also asked to provide the likelihood that they would monitor additional forecast information, prepare, and take protective action. Respondents were asked to indicate (on a scale from 1 to 5) their likelihood of performing these actions. Finally, my survey also included several perception variables (perceived risk, perceived urgency, perceived confidence, and probability of occurrence) that assist in understanding an individual's response to each prototype and their knowledge of the current WWA system.

To analyze these data, we used ordered logistic regression to estimate odds ratios. An *ordered logistic regression analysis* correlates a set of ordered response categories (e.g., overall action taken, likelihood to monitor, likelihood to prepare, and likelihood to act) with a set of explanatory variables (e.g., the prototype the respondent saw, demographics, responses to other questions) to determine the factors that lead to respondents selecting higher or lower categories. The results we present are phrased in terms of odds ratios for the included variables. Odds ratios reflect the increased probability of being in a "higher" response category for increased values of the variable. For example, we estimated odds ratios associated with seeing Prototypes 1-4 relative to seeing the current system; thus, our results allow us to make statements such as "those who saw prototype 1 were 1.5 times more likely to select a more protective action than those who saw the current system wording." In that example, the odds ratio is the value 1.5. The key value in an odds ratio is 1.0; estimates below 1.0 reflect decreased probabilities of being in higher categories and values above 1.0 reflect increased probabilities of being in higher categories[3]. The statistical significance of an odds ratio is judged by comparing the value to 1.0; values that are significantly different than one are considered statistically significant.

Given this statistical analysis approach, the following results are offered:

[2] The hazards (excessive heat and high winds) specifically discussed in this report did not have a "Warning with an Upgrade" scenario. In the companion piece, authored by ERG, some hazards include the "Warning with an Upgrade" scenario.

[3] By design, odds ratios cannot be below zero.

Findings from the Excessive Heat and High Wind Surveys:

Overall Results for Current WWA Knowledge:

Participants seem to be responding appropriately to the current excessive heat WWA headlines. This conclusion can be drawn based on the means associated with behavior (i.e., overall action, monitoring, prepare, and protective action) increasing linearly across the conditions. Further, a similar trend is observed among the perception variables (i.e., risk, confidence, urgency, and probability). This conclusion is observed in both the excessive heat cold and warm region surveys.

Respondents appear to misunderstand the "Wind Advisory" headline in the current system – for both the upgrade and downgrade scenarios. Instead of an increase in all of the perception variables, respondents perceived less risk, confidence, urgency, and probability when an "Advisory" headline was seen. In fact, their response to these variables was lower than their response to the "Watch" headline.

Overall Results by Prototype and Hazard:

Prototypes 1, 2, and 4 performed the best overall in comparison to the current system. However, Prototype 1 also had several estimates that were significantly less than 1.0 – this should be taken into consideration. It is important to keep in mind that these prototypes only outperformed the current system in roughly one out of five estimates (i.e., Prototype 1), one out of ten estimates (i.e., Prototype 2), and one out of every four estimates (i.e., Prototype 4). While these three prototypes outperformed the current system at times, it was not a staggering result.

Prototype 3 performed poorly in comparison to the current system. Prototype 3 only received two estimates that were significantly greater than 1.0 and six estimates that were less than 1.0. Again, this lack of performance was not overwhelming – but noteworthy.

Table ES-4. Percentages of All Estimates Significantly Greater and Less than 1.0, by Prototype: Excessive Heat and Wind Surveys Combined

Prototype	Significantly Greater Than 1.0	Significantly Less Than 1.0
Prototype 1	17%	10%
Prototype 2	10%	4%
Prototype 3	4%	13%
Prototype 4	25%	10%
Total Number of Estimates [a]	48	

[a] This is the total for each Prototype

Overall Results by Prompt Level:

Prototype performance varied by hazard; however, overall they agreed with the conclusions presented above. The excessive heat surveys from warm and cold regions did not completely agree. Prototypes 1, 2, and 4 outperformed the current system in the Warm Regions, whereas Prototypes 2 and 4 outperformed the current system in the Cold Regions. Again, this outperformance was not an

overwhelming result. For the high wind hazard, Prototype 4 outperformed the current system and the other prototypes. While it also possessed estimates that were significantly less than 1.0, these values were isolated to the "Watch level."

The prototypes perform differently within each prompt level. Although Prototypes 1, 2, and 4 performed best overall, this result varies by prompt level. For example, Prototypes 1 and 4 perform best at the "Advisory level" for High Winds, but Prototypes 2 and 4 perform best when issuing an "Advisory" headline within Excessive Heat. This breakdown by prompt level (in this report and the companion report authored by ERG) may prove beneficial if crafting a "Frankenstein" operational prototype is desirable by the NWS.

The current wind "Watch" headline (i.e., High Wind Watch) outperforms all of the high wind prototypes at the "Watch level." This is evident in Table ES-5 under the "High Wind Estimates" portion of the table, where a high percentage of odds ratio estimates were significantly less than 1.0 at the "Watch level."

Table ES-5. Percentages of All Estimates Significantly Greater and Less than 1.0, by Prototype and Prompt Level: Excessive Heat and Wind Surveys Combined

Prototype	High Wind Estimates						Excessive Heat Estimates [b]					
	Watch		Advisory		Warning		Watch		Advisory		Warning	
	> 1.0	< 1.0	> 1.0	< 1.0	> 1.0	< 1.0	> 1.0	< 1.0	> 1.0	< 1.0	> 1.0	< 1.0
Prototype 1	0%	13%	63%	0%	0%	38%	13%	0%	0%	0%	13%	0%
Prototype 2	0%	13%	25%	0%	0%	13%	25%	0%	0%	0%	13%	0%
Prototype 3	0%	50%	0%	0%	0%	0%	13%	13%	13%	0%	0%	0%
Prototype 4	0%	63%	63%	0%	25%	0%	25%	0%	0%	0%	13%	0%
Total Number of Estimates [a]	8		8		8		8		8		8	

[a] This is the total for each Prototype

[b] The hazards were separated because the Excessive Heat Prototypes did not test "Watch" headlines.

Overall Results by Protective Response Variable:

Prototypes 1 and 4 were both more effective at eliciting action in comparison to the current system. For both the "Action Taken" and "Likelihood of Acting" response variables, Prototypes 1 and 4 performed the best.

Prototypes 2 and 4 were both better at increasing the monitoring of weather forecast information in comparison to the current system. For the "Likelihood of Monitoring" response variable, Prototypes 2 and 4 had a greater percentage of estimates that were significantly larger than 1.0. However, both of these prototypes did have a couple of estimates that were significantly less than 1.0.

Prototype 4 was more effective at increasing preparation in comparison to the current system. For the "Likelihood of Preparing" response variable, Prototype 4 had the greatest percentage of estimates that were significantly larger than 1.0. However, this prototype also had a fairly large percentage of estimates than were significantly less than 1.0. Upon further investigation, almost all of the estimates

that were significantly lower than 1.0 occurred under the "Watch" headline, where all prototypes failed to outperform the current system.

Table ES-6. Percentages of All Estimates Significantly Greater and Less than 1.0, by Prototype and Protective Response Variable: Excessive Heat and Wind Surveys Combined

	Action Taken		Likelihood of Monitoring		Likelihood of Preparing		Likelihood of Acting	
	> 1.0	< 1.0	> 1.0	< 1.0	> 1.0	< 1.0	> 1.0	< 1.0
Prototype 1	17%	0%	25%	25%	8%	17%	8%	0%
Prototype 2	8%	0%	17%	8%	8%	8%	8%	0%
Prototype 3	0%	25%	8%	17%	8%	8%	0%	8%
Prototype 4	25%	8%	25%	8%	25%	17%	17%	8%
Total Number of Estimates [a]	12		12		12		12	

[a] This is the total for each Prototype

Overall Results by Protective Response Variable and Prompt Level:

Tables ES-7, ES-8, and ES-9 further breakdown the percentages by looking at both protective response variable (i.e., Action taken, Likelihood to Monitor, Likelihood to Prepare, and Likelihood to Act) and prompt level (i.e., Watch level, Advisory level, Warning level). These tables offer additional information to better determine if individuals are taking the *most appropriate actions* at each prompt level. These tables only reflect the high wind surveys, due to the prompt level differences that exist within the excessive heat surveys.

Prototype 4 performs well at both the "Advisory level" and "Warning level." In comparison to the other prototypes, Prototype 4 consistently performs well at both the "Advisory" (Table ES-8) and "Warning level" (Table ES-9). Specifically, at the "Advisory level", Prototype 4 performs well across all of the protective response variables. At the "Warning level," Prototype 4 is effective at eliciting action.

Table ES-7. Percentages of All Estimates Significantly Greater and Less than 1.0 at the Watch level, by Prototype and Protective Response Variable: High Wind Survey

WATCH LEVEL								
Prototype	Action Taken		Likelihood of Monitoring		Likelihood of Preparing		Likelihood of Acting	
	> 1.0	< 1.0	> 1.0	< 1.0	> 1.0	< 1.0	> 1.0	< 1.0
Prototype 1	0%	0%	0%	50%	0%	50%	0%	0%
Prototype 2	0%	0%	0%	0%	0%	50%	0%	0%
Prototype 3	0%	50%	0%	100%	0%	100%	0%	50%
Prototype 4	0%	50%	0%	50%	0%	50%	0%	50%
Total Number of Estimates [a]	2		2		2		2	

[a] This is the total for each Prototype

[b] Due to the differences in the excessive heat prototypes, only the breakdown for high winds is shown.

Table ES-8. Percentages of All Estimates Significantly Greater and Less than 1.0 at the Advisory level, by Prototype and Protective Response Variable: High Wind Survey

ADVISORY LEVEL								
Prototype	**Action Taken**		**Likelihood of Monitoring**		**Likelihood of Preparing**		**Likelihood of Acting**	
	> 1.0	**< 1.0**	**> 1.0**	**< 1.0**	**> 1.0**	**< 1.0**	**> 1.0**	**< 1.0**
Prototype 1	100%	0%	50%	0%	50%	0%	50%	0%
Prototype 2	50%	0%	0%	0%	0%	0%	50%	0%
Prototype 3	0%	0%	0%	0%	0%	0%	0%	0%
Prototype 4	100%	0%	50%	0%	100%	0%	50%	0%
Total Number of Estimates [a]	2		2		2		2	

[a] This is the total for each Prototype

[b] Due to the differences in the excessive heat prototypes, only the breakdown for high winds is shown.

Table ES-9. Percentages of All Estimates Significantly Greater and Less than 1.0 at the Warning level, by Prototype and Protective Response Variable: High Wind Survey

WARNING LEVEL								
Prototype	**Action Taken**		**Likelihood of Monitoring**		**Likelihood of Preparing**		**Likelihood of Acting**	
	> 1.0	**< 1.0**	**> 1.0**	**< 1.0**	**> 1.0**	**< 1.0**	**> 1.0**	**< 1.0**
Prototype 1	0%	0%	0%	100%	0%	50%	0%	0%
Prototype 2	0%	0%	0%	50%	0%	0%	0%	0%
Prototype 3	0%	0%	0%	0%	0%	0%	0%	0%
Prototype 4	50%	0%	0%	0%	0%	0%	100%	0%
Total Number of Estimates [a]	2		2		2		2	

[a] This is the total for each Prototype

[b] Due to the differences in the excessive heat prototypes, only the breakdown for high winds is shown.

Recommendations:

After examining the results and conclusions *from the companion report authored by ERG and considering the conclusions described above*, the following recommendations are offered:

- ***Fixing the "problem" words (i.e., Watch and Advisory) can be a possible solution.***

  When examining the overall results by prompt level, Prototype 2 appears to be more effective at the "Watch" level and the "Advisory" level – in comparison to the current system. The goal of

Prototype 2 was to evaluate a similar system to the current one; however, it allowed us to test alternative headlines for "Watch" and "Advisory." Considering that previous Hazard Simplification projects have noted that emergency managers and broadcast meteorologists were interested in only making minor changes, this could be an solution that considers those needs. **After further examination of the results across different prompt levels, it appears that the transition from "Alert" to "Warning" does not provoke much behavior change. Therefore, replacing "Advisory" with "Alert" may only lead to individuals performing "Warning" level behaviors at the "Advisory" level. As a result, this change may fail to improve the spectrum of understanding that exists surrounding our current weather warning system.** ***This should be strongly considered when thinking about this as a possible solution.***

- ***Develop a new message sequence that combines Prototypes 2 and 4.***

  As described in both reports, Prototypes 2 and 4 consistently performed better than the current system and other prototypes. However, when examining the overall results by prompt level, Prototype 2 appears to be more effective at the "Watch" level and the "Emergency" level and Prototype 4 consistently performs well at the "Advisory," and "Warning" levels. To maximize the results of these two prototypes, it is suggested that a new prototype combine the two. Table ES-10 provides one option for a possible "Operational Prototype" when combining Prototype 2 and 4. **The message sequence in the combined column would, based on the data analyses, generate the greatest preparation and protective action response. However, this is only one option for combining the two prototypes.** Additional conversations and further discussion with NWS will be conducted to determine the best approaches to consider.

Table ES-10. Combined Prototype 2 and 4 Based on Data Analysis Results

Prompt Level	Prototype 2	Prototype 4	Combined
Watch	X Notice	Possible X Conditions	X Notice
Advisory	X Alert	Level Orange X Warning	Level Orange X Warning
Warning	X Warning	Level Red X Warning	Level Red X Warning
Emergency	X Emergency	Level Purple X Warning	X Emergency

Additional Thoughts:

- **Headlines matter.** Prototype 1 was specifically designed to evaluate whether individuals anchor to weather information or the weather-related headlines. Because Prototype 1 performs poorly across most of the hazards, this survey effort reveals the importance of weather headlines when communicating with a general public audience.

- **Any changes to the prototypes should take into account all hazards.** As discussed in the results, the success of the prototypes varied by hazard. Therefore, strong consideration should be given

to each hazard when deciding on a final "Operational Prototype." Further, other hazards that were not considered during this survey process (i.e., Tropical hazards) should also be considered when deciding on a final "Operational Prototype." Ask questions such as: Does this prototype make sense for all hazards? Are we staying consistent across all program areas? Will the tropical hazards fit into this "Operational Prototype?"

- **The NWS should continue thinking about the meteorological attributes that will drive each headline change.** The survey discussed in this report mapped meteorological criteria that is currently used by NWS policy to issue *watches, warnings, and advisories.* Therefore, considerable effort should be given to the meteorological attributes that would drive each headline change in a new or modified weather warning system. For example, would it be focused around impacts, confidence, or even a matrix system combining both impacts and confidence? This should be strongly considered as the NWS moves forward with additional testing.

Next Steps:

Given these recommendations, several next steps are proposed for consideration as the NWS continues to evaluate alternatives to the current WWA system:

Discuss the results of the generalizable survey with members of the weather community, partners, and stakeholders.

- **Hazard Simplification Workshop 2.0:** Consider conducting another workshop similar to the Hazard Simplification Workshop in 2015. Given the various options and recommendations for creating an "Operational Prototype," NWS participants, emergency managers, broadcast meteorologists, social scientists, and other relevant partners could assist in finalizing an appropriate "Operational Prototype" that could be evaluated via additional operational testing in the Hazardous Weather Testbed. However, it will be *very important* to develop a core set of goals ahead of the workshop to ensure that a "Operational Prototype" is obtained at the end of the workshop.

- **Hazard Simplification Webinar:** Since the Hazard Simplification Workshop 2.0 would only allow a select number of participants and would ultimately require travel, webinar(s) in conjunction with the workshop may be considered to obtain feedback from a larger community perspective. This activity could act as a mini "listening tour" to better understand the partner's/stakeholder's perspective on the finalized "Operational Prototype." For example, the NWS could team up with members of the NWA Societal Impacts Committee to co-host a NWA Webinar Wednesday by creating an interactive, online focus group with various members of the community. This could produce additional opportunities to obtain feedback from the weather enterprise, while collaborating with professional organizations in our community.

Utilize the Hazardous Weather Testbed (HWT) to evaluate the operational viability of a finalized "Operational Prototype."

- **Testing operational feasibility of "Operational Prototype" in the HWT:** Consider conducting another operational feasibility study in collaboration with the HWT to test the "Operational Prototype" with NWS forecasters, emergency managers, and broadcast meteorologists using past events and real-world examples. The proposed "Operational Prototype" may seem appropriate on paper, but caveats and shortcomings of the newly proposed system may only arise through further operational testing.

- **Incorporate members of the general public into the HWT process:** Although the results of the generalizable survey allow us to understand the warning language that best resonates with the public, that data only used hypothetical situations. Therefore, it is recommended that members of the general public be included in the HWT process. To my knowledge, this has never been done before. However, if it is important to evaluate the "Operational Prototype" among NWS forecasters, emergency managers, and broadcast meteorologists using past events, then this process should also be conducted with members of the public. This exercise may reveal additional details about the proposed "Operational Prototype" that did not arise when members of the public completed the generalizable survey.

- **Evaluate the feasibility of the "Operational Prototype" in relation to the other NOAA/NWS initiatives:** The use of further testing within the HWT could also provide an opportunity to evaluate the Hazard Simplification "Operational Prototype" with other NOAA/NWS initiatives (e.g., FACETS, PHI, Hazard Services). All of these different projects are progressing independently; however, collaborating with the HWT would allow for feasibility testing of the "Operational Prototype" with these other initiatives. This process was extremely insightful during the previous Hazard Simplification Testbed evaluation; therefore, it is recommended that further testing be conducted that combines all of these initiatives.

Offer remote and/or on-site internship or research opportunities for students to continue analyzing the Hazard Simplification survey data.

- The Hazard Simplification survey data collected by myself and ERG contains a plethora of variables and demographic information that was not able to be completely investigated. Therefore, NWS should invest in internship and/or research opportunities for students and early career professionals. For example, the NWS may consider advertising on the National Science Foundation (NSF) Graduate Research Internship Program (GRIP) website. This dataset would also be optimal for further investigation by a Masters or Ph.D. student. This could promote further collaborations between the NWS and the academic sectors of the weather enterprise.

Develop and implement an extensive public education campaign to inform the general public of any changes to the weather warning system.

- **Conduct focus groups, interviews, and/or surveys to evaluate the audience and test messages.** If changes are made to the weather warning system, then extensive educational

research will need to be conducted. This could involve focus groups, interviews, and/or surveys to better understand your audience and to test any messages developed. Prior to implementing any changes to the weather warning system, this research will need to be conducted and evaluated to better understand the best way to convey and communicate these changes to the general public. Only then, can a major marketing effort occur.

- **Revise K-12 curriculum to emphasize any new changes to the weather warning system.** Since individuals learn about our weather warning system in school, it will be incredibly important to update the K-12 curriculum in schools across the United States. Further, K-12 students can be used as a vehicle to discuss the changes to the weather warning system with their families. This could include sending information home with students, assignments to be completed with the entire family, as well as projects such as creating a family emergency plan.

Coordinate with all sectors of the weather enterprise and partners/stakeholders to assist with transition to new weather warning system.

- **Develop a task force or advisory group to assist with weather warning system transition:** If any changes are made to the weather warning system, the NWS may consider developing a taskforce, advisory group, or subcommittee to assist with the transition. This task force/advisory group should be charged with stimulating ideas and activities on matters that pertain to the interests and transition of the weather warning system across all sectors of the weather enterprise and partners/stakeholders. This task force/advisory group should also promote consistency across the entirety of the weather enterprise, to ensure we are all working together toward a common goal. The task force/advisory group should consist of members drawn from the academic, private, emergency manager, and government sectors of our enterprise. Specifically, the government sectors should include representatives from other governmental partners (e.g., Department of Transportation, National Parks Service, and other entities that convey weather-related warnings).

- **Collaborate with professional organizations (e.g., American Meteorological Society, National Weather Association, etc.) and develop subcommittees to assist with weather warning system transition:** If a task force or advisory group is not preferred, the NWS could consider collaborating with several relevant committees within different professional organizations. Some relevant boards/committees include: AMS Board on Enterprise Communication, AMS Committee on Effective Communication of Weather and Climate Information, NWA Societal Impacts Committee, etc. In addition to these professional organizations, NWS may consider reaching out to the Alliance for Integrative Approaches to Extreme Environmental Events – a newly formed entity that seeks to serve as an organizing mechanism among the various sectors and stakeholders in the hazards community.

1.0 Introduction and Overview

The National Weather Service (NWS) provides weather, hydrologic, and climate forecasts and warnings for the United States in order to protect life and property. A key component of that mission lies in the NWS' ability to effective communicate weather-related warnings and alerts to various end users. Currently, this is accomplished through the use of ***watches, warnings, and advisories (WWA).*** These products are designed to inform communities of impending weather-related hazards and prompt response. Further, watches, warnings, and advisories are communicated to various end users through the NWS website, smart phones (WEA alerts), NOAA Weather Radios, and through other meteorologists and members of the weather community via television and/or radio programs. These end users include, but are not limited to: members of the weather community, transportation and aviation officials, emergency managers, as well as broadcast meteorologists and other media personnel.

With previous studies acknowledging that many members of the general public may not understand the distinctions between the watch, warning, and advisory terminology, the NWS embarked on an extensive research endeavor (called the **Hazard Simplification Project)** to begin addressing some of these concerns. With initial efforts on this project dating back to 2011, the infusion of social science engagement in 2013/2014 ignited further inquiry into the status of the WWA system. As a result, several projects have emerged that seek to better understand the knowledge and use of the WWA system among partners and the general public:

- **Phase 1: HazSimp Focus Groups**. During the summer of 2014, NWS sponsored 20 focus groups at four different locations across the United States. The goal of these focus groups was to obtain stakeholder perspectives (i.e., emergency managers, broadcast meteorologists, other media professionals, NWS Weather Forecast Office (WFO) staff, and members of the general public) and better understand how end users receive and perceive weather and water hazard information – including the WWA system. Major takeaways from this phase of the project include: (1) A spectrum of understanding exists surrounding the current WWA system, ranging from comprehension to complete lack of understanding, (2) a variety of support for either changing the WWA system or leaving it the same, and (3) there was considerable support for additions to the WWA system – including the addition of color and simple explanatory language.

- **Phase 2: AMS Feedback on Prototypes and Case Studies.** During 2015, NWS sponsored two research endeavors: (1) the collection of feedback on the initial prototypes designed as alternatives to the current WWA system at the annual American Meteorological Society (AMS) meeting in Phoenix, AZ and (2) the creation and release of a survey targeting NWS partners. Obtaining feedback from the community at the AMS conference provided some insights and possible paths forward within the Hazard Simplification Project. Specifically, respondents preferred prototypes that suggested more change than those interested in minor changes to the current WWA system. To examine the partner's perspective in more detail, NWS sponsored the release of a survey that examined how NWS and its stakeholders perceive and use the current WWA system. Highlights from this research study include: (1) Emergency managers preferred the current WWA system, while NWS forecasters and media partners desired more change, (2) there was general support for simplifying and reducing the current number of

WWA products, as well as improving the formatting and using concise language, (3) the rigid criteria for issuing WWA products can present collaboration and coordination challenges among WFOs and may contribute to inconsistent messaging.

- **Phrase 3: Hazard Simplification Workshop.** The NWS hosted a 3-day Hazard Simplification workshop that included a wide variety of NWS partners (e.g., emergency managers, broadcast meteorologists, members of the private sector, and the social science community) in late 2015. The goals of the workshop were two-fold: (1) develop a set of language-based prototypes that could be tested to replace some or all of the WWA system and (2) to suggest ideas for WWA enhancements that could simplify current NWS hazard messages in the short-term. The results of the Hazard Simplification Workshop were consistent with feedback from several other projects, and included: Participants suggesting to only focus on some of the "problem" language (i.e., Advisory) and others recommended replacing all WWA terms with colors, tiers, and/or actionable phrases. In the short-term, a majority of partners were in favor of consolidating and/or eliminating various hazard message headlines.

- **Phrase 3: Hazardous Weather Testbed.** At the suggestion of several workshop participants, some of the prototypes developed during the Hazard Simplification Workshop were examined in the Hazardous Weather Testbed (HWT). The testbed environment provided the opportunity to integrate the prototypes into other NOAA initiatives (PHI, FACETS, etc.). The HWT creates an environment where different NWS partners get to work together using past events and real-time severe weather events to better understand the operational components of these newly developed systems. Within this testbed process, three prototypes – that were developed during the workshop – were evaluated. Major takeaways from the HWT include: (1) the current WWA system is ingrained in forecasters and forecasters had difficulty mapping the newly designed "Be Aware" or "Take Action" headlines to meteorological criteria, (2) the HazSimp alert-level language also influenced the forecasters' probability choices, such that forecasters tended to choose the HazSimp level first and then draw the probability, and (3) the blending of HazSimp and the Probabilistic Hazard Information (PHI) created some messaging inconsistencies that frustrated broadcast meteorologists and emergency managers.

- **Phase 3: Institutional Study.** In 2016, the NWS sponsored the creation and release of a survey to gauge the degree that different WWA terminology (i.e., watch, warning, and advisory) is embedded or "institutionalized" in organizational decision-making, laws, policies, operating procedures, bylaws, or other activities or processes. Nearly 4,500 responses from 32 sectors (i.e., emergency management, transportation, telecommunication, utilities, etc.) were collected. The study found that "advisory" terminology was the least institutionalized term, and that, on average, organizations need at least a three-month timeframe to incorporate any changes to the current WWA system in their departments. However, this time frame does not include the time needed to educate the public and partners on any changes – and even then three months may not be a realistic timeframe for all organizations.

- **Phrase 4: Generalizable Surveys of the General Public.** Until this point, a majority of the the research efforts sponsored by the NWS have been devoted to understanding the WWA system

from the perspective of their partners and stakeholders. These research projects were important, as thinking through the intricacies and caveats of a new weather warning system can best be accomplished with members of the weather community, partners, and stakeholders. However, before pressing forward with newly developed prototypes, it is imperative to obtain the general public's perspective of these alternative approaches and truly gauge their understanding of the current WWA system. As a result, the following research report describes and documents the testing of several weather warning system prototypes among members of the general public.

Through funding provided by the National Science Foundation's (NSF) Graduate Research Internship Project (GRIP), **the following report offers an extension of Eastern Research Group's (ERG) research efforts on the Hazard Simplification Project by investigating additional hazards (i.e., excessive heat – warm regions, excessive heat – cold regions, and high winds).** Although a separate research endeavor, this report should be treated as a companion piece and as such considerable effort was given to remaining uniform in the development and implementation of these generalizable surveys. Therefore, this final report describes in detail the methodological approach that was taken in creating the questionnaire and study design (Section 2.0), the sampling approach and inclusionary/exclusionary criteria when selecting members of the public to complete these generalizable surveys (Section 3.0), an in-depth discussion of the statistical approach used to evaluate the prototypes shown to the general public (Sections 4.0), followed by a discussion of the results associated with each hazard (Section 5.0 – Section 7.0), a small discussion surrounding the educational component (Section 8.0) and finally a section devoted to conclusions, recommendations, suggested next steps, and lessons learned throughout this process (Section 9.0).

2.0 Generalizable Survey Approach and Methodology

The following sections provide a general overview of the methodological approach taken to examine various messaging prototypes. Because this research project offers an extension of ERG's research efforts in the Hazard Simplification Project, considerable effort was given to remaining uniform with the proposed methodological approach, questionnaire design, and sampling techniques. It is our hope that this uniformity will offer generalizable results comparable to those produced by ERG. This section will begin with a general overview of the prototypes examined (Section 2.1), provide a brief discussion of the scenario-based methodology utilized in the generalizable survey (Section 2.2.), and finally elaborate on the questionnaire design and the survey items used to assess how respondents react to existing WWA headlines compared to the proposed prototypes (Section 2.3).

2.1 Prototypes

In collaboration with various NOAA social scientists, ERG, the NWS, and previous Hazard Simplification Project research efforts, four prototypes were developed that sought to examine alternative WWA headlines in comparison to the current system. Taken together, the generalizable survey assessed five prototypes - current system plus the four newly developed prototypes. Table 1 provides a breakdown of the five prototypes, and the goals of each prototype can be described as follows:

- **Current System:** Gathering data on the public's understanding of the current system.
- **Prototype 1: Outlook, Warning, Warning, Warning:** This prototype was used for theoretical purposes. Specifically, we wanted to test whether people anchor to headlines *or* information. Thus, we used the *same* "Warning" headline for every level, but only change the information in each prompt. This prototype also allows for testing a new headline for "Watch" – "Outlook."
- **Prototype 2: Notice, Alert, Warning, Emergency:** This prototype follows a similar pattern to our current system; however, allows us to change the headlines for "Watch" and "Advisory" as previous research has found these headlines in the current system to be problematic.
- **Prototype 3: Possible X Event, (Minor), Moderate, Severe, Extreme Warnings.** This prototype is a larger overhaul of the system. It changes the word for "Watch" to "Possible X Event," where X is the hazard (e.g., Possible Winter Weather Event). The headline "Warning" is maintained while using adjectives to convey different levels of risk.
- **Prototype 4: Possible X Conditions, Level Orange, Level Red, Level Purple Warnings.** This prototype is also a larger overhaul of the system. It changes the word "Watch" to "Possible X Conditions," where X is the hazard (e.g., Possible Winter Weather Conditions). The word warning is maintained while using colors to denote different levels of risk.

Table 1. Five Prototypes Assessed in the Generalizable Survey

Level	Current System	Prototype 1	Prototype 2	Prototype 3	Prototype 4
Watch level	X Watch	X Outlook	X Notice	Possible X Event	Possible X Conditions
Advisory level	X Advisory	X Warning	X Alert	Moderate	Level Orange X Warning
Warning level	X Warning	X Warning	X Warning	Severe	Level Red X Warning
Emergency level	X Emergency	X Warning	X Emergency	Extreme	Level Purple X Warning

Thinking specifically about the hazards tasked by this research project (i.e., excessive heat and high winds), it was decided in collaboration with the NWS that the prototypes would address the following:

Excessive Heat (both regions):

- The current WWA messages (i.e., Excessive Heat Watch, Heat Advisory, and Excessive Heat Warning) would constitute the current system prototype.
- The excessive heat prototypes would only retain the "Advisory" headline and "Warning" headline.
- The excessive heat prototypes would only progress linearly and would not account for downgrades. Therefore, respondents saw a continuance of the "Advisory" level condition to keep the number of prompt levels consistent across all hazards.
- The excessive heat prototypes would account for the upcoming consolidation efforts by dropping "Excessive" from the new prototype headlines.

High Wind:

- The current WWA messages (i.e., High Wind Watch, Wind Advisory, and High Wind Warning) would constitute the current system prototype.
- Two scenarios would be used: Advisory with an Upgrade and Warning with a Downgrade.
- The high wind prototypes would account for the upcoming consolidation efforts by dropping "High" from the new prototype headlines.

2.2 Scenarios and Prompts

To effectively evaluate the newly-designed prototypes and the current system, it was determined that it would be best to have members of the general public walkthrough a real-world weather scenario that was hypothetically threatening them and their family. The scenarios reflected upgrades or downgrades in the risk overtime, and each of the weather hazards had between one and two scenarios. Each real world-scenario was divided into four prompts. The first prompt was a *baseline condition*, where participants were provided with *only* weather information and timing information regarding the hazard being surveyed. This *baseline condition* was exactly the same across all scenarios within a particular weather hazard. The second prompt was always a *"Watch-level" prompt* (see Table 1) and included specific prototype language.

The third and fourth prompts provided either upgrades, continuances, or downgrades that reflect real-life weather situations. Table 2 provides a summary of the prompt sequences used in each scenario for excessive heat and high winds.

Table 2. Prompt Sequences Associated with Each Upgrade/Downgrade Scenario

Weather Event	Scenario	Prompt Level Sequence [a]		
		Prompt 2	Prompt 3	Prompt 4
Excessive Heat – Warm	Advisory with upgrade (AU)	Advisory[b]	Advisory Cont.	Warning
Excessive Heat – Cold	Advisory with upgrade (AU)	Advisory[b]	Advisory Cont.	Warning
High Winds	Warning with downgrade (WD)	Watch	Warning	Advisory
	Advisory with upgrade (AU)	Watch	Advisory	Warning

[a] Prompt #1 is always a baseline prompt is not prototype-specific.
[b] For the excessive heat hazard, respondents saw an "Advisory" headline at Prompt 2 and a continuance of the "Advisory" headline at Prompt 3.

This surveys associated with examining excessive heat and high wind hazards included two types of scenarios, **Advisory with an Upgrade** and **Warning with a Downgrade**:

- **Advisory with an Upgrade (AU) – Excessive Heat:** For the excessive heat hazard, the scenario included a continuance of the "Advisory" headline at Prompt 3 and then an upgrade to a "Warning" headline at Prompt 4.
- **Advisory with an Upgrade (AU) – High Winds:** The high wind hazard followed a more normal progression. Within this scenario, participants saw an "Advisory" headline that was then upgrade to a "Warning" headline.
- **Warning with a Downgrade (WD) – High Winds:** In this situation, the high wind hazard seems more severe; therefore, the NWS would issue a "Warning" headline and then downgrade the situation to an "Advisory" headline.

The scenarios were designed to elicit a real-world response to the proposed prototype language; therefore, it was especially important to achieve consistency between the prompts, scenarios, and surveys. As a result, considerable attention was given during the creation of the prompts and the survey instrument. Specifically, cognitive interviews and a pilot survey deployment were used to improve the scenario wording and identify any ordering effects or priming that occurred. This process identified that the respondents experienced difficulty progressing through the scenarios. However, this external validation of the scenario language allowed us to make several changes to the scenario language and better frame the scenarios to ensure respondents effectively progressed through time.

To provide an example of the language used in the excessive heat and high winds surveys, the following prompts are offered:

Prompt #1: Imagine you are home on a Saturday. You learn that the National Weather Service is forecasting the potential for high winds on Sunday with sustained wind speeds greater than 40 miles per hour for one hour or longer, or winds gusting to 58 miles per hour for any duration.

Prompt #2: Suppose it is still Saturday and the National Weather Service has issued a **HIGH WIND WATCH** for Sunday with the potential for sustained wind speeds greater than 40 miles per hour for one hour or longer, or winds gusting to 58 miles per hour for any duration.

Prompt #3: Now, it is Sunday at 10:00am and the National Weather Service has issued a **HIGH WIND WARNING** from Sunday at 10:00am through Sunday at 8:00pm for sustained winds greater than 40 miles per hour or winds gusting to 58 miles per hour.

Prompt #4: Now, imagine it is 4 hours later (Sunday at 2:00pm), and you receive the following information: "The National Weather Service has changed their forecast to a **WIND ADVISORY** lasting from Sunday at 2:00pm through Sunday at 8:00pm, now expecting sustained wind speeds ranging from 30 to 39 miles per hour.

In order to increase exposure to the five prototypes, each respondent was randomly assigned to two prototypes and went through the four prompts described above. Although ERG identified the sequence at which individuals saw each prototype, this research project did not.

Finally, to investigate the intuitiveness of each prototype, participants were randomly assigned to receive additional information about the warning headlines. It was anticipated that this would also provide some insight on the influence of further educational outreach toward improving the use of the current system and/or any future changes to the WWA system.

In sum, participants were randomly assigned to (1) *two* of five prototypes, (2) a scenario condition (e.g., advisory with an upgrade) for each prototype, and (3) either receive additional information about the proposed prototype headlines or not.

2.3 Protective Response Questions

After seeing each prompt as described above, participants were asked to complete several protective response questions that evaluated how they would respond behaviorally. The first question asked participants to acknowledge the action that they would take given the forecast information described in each prompt. Here, respondents were only allowed to select *one* action – the one they believed best described their behavioral response.

- **Action taken** – Respondents were asked about the action they would take in response to the prompt provided; the actions included (1) do nothing, (2) monitor, (3) prepare, (4) take some action, or (5) take protective action. Each survey provided a unique description of what each type of action meant for the particular hazard being surveyed.

In addition to their overall action taken, respondents were also asked to provide the likelihood that they would monitor additional forecast information, prepare, and take protective action. Further, the variable *likelihood to take some action* was added for the High Winds survey only. It was included based on NWS' interest in investigating the importance of the "Wind Advisory" and the behavioral response associated with this WWA headline. These additional protective response variables allow us to better understand the respondent's likelihood of performing *more than one behavior*. Because the action taken variable requires that respondents select one action to perform, it was important to also assess other behaviors that participants may want to perform simultaneously.

- **Likelihood of monitoring** – Respondents were asked how likely they were to monitor forecast information given the scenario provided and could select from a five-point scale with one indicating "very unlikely" and five indicating "very likely."

- **Likelihood of preparing** – Respondents were asked how likely they were to prepare given the information provided and could select a five-point scale with one indicating "very unlikely" and five indicating "very likely."

- **Likelihood of taking some action**[4] – Respondents in the high wind survey were asked how likely they were to take some action given the information provided and could select a five-point scale with one indicating "very unlikely" and five indicating "very likely."

- **Likelihood of acting** – Respondents were asked how likely they were to take a protective action given the information provided and could select from a five-point scale with one indicating "very unlikely" and five indicating "very likely."

Finally, several perception questions were asked at each prompt level to obtain additional information that may provide further insight on the respondent's behavioral response. Due to OMB restrictions, these questions were removed from ERG's survey instrument. However, my IRB process did not require these questions to be removed. As a result, these questions were included when respondents assessed each prompt level within each prototype.

- **Perceived risk of the forecast** – Respondents were asked about their perceived risk given the forecast information provided and could select from a ten-point scale with one indicating "no risk" and ten indicating "extreme risk."

- **Perceived confidence in the forecast** – Respondents were asked about their perceived confidence in the forecast information provided and could select from a ten-point scale with one indicating "no confidence" and ten indicating "extreme confidence."

- **Perceived urgency of the forecast** – Respondents were asked about their perceived urgency given the forecast information and could select from a ten-point scale with one indicating "no urgency" and ten indicating "extreme urgency."

- **Probability of Occurrence –** Respondents were asked to describe the probability that they would see excessive heat or high winds given the forecast information provided and could select from a sliding scale from one to one hundred.

2.4 Current Knowledge Questions

Due to time differences in survey deployment, a set of questions specifically asking respondents about their current knowledge of the watch, warning, advisory system (WWA) was not included in these surveys. However, the inclusion of the perception questions described above (i.e., perceived risk, perceived confidence, perceived urgency, and probability of occurrence) in conjunction with the participant's behavioral response to the current system prototype, offer additional insight on the current knowledge of the WWA system for the excessive heat and high wind hazards.

[4] **Note:** This variable was only included in the High Winds survey. It was added based on the NWS' interest in investigating the importance of the "Wind Advisory" and the behavioral response associated with this WWA headline.

A discussion about the current knowledge of each hazard can be found in their respective result sections.

2.5 Questionnaire Overview

To remain consistent with the survey developed by ERG, the questionnaire was created in collaboration with NWS and ERG. Therefore, the overall goal of the questionnaire was to effectively evaluate how respondents react to existing excessive heat and high wind WWA messages compared to the developed HazSimp prototypes. Beyond testing the prototype language, a larger survey existed that asked respondents a variety of questions. Several theoretical variables were utilized from the Theory of Planned Behavior (Ajzen, 1985[5], 1991[6]) and the Risk Information Seeking and Processing model (Griffin et al. 1999[7]). In addition to these theoretical risk variables, participants completed demographic questions, the protective response variables associated with the prototypes, and questions that assessed weather information habits. For more information on the questionnaire used, please see Appendix A. The questionnaire sequence was as follows:

- The survey began with several easy demographic questions: State of primary residence, primary residence type, environment near residence, number of adults in household, number of children in household.
- Participants were then asked to complete the various theoretical risk variables: perceived susceptibility, perceived severity, risk perception as affect, previous hazard experience, adaptive behaviors, gathering capacity, and subjective norms.
- A first prototype testing scenario; see Sections 2.1.-2.3
- A second prototype testing scenario; see Sections 2.1-2.3
- After completing the prototype testing process, participants were asked various questions about their weather information habits: how do individuals receive weather information, frequency of receiving weather information from various sources, etc.
- Finally, several additional demographic questions were asked: gender, race, age, educational background, Hispanic origin, and annual household income.

After completing the survey, participants were debriefed and provided information on the current warning system and additional links for further information that described the watch, warning, and advisory terminology in more detail and provided appropriate protective actions given each headline.

2.6 External Validation of Questionnaire

To offer an external validation of the questionnaire and study design, college students from a southeastern university were used to pilot the study. Pretesting occurred in two phases: cognitive interviewing and pilot survey deployment. First, a small sample of students (*n* = 20) completed the questionnaire in a one-on-one setting and were asked to describe their thoughts while completing the

[5] Ajzen, I. (1985). From intentions to actions: A theory of planned behavior. In *Action control* (pp. 11-39). Springer Berlin Heidelberg.
[6] Ajzen, I. (1991). The theory of planned behavior. *Organizational behavior and human decision processes*, *50*(2), 179-211.
[7] Griffin, R. J., Dunwoody, S., & Neuwirth, K. (1999). Proposed model of the relationship of risk information seeking and processing to the development of preventive behaviors. *Environmental research*, *80*(2), S230-S245.

study. This technique, known as cognitive interviewing, was used to uncover problems with question wording, order effects, priming, and questionnaire length (Collins, 2003[8]). Specifically, this process identified that the respondents experienced difficulties progressing through the prototype prompts. However, this process allowed us to make several changes to the scenario language and better frame the scenarios to ensure respondents understood the progression through time. Next, the survey instrument was piloted with a larger sample of college students (*n* = 961) to evaluate the study design, questionnaire, and total time needed to complete the study. Finally, a small sample of the generalizable sample was obtained from Qualtrics. This additional pilot testing phase (i.e., a soft launch) allowed us to look for inconsistencies in the responses among a general public sample, and correct anything out of the ordinary. Overall, these validation efforts offered guidance for improving the quality of the survey instrument.

[8] Collins, D. (2003). Pretesting survey instruments: an overview of cognitive methods. *Quality of life research*, *12*(3), 229-238.

3.0 Sampling Approach

The following sections describe the sampling approach that was taken to obtain participants. A generalizable sample of the public was purchased from Qualtrics. In other words, Qualtrics selected a random sample of individuals who have opted-in to take their online surveys. However, we provided various inclusionary criteria to assist in screening potential participants – this often was used to account for geographical differences in hazard frequency (Section 3.1). Using this sample information, Qualtrics made individuals in these areas aware of the project and managed all eligibility parameters. As an incentive for participating, Qualtrics respondents received an incentive based on the length of the survey, their specific panelist profile and target acquisition difficulty. The remainder of this section will provide a rationale for the geographic areas selected (Section 3.1), offer total sample sizes (Section 3.2), and address the logistical details of survey deployment (Sections 3.3 and 3.4). Table 3 offers a summary of the survey collection efforts for both the excessive heat and high wind survey samples.

Table 3. Summary of Survey Collection Efforts

Weather Hazard	Survey Parameters	Dates	Targeted Sample	Collected Sample
Excessive heat – warm regions	• AL, AZ, AR, CA, FL, GA, KY, LA, MS, NV, NM, NC, OK, SC, TN, TX, and VA. • Adults aged 18+	12/4/17 – 12/5/17	275	275
Excessive heat – cold regions	• CO, CT, DE, ID, IL, IN, KS, ME, MD, MA, MI, MN, MO, NE, NH, NJ, NY, ND, OH, OR, PA, RI, SD, UT, VT, WA, and WV. • Adults aged 18+	12/4/17 – 12/5/17	275	277
High Winds	• All Contiguous U.S. States • Adults aged 18+	2/20/18 – 2/22/18	1,080	1,079 [a]

[a] A response was thrown out for being incomplete.

3.1 Geographic Areas

When selecting the geographic areas of interest for both the excessive heat and high wind hazards, the NWS was consulted.

3.1.1 Excessive Heat

To evaluate the excessive heat prototypes in both warm and cold regions, the geographical criteria was determined based on temperature climatologies, NWS policy, and criteria for the issuance of excessive heat products across the country. Given this distinction, the contiguous U.S. were split up into *warm region states* and *cold region states.* See Figure 1 for a map of the warm and cold region states.

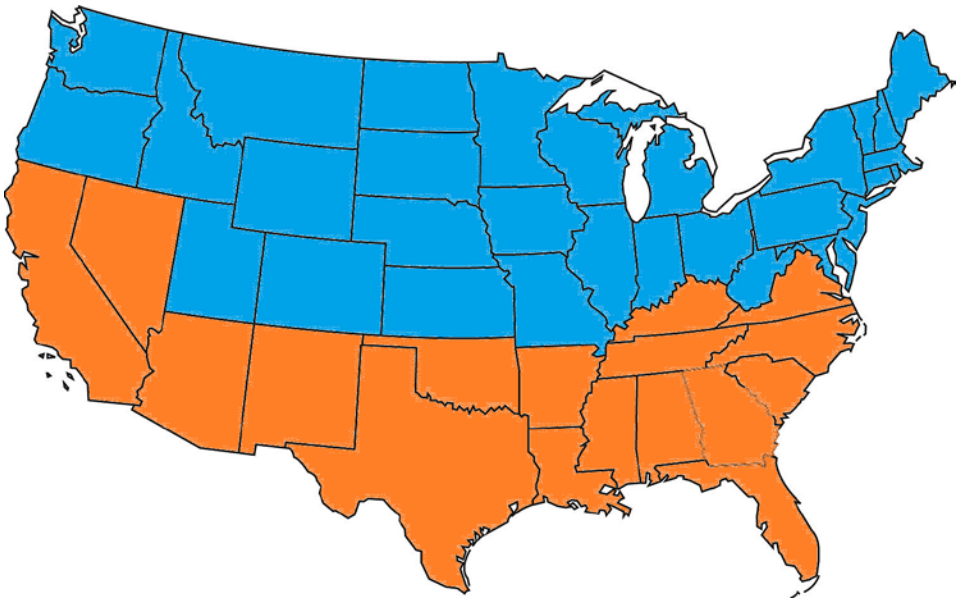

Figure 1. Sampling map of warm region states (orange) and cold region states (blue).

3.1.1 High Winds

Obtaining a sample to evaluate the high wind prototypes had less geographical restrictions, in comparison to the excessive heat prototypes. After collaborating with the NWS, it was determined that there were not specific states that experienced high winds more frequently than others. In a similar vein, the diverse high wind issuance criteria across the United States made it difficult to narrow down specific geographical parameters. Therefore, participants across the entire contiguous United States were eligible to participate in the survey. To encourage a diverse sample, an East/West sampling technique was employed to ensure the survey sample was representative of states across the entire country. In short, Qualtrics pulled an equal number of participants from the western and eastern United States.

3.2 Sample Sizes

The overall sample size was determined based on the budgetary restrictions determined by the NSF GRIP program. Therefore, my budget only allowed for a sample of 1,630 members of the public. Given this budget and potential sample size, decisions were made in collaboration with the NWS to allocate respondents across the three surveys (i.e., excessive heat – cold regions, excessive heat – warm regions, and high winds).

Excessive Heat:

- Because excessive heat events usually only warrant upgrade scenarios, it was determined that both excessive heat surveys would only evaluate an **Advisory with an Upgrade** condition. As a result, the sampling needs of these two surveys were minimal (*n* = 275 each; total 550).

High Winds:

- Because high wind events do not currently have an "Emergency level," it was determined that the high wind survey would only evaluate two scenarios: **Warning with a Downgrade** and **Advisory with an Upgrade.** Given the need to test two scenarios, a majority of the sample was devoted to the high wind hazard (*n* = 1,080).

3.3 Mode

The survey was implemented on the web-based Qualtrics platform drawing from publicly available samples. Qualtrics was provided with all of the specifications that have been described thus far and Qualtrics drew random samples from each in-scope state. Additionally, it was determined that mobile users *would not be targeted* based on the poor formatting of the excessive heat and high wind surveys on a mobile device. As a result, survey participants were encouraged to complete the survey on a computer-based platform. This methodological caveat may need to be considered when evaluating the weather information habits demographic information.

3.4 Timeframes

Table 3 above summarizes the time frames and final sample sizes. The excessive heat surveys were soft launched on December 1, 2017. After checking for inconsistencies, both excessive heat surveys were officially deployed on December 4, 2017 and successfully completed data collection on December 5, 2017.

The high wind survey was soft launched on January 2, 2018 and January 3, 2018. After checking for data inconsistencies, the high wind survey was officially deployed on January 3, 2018 and successfully completed data collection on January 4, 2018.

4.0 Statistical Analysis Approach

The following section describes the statistical analysis that was performed to analyze the survey data collected to assess the prototypes developed by the NWS. Considerable effort was given to remaining consistent with the statistical analysis approach proposed by ERG; therefore, this section is very similar to the report offered by ERG. The only difference lies in the absence of the *Sequence* variable. My study did not take the sequence with which individuals saw the prototypes into consideration. After conducting initial analyses, ERG noted that the sequence variable was not overwhelmingly important; however, it is an important caveat to note.

This section begins with a discussion of the outcome variables and the treatments that we use in the statistical analysis (Section 4.1), then we discuss the procedure associated with the statistical analyses used to evaluate the outcome variables and treatments (Section 4.2), and the section concludes by discussing the other variables used to explain the variation in the outcome variables (Section 4.3).

4.1 Outcome Variables and Treatments

The survey we developed was designed to assess how respondents' protective responses (outcomes) differed between groups that saw different prototypes (treatments). As discussed in Section 2.3, several variables were used to gauge the protective response of the survey participants:

- **Action taken** – Respondents were asked about the action they would take in response to the prompt provided; the actions included (1) do nothing, (2) monitor, (3) prepare, (4) take some action, or (5) take protective action. Each survey provided a unique descriptions of what each type of action meant for the particular hazard being surveyed.

- **Likelihood of monitoring** – Respondents were asked how likely they were to monitor forecast information given the scenario provided and could select from a five-point scale with one indicating "very unlikely" and five indicating "very unlikely."

- **Likelihood of preparing** – Respondents were asked how likely they were to prepare given the information provided and could select a five-point scale with one indicating "very unlikely" and five indicating "very likely."

- **Likelihood of acting** – Respondents were asked how likely they were to take a protective action given the information provided and could select from a five-point scale with one indicating "very unlikely" and five indicating "very likely."

These four variables form the basis of our analyses in order to compare the effectiveness of the four prototypes and the current system.

4.2 Ordered Logistic Regression

Because each protective response variable contains five discrete categories that are ordered from least to most, a statistical method called *ordered logistic regression analysis* was used to assess these data. An ordered logistic analysis correlates a set of ordered response categories with a set of explanatory variables (e.g., demographics, responses to other variables, etc.) to determine factors that lead to

respondents selecting higher or lower categories. As with any logistic regression, the ordered logistic model is a probability model. In sum, we are assessing the probability of respondents being in certain categories and identifying the factors that make it more (or less) likely for respondents to be in higher categories.

The primary explanatory factor in our analysis revolves around the prototype that the respondent saw. Therefore, an ordered logistic regression analysis will tell us which prototypes are associated with respondents being more likely to select a higher-order protective action. For example, this type of analysis will allow us to determine whether individuals who saw "Prototype 1" would be more or less likely to take protective action in comparison to the current system.

An additional consideration in our analysis is that respondents are represented twice in our datasets because they each saw two prototypes. Therefore, we have two sets of responses to the protective response variables – one set for each prototype that the respondent saw. Although this effectively doubles the sample size we can use for the statistical analysis, it requires an adjustment to the estimated variances for the fact that our *n* analytical data points are derived from only *n/2* survey respondents. There are well-documented procedures for doing this and we follow the one in the statistical software we used (Stata).[9]

To better interpret the results from the ordered logistic regression analyses, the results we present are phrased in terms of odds ratios. Odds ratios reflect the increased probability of being in a "higher" response category when odds ratios are a larger number. For example, we will be presenting the odds ratios associated with seeing prototypes 1-4 relative to seeing the current system; thus, we will be generating results that say things such as "those who saw prototype 1 were 1.5 times more likely to select a more protective action than those who saw the current system wording." In that example, the odds ratio is the value 1.5. The key value in an odds ratio is 1.0; estimates below 1.0 reflect decreased probabilities of being in higher categories and values above 1.0 reflect increased probabilities of being in higher categories.[10] The statistical significance of an odds ratio is judged by comparing the value to 1.0; values that are significantly different (i.e., more or less) than one are considered statistically significant.

4.3 Other Explanatory Variables

When conducting ordered logistic regression analyses, you are essentially creating a model that allows you to consider other factors that may help explain the outcome variable – in this case the protective response variables. For example, the survey includes several demographic variables (e.g., gender, educational background, race, etc.) and theoretical risk variables (e.g., risk perception, affective response, adaptive behavior, etc.). Although my survey instrument collected responses to several additional variables, considerable effort was given to remaining consistent with the modeling efforts provided by ERG. Therefore, the explanatory factors included in this report are uniform with those used by ERG. The explanatory factors included in our modeling efforts include:[11]

[9] https://www.stata.com/manuals13/u20.pdf#u20.21Obtainingrobustvarianceestimates.
[10] By design, odds ratios are never less than zero.
[11] The factors included were based on a detailed statistical specification analysis.

- *The baseline protective response*. Each respondent was prompted with a baseline statement prior to seeing the prototype language. All respondents saw the same baseline statement. We used the respondents baseline protective response for the scenario as the first control variable.
- *Respondents' perceived susceptibility and severity to hazard-specific risk.* The survey asked respondents to rate their *perceived harm* and their *perceived threat* from the hazard to (1) themselves personally, (2) their home, and (2) their local community to the hazard, each on a scale of 1 (no likely risk) to 10 (extremely likely risk) (six total questions). An index value was calculated by adding together the response to each of six questions for each respondent. Higher values for this scale indicate respondents perceive they are at higher risk.
- *Affective response, part 1.* The survey asked respondents to rate their feelings (negative to positive) about varying degrees of the weather hazards (e.g., a 90-100 degree day, multiple days with temperatures about 105 degrees, etc.). An index value was calculated by adding the values together for each respondent. Higher values of this index indicate the respondent is less worried about the surveyed weather hazard.
- *Affective response, part 2.* The survey asked respondents to describe their feelings about the weather hazards (e.g., excessive heat). Respondents selected from four five-point scales (calm/stressed, pleased/displeased, happy/sad, and elated/depressed). An index value was calculated by adding the values together for each respondent. Higher values of this index indicate the respondent is less worried about the surveyed weather hazard.
- *Adaptive behavior*. The survey asked respondents to rate their preparedness and ability to adapt to the hazard in a series of questions that varied by hazard (e.g., I don't feel safe leaving my house to find a place to stay cool during excessive heat). An index value was calculated for each respondent by adding the responses together. Higher values of this variable indicate that respondents may be more prepared or have thought or performed precautionary measures in the past.
- *Past experience.* The survey asked respondents whether they had been experienced property damage or personal injury in the past from the specific hazard. This variable was measured as a yes/no question in the analysis.
- *Attentiveness.* The respondents were asked whether it was (1) wise, (2) useful, (3) valuable, and (4) beneficial to understand the risk posed by the weather hazard using a 10-point scale for each aspect (e.g., wise). This response was converted to an index value by adding over the four for each respondent. Higher values of this index indicate the respondent sees value in staying informed on the surveyed weather hazard.
- *Information gathering capacity*. The survey asked respondents to agree or disagree with a series of four statements that asked about the ease of understanding weather information. An index was formed based on the responses to the four questions. The questions were phrased in the negative, so higher values reflect respondents who have lower capacities to gather/understand weather information.

- *Subjective norms*. The survey asked respondents about whether they felt friends and family looked to them to understand weather-related information. An index was formed by summing over the three questions. Higher values reflect respondents who feel that others look to them to understand the surveyed weather hazard.
- *The respondent's age.* We measured age using the age category selected by the respondent. The values ranged from 1 (aged 18-24) to 6 (65 and older) using 10-year intervals in between.
- *Presence of children in the home*. This variable measured the presence (yes or no; one or zero, respectively) of children in the respondent's' home. We assumed that those with children would be more likely to take a protective action.
- *Gender*. This was set equal to one if the respondent was female and zero otherwise.
- *College education*. This was set equal to one if the respondent indicated he/she had completed a college degree.
- *Race*. This was set equal to one if the respondent was white.
- *Information on prototype*. This was set equal to one if the respondent was provided with information on how to interpret the current system or the prototype prior to the scenario. One half of respondents were provided with this information.
- ***Scenario sequence*: Although ERG considered this in their analysis, ***I did not*** account for the sequence with which individuals saw a given prototype.

5.0 Excessive Heat: Warm Regions

This section discusses the results from the excessive heat warm regions survey. To account for differences in excessive heat warning issuance criteria, It was decided between the researcher and the NWS, that the excessive heat survey would need to be implemented in two different surveys: one for colder regions and one for warmer regions. The warm regions survey was implemented in states that experience higher extreme heat, and therefore, have a higher threshold for the issuance of excessive heat warnings.

***States**: AL, AZ, AR, CA, FL, GA, KY, LA, MS, NV, NM, NC, OK, SC, TN, TX, and VA.*

***Respondents**: 275*

***Collection time frame**: 12/4/17 – 12/5/17*

5.1 Basic Demographics

Figure 2 provides of summary of the states and the total number of respondents from each state that completed the excessive heat warm region survey. The largest number of participants lived in Florida (48), and the least resided in Mississippi (1).

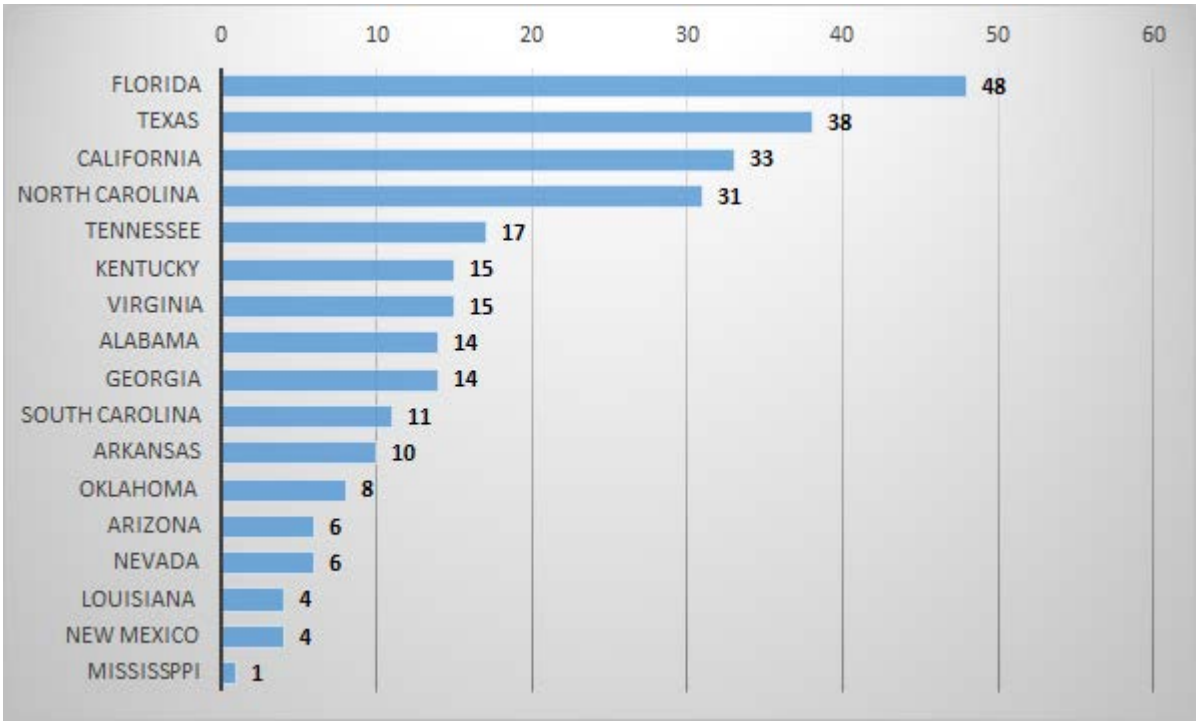

Figure 2. Number of respondents from States in the Excessive Heat Warm Region Survey

Table 4 provides a summary of the demographics assessed in the excessive heat warm region survey. Overall, the sample contains more females and Caucasian Americans. However, the sample seems to be fairly balanced across income levels, educational background, and age. For a complete breakdown of all the demographic variables collected within the excessive heat warm region sample, please see Appendix 2.

Table 4. Basic Demographics for the Excessive Heat Warm Region Survey

Category	Percentage of Sample / Sample Value	Category	Percentage of Sample / Sample Value
Age		**Race**	
20-24	8.0%	White	81.5%
25-34	16.7%	Black/African-American	12.0%
35-44	16.7%	Asian	5.1%
45-54	13.8%	American Indian or Alaska Native	1.1%
55-64	22.9%	**Income**	
65+	21.8%	Less than $24,999	25.8%
Gender		$25,000 - $49,999	34.9%
Female	76.2%	$50,000 - $99,999	28.0%
Male	23.1%	$100,000 - $199,999	9.5%
Education		More than $200,000	1.8%
Less than college degree	61.4%	**Home Location**	
College degree	26.7%	Urban	23.7%
Graduate work/degree	13.0%	Suburban	48.5%
Hispanic origin		Rural	27.7%
Yes	8.7%		
No	91.3%	**Average number of adults in home**	**1.98**
		Average number of children in home	**0.67**

5.2 Weather Information Use

Figure 3 provides an overview of the participants' preference for receiving *daily* weather information. Participants overwhelmingly reported the use of television and a website/app for receiving their *daily* weather information.

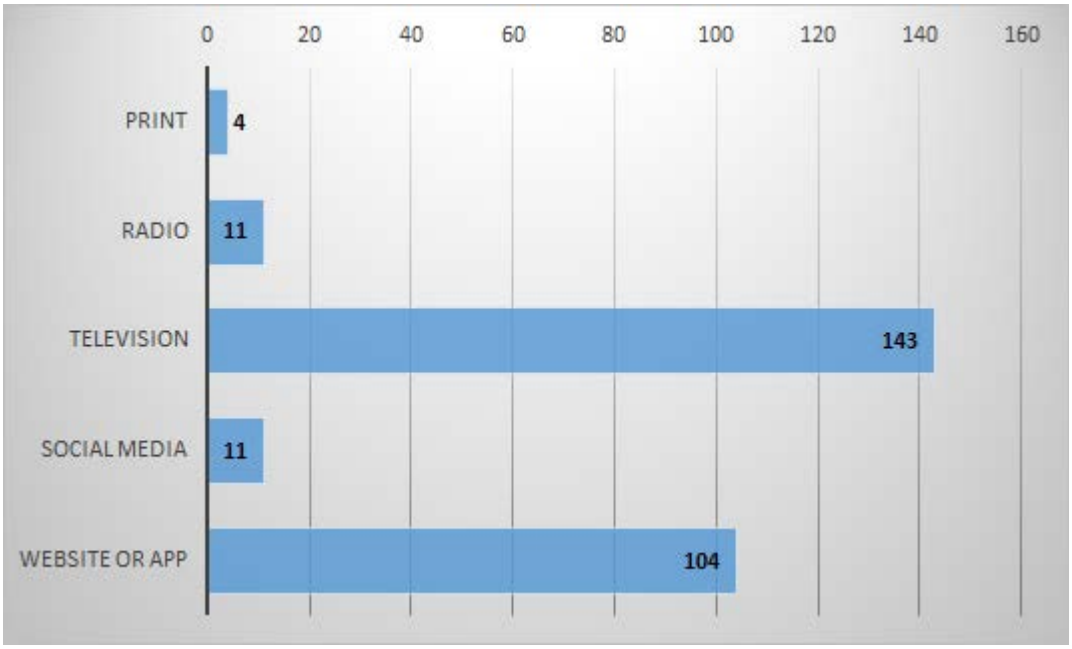

Figure 3. Participant's preference for receiving daily weather information

Figure 4 provides an overview of the participants' preference for receiving *information about excessive heat*. Similar to daily weather information, a large majority of participants reported the use of television and a website/app for receiving information about *excessive heat.*

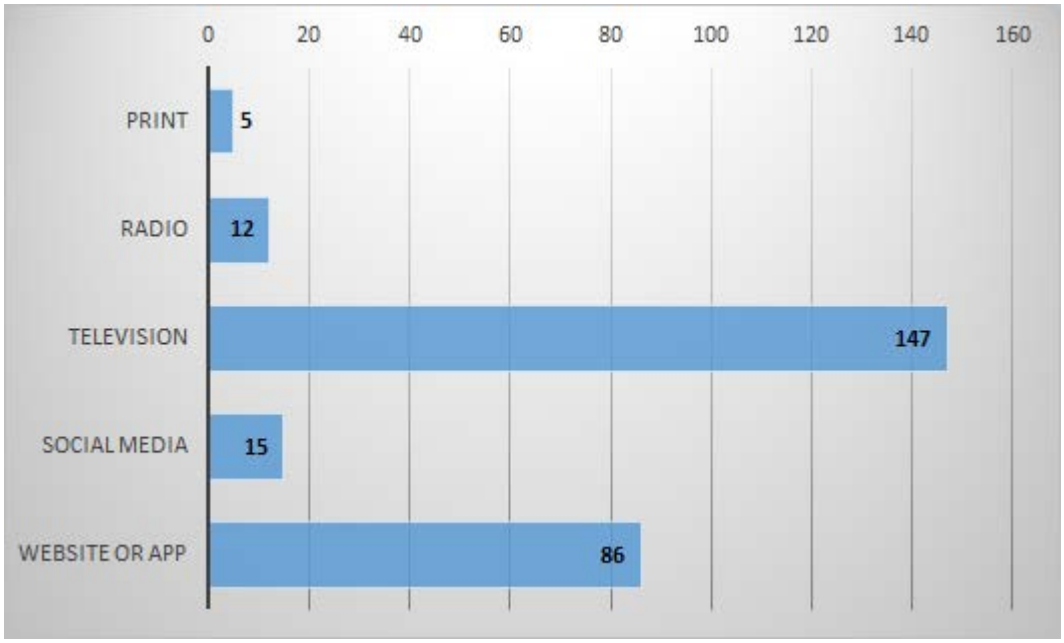

Figure 4. Participant's preference for receiving information about excessive heat

5.3 Current Knowledge

As discussed in Section 2.4, the current knowledge questions were developed after the deployment of the excessive heat warm region survey; however, additional questions were included that provide some insight into the participants' current knowledge of the excessive heat products. Taken together, the following questions were used to assess knowledge of the Excessive Heat Watch, Heat Advisory, and Excessive Heat Warning:

- **Action taken** – Respondents were asked about the action they would take in response to the prompt provided; the actions included (1) do nothing, (2) monitor, (3) prepare, (4) take some action, or (5) take protective action. Each survey provided a unique descriptions of what each type of action meant for the particular hazard being surveyed.
- **Likelihood of monitoring** – Respondents were asked how likely they were to monitor forecast information given the scenario provided and could select from a five-point scale with one indicating "very unlikely" and five indicating "very likely."
- **Likelihood of preparing** – Respondents were asked how likely they were to prepare given the information provided and could select a five-point scale with one indicating "very unlikely" and five indicating "very likely."

- **Likelihood of acting** – Respondents were asked how likely they were to take a protective action given the information provided and could select from a five-point scale with one indicating "very unlikely" and five indicating "very likely."
- **Perceived risk of the forecast** – Respondents were asked about their perceived risk given the forecast information provided and could select from a ten-point scale with one indicating "no risk" and ten indicating "extreme risk."
- **Perceived confidence in the forecast** – Respondents were asked about their perceived confidence in the forecast information provided and could select from a ten-point scale with one indicating "no confidence" and ten indicating "extreme confidence."
- **Perceived urgency of the forecast** – Respondents were asked about their perceived urgency given the forecast information and could select from a ten-point scale with one indicating "no urgency" and ten indicating "extreme urgency."
- **Probability of Occurrence –** Respondents were asked to describe the probability that they would see excessive heat given the forecast information provided and could select from a sliding scale from one to one hundred.

Using these questions, we can examine different aspects of the participants' knowledge of the current watch, warning, advisory system. Table 5 provides a summary of the means associated with all of these variables for individuals who saw the current system. Overall, the respondents appear to be responding appropriately to the excessive heat WWA headlines and weather scenarios. This conclusion can be drawn based on the means associated with behavior (i.e., overall action, monitoring, prepare, and protective action) increasing linearly across the conditions. Further, a similar trend is observed among the perception variables (i.e., risk, confidence, urgency, and probability).

Note: A previous report noted that adding the "Watch" headline decreases perceived confidence, urgency, and probability of occurrence; however, further statistical analyses were conducted and these means are not significantly different from the base condition.

Table 5. Knowledge of the Current System using Behavioral and Perception Variables

Current System				
	Base	**Watch**	**Advisory**	**Warning**
Overall Action	2.80	2.78	3.21	3.55
Monitor	4.04	3.96	4.14	4.24
Prepare	3.74	3.76	4.03	4.04
Prot. Action	3.59	3.65	3.90	4.21
Risk	7.34	7.29	7.64	7.92
Confidence	7.97	7.80	8.10	8.27
Urgency	7.17	7.08	7.72	7.94
Probability	72.92	72.22	78.24	79.86

To further examine the behavioral response associated with each WWA headline, a breakdown of **actions taken** is shown in Table 6. Overall, the behavioral response seems appropriate given the goal of each warning headline: (1) A majority of individuals are monitoring and preparing after a "Watch" headline, (2) A majority of individuals are preparing, taking some action, and/or protective action following the "Advisory" headline, and (3) a large majority of respondents indicated they would take protective action following a "Warning" headline.

Table 6. Percentage Breakdown of Actions associated with each WWA Headline

Current System - Action Breakdown (%)				
	Base	**Watch**	**Advisory**	**Warning**
Nothing	26.5	21.2	12.4	9.8
Monitor	16.8	23.0	18.6	12.5
Prepare	26.5	26.5	27.4	25.9
Some Action	10.6	15.0	18.6	16.1
Prot. Action	19.5	14.2	23.0	35.7

5.4 Prototype Analyses

This section presents the results of the ordered logistic regression analyses we performed on the prototype testing. The methods are discussed in Section 4.0. We analyzed data from the first four questions described in the previous section: **Action taken, Likelihood of monitoring, Likelihood of preparing, and Likelihood of acting.**

The goal of the analyses was to determine whether those who saw certain prototypes were more or less likely to take protective actions compared to the current system using those four questions to measure different responses. As noted in Section 4.2, the analyses resulted in the estimation of odds ratios that indicate the degree to which the four new prototypes performed against the current system. An odds ratio of 1.0 indicates that a prototype is just as protective as the current system, odds ratios below 1.0 indicate the prototype is less protective, and odds ratios above 1.0 indicate the prototype is more protective. By design, odds ratios cannot be below zero.

As discussed in Section 2.2, it was decided that excessive heat would only examine one scenario: **Advisory with an Upgrade.** Therefore, the next section will provide an in-depth discussion of the results for this scenario. We present odds ratios for each prompt within the scenario. The results are organized by the protective response variables listed above. The specific prototypes tested for the excessive heat warm regions survey appear in Table 7.

Recall: It was decided by NWS that the excessive heat prototypes would only retain the "Advisory" and "Warning" headlines. As a result, respondents saw an "Advisory" headline at the "Watch level" and a continuance of the "Advisory" headline at the "Advisory level." Further, it was decided that Prototype 3 would avoid using "Moderate" to describe the "Advisory," and instead use "Severe" and "Extreme" to describe the threat of excessive heat. Table 6 reflects these decisions.

Table 7. Specific Prototype Language Tested for Excessive Heat Warm Region Survey

Level	Current System	Prototype 1	Prototype 2	Prototype 3	Prototype 4
Watch level	Excessive Heat Watch	Heat Warning	Heat Alert	Severe Heat Warning	Level Orange Heat Warning
Advisory level	Heat Advisory	Heat Warning	Heat Alert (continued)	Severe Heat Warning (continued)	Level Orange Heat Warning (continued)
Warning level	Excessive Heat Warning	Heat Warning	Heat Warning	Extreme Heat Warning	Level Red Heat Warning

5.4.1 *Advisory with an Upgrade Scenario*

After a baseline prompt, the advisory with an upgrade scenario started with an advisory-level prompt[12], and then progressed through time with a continuance of the advisory-level prompt followed by an upgrade to a warning. Table 8 presents the estimated odds ratios for the advisory upgrade scenario; in the table, the "*" symbol depicts statistical significance. Figure 5 provides a graphical depiction of the estimates in Table 8 and using red text and the "*" again to depict statistical significance. The results of each protective response variable can be described as follows:

Action Taken

- Overall, the prototypes appear to be less protective or equally as protective in terms of the action selected by respondents. This was especially true at the "Advisory level" (i.e., advisory continued) and "Warning level," where Prototypes 3 and 4 were close to significance.
- Interestingly, at the "Watch level" (i.e., advisory), those who saw Prototype 3 were ***more likely*** to take a more protective action compared to those who saw the current system.

Likelihood of Monitoring

- Those who saw Prototype 1, 2, or 4 were significantly more likely to monitor at both the "Watch level" (i.e., advisory) and "Warning level," in comparison to those who saw the current system.
- There were no significant results at the "Advisory level" (i.e., advisory continued); however, Prototypes 1, 2, and 4 again outperformed the current system.

Likelihood of Preparing

- At the "Watch level" (i.e., advisory) and "Warning level," the prototypes provided more or less the same level of protective response. However, at the "Advisory level" (i.e., advisory continued), all prototypes had odds ratios below 1.0 – but none were significant.

[12] Remember, the Current System Prototype first saw a Watch-level prompt, followed by an upgrade to an advisory and another upgrade to a warning.

Likelihood of Acting

- The prototypes provided more or less the same level of protective response. However, Prototype 3 consistently had odds ratios below 1.0 at the "Advisory level" (i.e., advisory continued) and "Warning level" – but none were significant.

Table 8. Estimated Odds Ratios for Advisory Upgrade Scenario: Excessive Heat Warm Regions

	(1) Action Taken	(2) Likelihood of Monitoring	(3) Likelihood of Preparing	(4) Likelihood of Acting
Prompt 2: Advisory				
Prototype 1	1.344 (1.10)	2.262** (2.54)	1.195 (0.58)	1.122 (0.40)
Prototype 2	1.403 (1.26)	2.324*** (2.67)	1.076 (0.24)	1.373 (1.10)
Prototype 3	1.730** (2.04)	1.541 (1.40)	1.230 (0.69)	1.141 (0.46)
Prototype 4	1.080 (0.29)	2.382*** (2.72)	1.104 (0.33)	1.061 (0.21)
Prompt 3: Advisory Cont.				
Prototype 1	0.980 (-0.08)	1.550 (1.39)	0.763 (-0.91)	1.159 (0.50)
Prototype 2	0.807 (-0.82)	1.395 (1.08)	0.709 (-1.15)	1.128 (0.41)
Prototype 3	0.878 (-0.50)	1.127 (0.40)	0.758 (-0.93)	0.825 (-0.67)
Prototype 4	0.676 (-1.54)	1.254 (0.75)	0.663 (-1.41)	0.931 (-0.25)
Prompt 4: Warning				
Prototype 1	1.086 (0.32)	2.013** (2.15)	1.124 (0.41)	1.268 (0.80)
Prototype 2	1.234 (0.79)	2.140** (2.35)	1.453 (1.30)	1.126 (0.41)
Prototype 3	0.758 (-1.09)	1.272 (0.78)	1.202 (0.65)	0.832 (-0.64)
Prototype 4	1.008 (0.03)	2.268** (2.53)	1.348 (1.06)	1.161 (0.52)

Exponentiated coefficients; *z* statistics in parentheses
* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

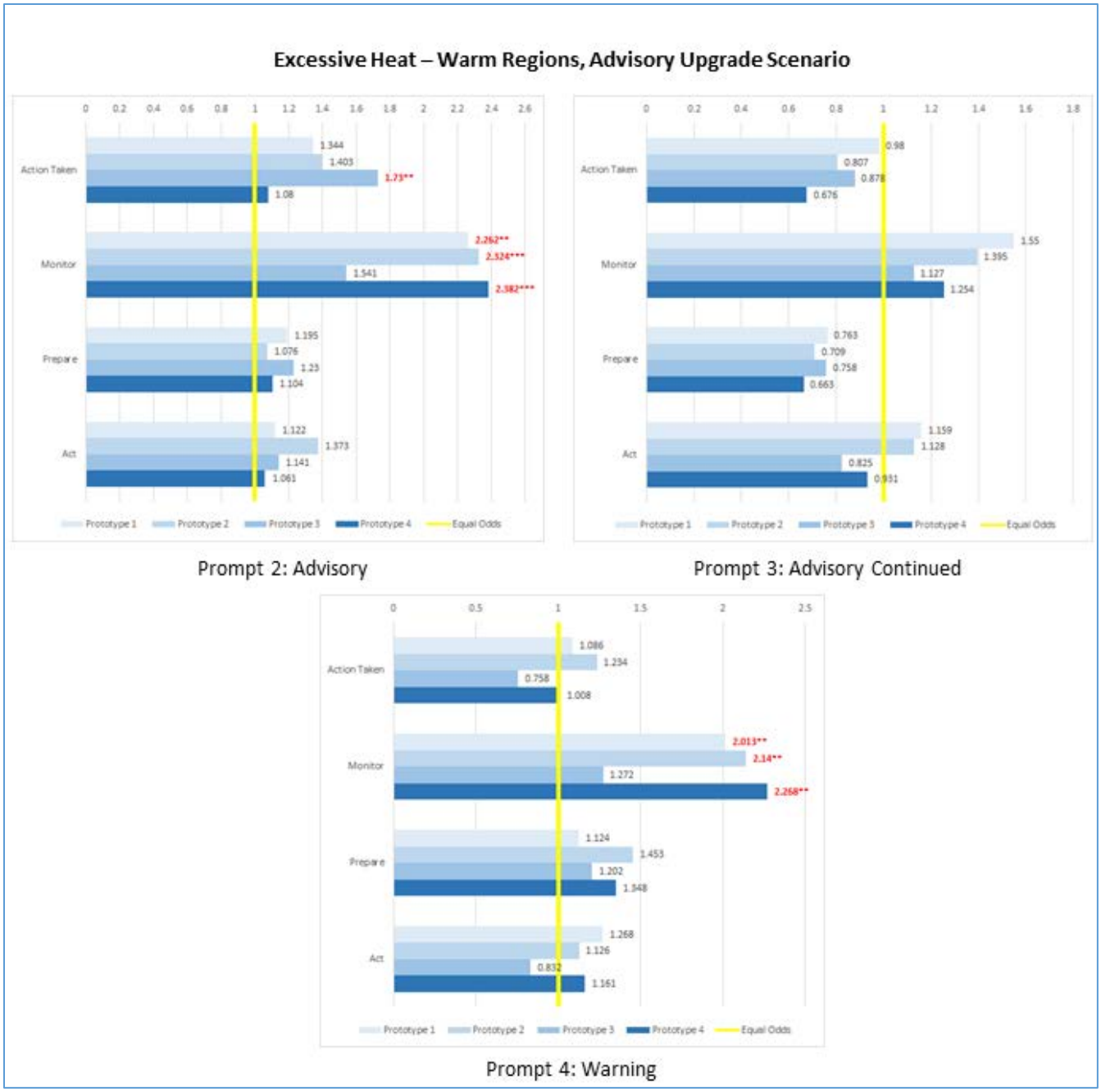

Figure 5. Graphical Depiction of Estimated Odds Ratios for Advisory Upgrade Scenario: Excessive Heat Warm Regions Survey

5.5 Summary and Conclusions

To offer a summary of the results provided in this section, Table 9 presents the percentages of estimates for each prototype that were significantly greater or significantly less than 1.0. Based on Table 8, Prototype 1, 2, and 4 had the same percentage of estimates greater than 1.0; however, Prototype 3 also had one estimate that was significantly greater than 1.0.

Table 9. Percentages of All Estimates Significantly Greater and Less than 1.0, by Prototype: Heat Warm Survey

Prototype	All Estimates	
	> 1.0	< 1.0
Prototype 1	16%	0%
Prototype 2	16%	0%
Prototype 3	8%	0%
Prototype 4	16%	0%
Total Number of Estimates [a]	12	

[a] This is the total for each Prototype

Table 10 expands the summary in Table 9 by breaking the percentages down by prompt level (i.e., Watch, Advisory, Warning). **Remember:** for the Excessive Heat Warm Regions Prototypes, a "Watch Level" involved an "Advisory" headline, the "Advisory level" involved the continuance of an "Advisory" headline, and the "Warning level" involved a "Warning" headline. In Table 10, we see that all of Prototype 1, 2 and 4's estimates that were significantly greater than 1.0 were at the "Watch level" and "Warning level." Further, we see that Prototype 3's estimate that was significantly greater also occurred at the "Watch level."

Table 10. Percentages of All Estimates Significantly Greater and Less than 1.0, by Prototype and Prompt Level: Heat Warm Survey

Prototype	Watch		Advisory		Warning	
	> 1.0	< 1.0	> 1.0	< 1.0	> 1.0	< 1.0
Prototype 1	25%	0%	0%	0%	25%	0%
Prototype 2	25%	0%	0%	0%	25%	0%
Prototype 3	25%	0%	0%	0%	0%	0%
Prototype 4	25%	0%	0%	0%	25%	0%
Total Number of Estimates [a]	4		4		4	

[a] This is the total for each Prototype

Table 11 expands the summary in Tables 9 and 10 by breaking the percentages down by protective response variable (i.e., Action taken, Likelihood to Monitor, Likelihood to Prepare, and Likelihood to Act. These data reveal that all of the estimates that were significantly greater than 1.0 were concentrated on increasing the monitoring of forecast information. Further, Prototype 3's estimate that was significantly

greater than 1.0 was associated with the action a respondent indicated they would take given the forecast information.

Table 11. Percentages of All Estimates Significantly Greater and Less than 1.0, by Prototype and Protective Response Variable: Heat Warm Survey

Prototype	Action Taken		Likelihood of Monitoring		Likelihood of Preparing		Likelihood of Acting	
	> 1.0	< 1.0	> 1.0	< 1.0	> 1.0	< 1.0	> 1.0	< 1.0
Prototype 1	0%	0%	66%	0%	0%	0%	0%	0%
Prototype 2	0%	0%	66%	0%	0%	0%	0%	0%
Prototype 3	33%	0%	0%	0%	0%	0%	0%	0%
Prototype 4	0%	0%	66%	0%	0%	0%	0%	0%
Total Number of Estimates [a]	3		3		3		3	

[a] This is the total for each Prototype

Based on this summary and the results presented in the above sections, some overall conclusions can be drawn.

- Prototypes 1, 2, and 4 consistently improve the likelihood of monitoring weather information, in comparison to the current system, across the "Watch" (i.e., advisory), "Advisory" (i.e., advisory continued), and "Warning" levels. However, these odds ratios are only significant at the "Watch" and "Warning" levels.

- Prototypes 1, 2, and 4 consistently outperform the current system – but do not show statistical significance. Further, these prototypes usually perform similarly across all response variables. The only exception is the "Advisory" level (i.e., advisory continued), where the odds ratios for **action taken and likelihood to prepare** are less than 1.0 – signifying the current system was more effective (albeit not significantly).

- Prototype 3 consistently underperforms across all response variables in comparison to the current system and other prototypes. However, those who saw Prototype 3 at the "Watch" level (i.e., advisory) were ***more likely*** to take a more protective action compared to those who saw the current system. This leads to the question: **Does the language associated with Prototype 3 encourage taking a more protective action too soon, especially in the case of a long-term hazard?**

6.0 Excessive Heat: Cold Regions

This section discusses the results from the excessive heat cold regions survey. To account for differences in excessive heat warning issuance criteria, It was decided between the researcher and the NWS, that the excessive heat survey would need to be implemented in two different surveys: one for colder regions and one for warmer regions. The cold regions survey was implemented in states that experience extreme heat less frequently, and therefore, have a lower threshold for the issuance of excessive heat warnings.

***States**: CO, CT, DE, ID, IL, IN, KS, ME, MD, MA, MI, MN, MO, NE, NH, NJ, NY, ND, OH, OR, PA, RI, SD, UT, VT, WA, and WV.*

***Respondents**: 277*

***Collection time frame**: 12/4/17 – 12/5/17*

6.1 Basic Demographics

Figure 6 provides of summary of the states and the total number of respondents from each state that completed the excessive heat cold region survey. The largest number of participants lived in Pennsylvania (34), and the least resided in Delaware, Rhode Island, and Vermont (1).

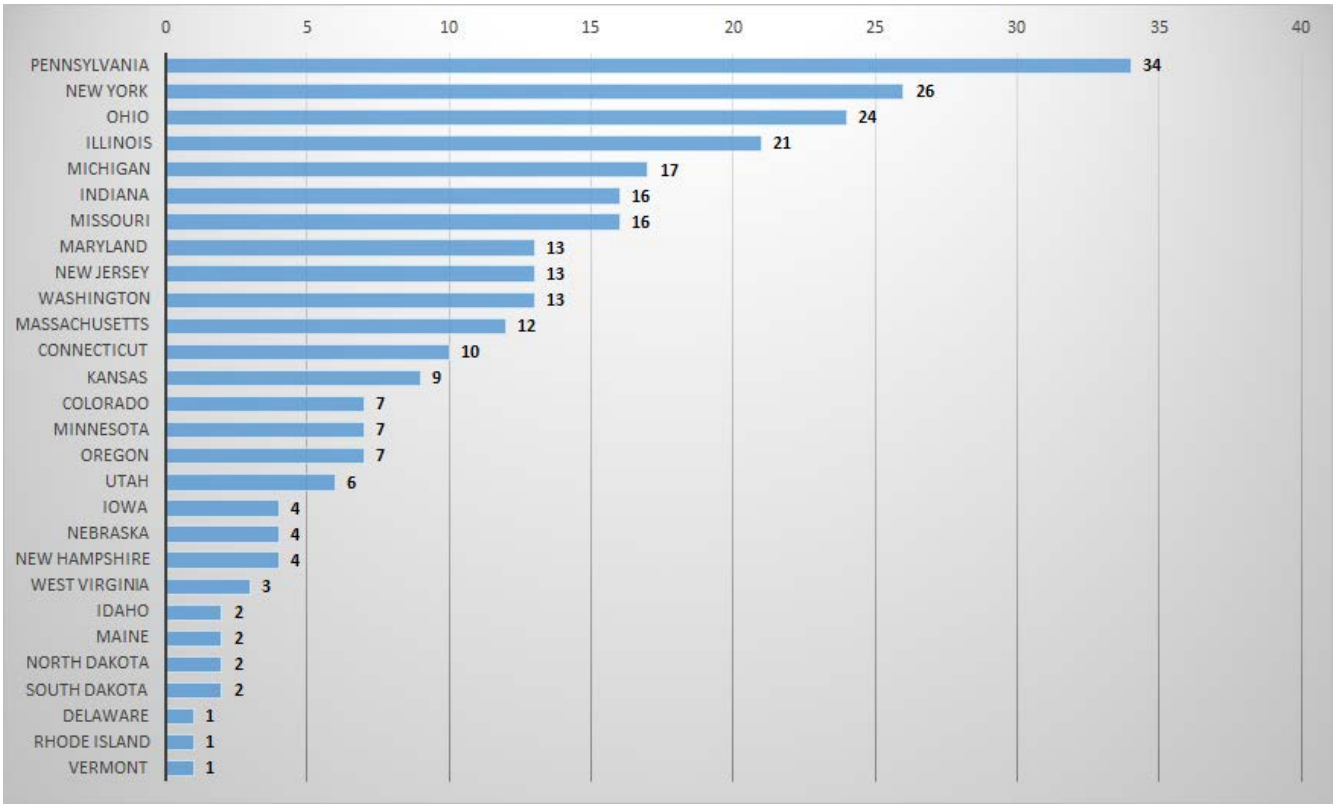

Figure 6. Number of respondents from States in the Excessive Heat Cold Region Survey

Table 12 provides a summary of the demographics assessed in the excessive heat cold region survey. Overall, the sample contains more females and Caucasian Americans. It is also fairly skewed toward an older age group; however, that can be seen as a strength of this dataset – as this group is often considered a vulnerable population. The sample seems to be fairly balanced across income and education level. For a complete breakdown of all the demographic variables collected within the excessive heat cold region sample, please see Appendix 3.

Table 12. Basic Demographics for the Excessive Heat Cold Region Survey

Category	Percentage of Sample / Sample Value	Category	Percentage of Sample / Sample Value
Age		**Race**	
20-24	7.2%	White	86.6%
25-34	17.0%	Black/African-American	9.4%
35-44	11.9%	Asian	3.2%
45-54	14.8%	Other	1.4%
55-64	22.0%	**Income**	
65+	27.1%	Less than $24,999	29.0%
Gender		$25,000 - $49,999	34.1%
Female	68.8%	$50,000 - $99,999	29.3%
Male	30.1%	$100,000 - $199,999	6.9%
Education		More than $200,000	0.7%
Less than college degree	61.4%	**Home Location**	
College degree	26.7%	Urban	26.4%
Graduate work/degree	11.9%	Suburban	46.7%
Hispanic origin		Rural	26.8%
Yes	6.5%		
No	93.5%	**Average number of adults in home**	**2.01**
		Average number of children in home	**0.38**

6.2 Weather Information Use

Figure 7 provides an overview of the participants' preference for receiving *daily* weather information. Participants overwhelmingly reported the use of television and a website/app for receiving their *daily* weather information.

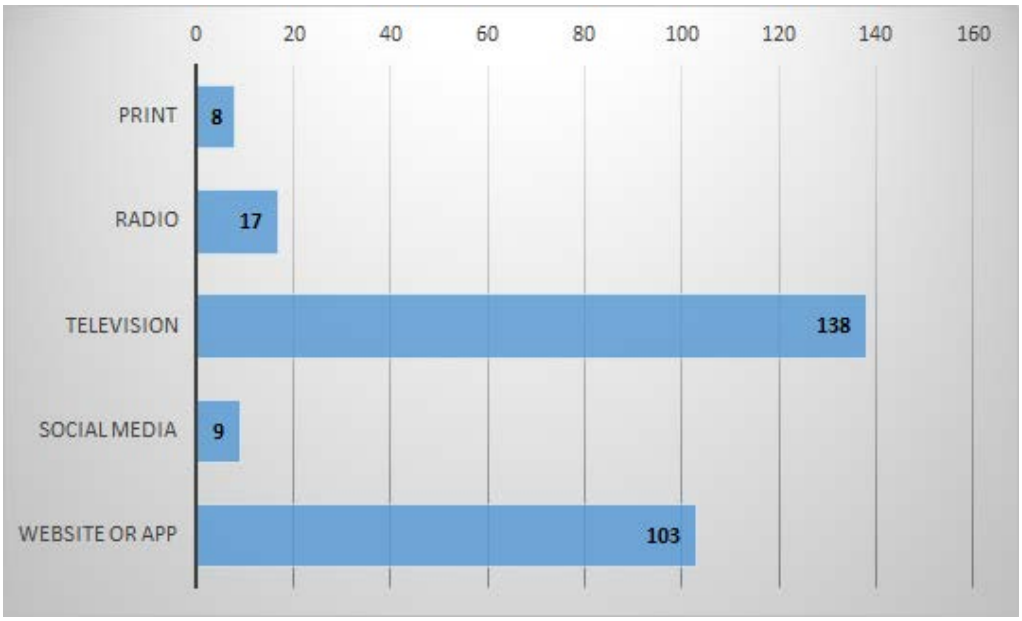

Figure 7. Participant's preference for receiving daily weather information

Figure 8 provides an overview of the participants' preference for receiving *information about excessive heat*. Similar to daily weather information, a large majority of participants reported the use of television and a website/app for receiving information about *excessive heat.*

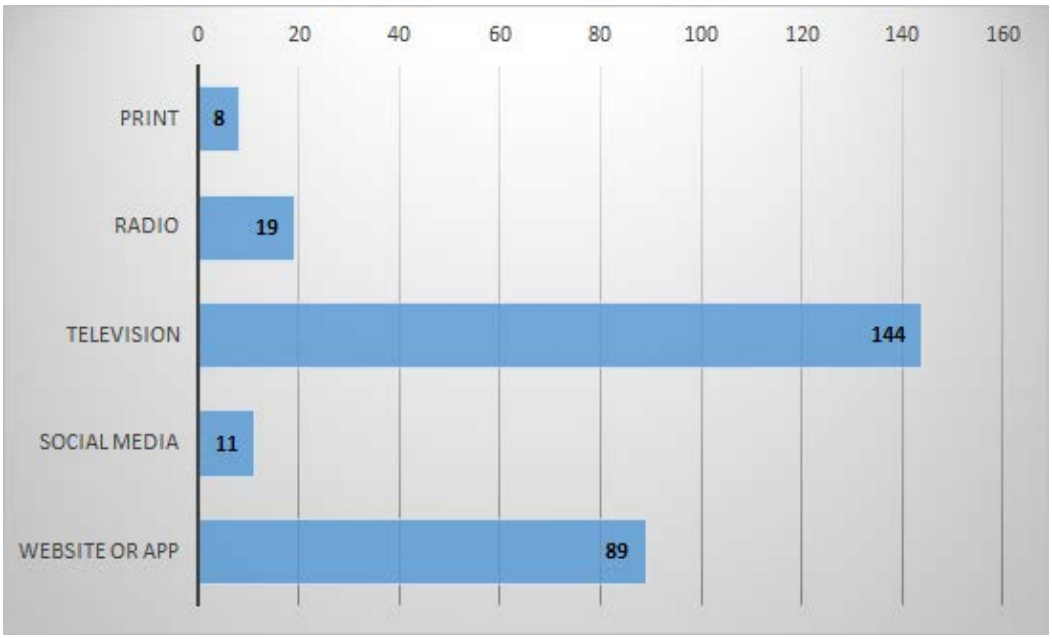

Figure 8. Participant's preference for receiving information about excessive heat

6.3 Current Knowledge

As discussed in Section 2.4, the current knowledge questions were developed after the deployment of the excessive heat cold region survey; however, additional questions were included that provide some insight into the participants' current knowledge of the excessive heat products. Taken together, the following questions were used to assess knowledge of the Excessive Heat Watch, Heat Advisory, and Excessive Heat Warning:

- **Action taken** – Respondents were asked about the action they would take in response to the prompt provided; the actions included (1) do nothing, (2) monitor, (3) prepare, (4) take some action, or (5) take protective action. Each survey provided a unique descriptions of what each type of action meant for the particular hazard being surveyed.
- **Likelihood of monitoring** – Respondents were asked how likely they were to monitor forecast information given the scenario provided and could select from a five-point scale with one indicating "very unlikely" and five indicating "very likely."
- **Likelihood of preparing** – Respondents were asked how likely they were to prepare given the information provided and could select a five-point scale with one indicating "very unlikely" and five indicating "very likely."
- **Likelihood of acting** – Respondents were asked how likely they were to take a protective action given the information provided and could select from a five-point scale with one indicating "very unlikely" and five indicating "very likely."
- **Perceived risk of the forecast** – Respondents were asked about their perceived risk given the forecast information provided and could select from a ten-point scale with one indicating "no risk" and ten indicating "extreme risk."
- **Perceived confidence in the forecast** – Respondents were asked about their perceived confidence in the forecast information provided and could select from a ten-point scale with one indicating "no confidence" and ten indicating "extreme confidence."
- **Perceived urgency of the forecast** – Respondents were asked about their perceived urgency given the forecast information and could select from a ten-point scale with one indicating "no urgency" and ten indicating "extreme urgency."
- **Probability of Occurrence –** Respondents were asked to describe the probability that they would see excessive heat given the forecast information provided and could select from a sliding scale from one to one hundred.

Using these questions, we can examine different aspects of the participants' knowledge of the current watch, warning, advisory system. Table 13 provides a summary of the means associated with all of these variables for individuals who saw the current system. Overall, the respondents appear to be responding appropriately to the excessive heat WWA headlines and weather scenarios. This conclusion can be drawn based on the means associated with behavior (i.e., overall action, monitoring, prepare, and

protective action) increasing linearly across the conditions. Further, a similar trend is observed among the perception variables (i.e., risk, confidence, urgency, and probability).

Note: A previous report noted that adding the "Watch" headline decreases perceived confidence, urgency, and probability of occurrence; however, further statistical analyses were conducted and these means are not significantly different from the base condition.

Table 13. Knowledge of the Current System using Behavioral and Perception Variables

Current System				
	Base	Watch	Advisory	Warning
Overall Action	2.53	2.75	2.98	3.60
Monitor	3.69	3.76	3.95	4.06
Prepare	3.65	3.52	3.72	3.84
Prot. Action	3.42	3.42	3.70	4.01
Risk	6.36	6.66	6.94	7.44
Confidence	7.06	7.28	7.69	8.00
Urgency	6.39	6.69	7.04	7.52
Probability	69.81	69.88	75.89	80.95

To further examine the behavioral response associated with each WWA headline, a breakdown of the **actions taken** is shown in Table 14. Overall, the behavioral response seems appropriate given the goal of each warning headline: (1) A majority of individuals are monitoring and preparing after a "Watch" headline, (2) A majority of individuals are preparing, taking some action, and/or protective action following the "Advisory" headline, and (3) a large majority of respondents indicated they would take some action or protective action following a "Warning" headline.

Table 14. Percentage Breakdown of Actions associated with each WWA Headline

Current System - Action Breakdown (%)				
	Base	Watch	Advisory	Warning
Nothing	29.2	21.4	13.3	10.7
Monitor	22.1	24.1	22.1	7.1
Prepare	27.4	29.5	31.9	26.8
Some Action	8.8	8.0	18.6	22.3
Prot. Action	12.4	17.0	14.2	33.0

6.4 Prototype Analyses

This section presents the results of the ordered logistic regression analyses we performed on the prototype testing. The methods are discussed in Section 4.0. We analyzed data from the first four questions described in the previous section: **Action taken, Likelihood of monitoring, Likelihood of preparing, and Likelihood of acting.**

The goal of the analyses was to determine whether those who saw certain prototypes were more or less likely to take protective actions compared to the current system using those four questions to measure different responses. As noted in Section 4.2, the analyses resulted in the estimation of odds ratios that indicate the degree to which the four new prototypes performed against the current system. An odds ratio of 1.0 indicates that a prototype is just as protective as the current system, odds ratios below 1.0 indicate the prototype is less protective, and odds ratios above 1.0 indicate the prototype is more protective. By design, odds ratios cannot be below zero.

As discussed in Section 2.2, it was decided that excessive heat would only examine one scenario: **Advisory with an Upgrade.** Therefore, the next section will provide an in-depth discussion of the results for this scenario. We present odds ratios for each prompt within the scenario. The results are organized by the protective response variables listed above. The specific prototypes tested for the excessive heat warm regions survey appear in Table 15.

Recall: It was decided by NWS that the excessive heat prototypes would only retain the "Advisory" and "Warning" headlines. As a result, respondents saw an "Advisory" headline at the "Watch level" and a continuance of the "Advisory" headline at the "Advisory level." Further, it was decided that Prototype 3 would avoid using "Moderate" to describe the "Advisory," and instead use "Severe" and "Extreme" to describe the threat of excessive heat. Table 15 reflects these decisions.

Table 15. Specific Prototype Language Tested for Excessive Heat Cold Region Survey

Level	Current System	Prototype 1	Prototype 2	Prototype 3	Prototype 4
Watch level	Excessive Heat Watch	Heat Warning	Heat Alert	Severe Heat Warning	Level Orange Heat Warning
Advisory level	Heat Advisory	Heat Warning	Heat Alert (continued)	Severe Heat Warning (continued)	Level Orange Heat Warning (continued)
Warning level	Excessive Heat Warning	Heat Warning	Heat Warning	Extreme Heat Warning	Level Red Heat Warning

6.4.1 Advisory with an Upgrade Scenario

After a baseline prompt, the advisory with an upgrade scenario started with an advisory-level prompt[13], and then progressed through time with a continuance of the advisory-level prompt followed by an upgrade to a warning. Table 16 presents the estimated odds ratios for the advisory upgrade scenario; in the table, the "*" symbol depicts statistical significance. Figure 9 provides a graphical depiction of the estimates in Table 16 and using red text and the "*" again to depict statistical significance. The results of each protective response variable can be described as follows:

Action Taken

- Overall, the prototypes appear to be less protective or equally as protective as the current system in terms of the action selected by respondents. This was especially true at the "Watch level" (i.e., advisory) and the "Advisory level" (i.e., advisory continued) where those who saw

[13] **Remember:** The Current System Prototype first saw a Watch-level prompt, followed by an upgrade to an advisory and another upgrade to a warning.

Prototype 3 were less likely to take a more protective action in comparison to those who saw the current system. This result was significant at the "Watch level" and *close to significance* at the "Advisory level."

Likelihood of Monitoring

- There were no significant results at the "Watch, Advisory, or Warning levels;" however, Prototype 4 consistently performed well at the "Watch level" (i.e., advisory) and "Warning level."
- At the "Advisory level" (i.e., advisory continued), Prototype 3 performed better than the current system and other prototypes – although not significantly.

Likelihood of Preparing

- At the "Watch level" (i.e., advisory), all of the prototypes outperformed the current system; however, those who saw Prototype 2 and 4 were significantly more likely to prepare.
- At the "Advisory level" (i.e., advisory continued), all of the prototypes outperformed the current system; however, those who saw Prototype 3 were significantly more likely to prepare.
- At the "Warning level," those who saw Prototype 3 and 4 were more likely to prepare. However, these results were not significant – although Prototype 4 was *close to significance.*

Likelihood of Acting

- The prototypes provided more or less the same level of protective response. However at the "Watch level" (i.e., advisory), those who saw Prototype 4 were more likely to take protective action. Although not significant, this result was *extremely close* to significance.

Table 16. Estimated Odds Ratios for Advisory Upgrade Scenario: Excessive Heat Cold Regions

	(1) Action Taken	(2) Likelihood of Monitoring	(3) Likelihood of Preparing	(4) Likelihood of Acting
Prompt 2: Advisory				
Prototype 1	0.701	0.941	1.233	0.748
	(-1.32)	(-0.22)	(0.75)	(-1.05)
Prototype 2	0.664	1.234	1.649*	0.997
	(-1.51)	(0.72)	(1.73)	(-0.01)
Prototype 3	0.519**	0.976	1.385	1.008
	(-2.44)	(-0.09)	(1.14)	(0.03)
Prototype 4	0.863	1.402	1.739*	1.566
	(-0.56)	(1.19)	(1.94)	(0.21)
Prompt 3: Advisory Cont.				
Prototype 1	1.139	0.933	1.289	1.029
	(0.52)	(-0.25)	(0.95)	(0.11)
Prototype 2	1.050	0.722	1.421	1.032
	(0.19)	(-0.92)	(1.28)	(0.12)
Prototype 3	0.743	1.253	1.626*	1.223
	(-1.17)	(0.78)	(1.75)	(0.74)
Prototype 4	1.044	1.040	1.256	0.926
	(0.17)	(0.14)	(-1.41)	(-0.29)
Prompt 4: Warning				
Prototype 1	0.841	1.031	1.082	1.128
	(-0.69)	(0.11)	(0.29)	(0.45)
Prototype 2	0.667	0.908	0.972	0.864
	(-1.57)	(-0.34)	(-0.10)	(-0.54)
Prototype 3	0.871	1.058	1.282	0.911
	(-0.53)	(0.19)	(0.91)	(-0.33)
Prototype 4	0.801	1.257	1.529	1.174
	(-0.87)	(0.77)	(1.53)	(0.58)

Exponentiated coefficients; *z* statistics in parentheses
* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

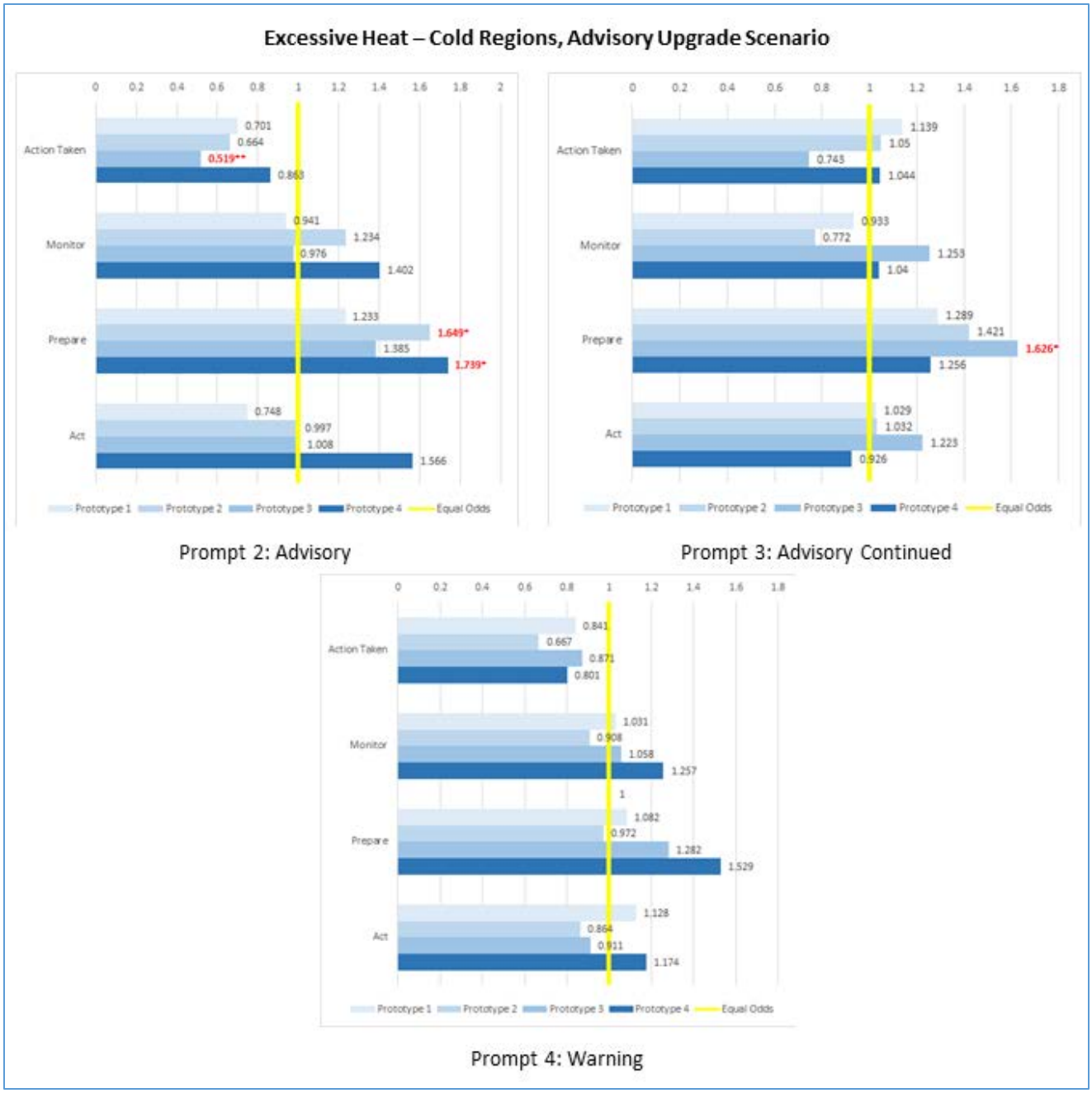

Figure 9. Graphical Depiction of Estimated Odds Ratios for Advisory Upgrade Scenario: Excessive Heat Cold Regions Survey

6.5 Summary and Conclusions

To offer a summary of the results provided in this section, Table 17 presents the percentages of estimates for each prototype that were significantly greater or significantly less than 1.0. Based on Table 17, Prototype 2, 3, and 4 had the same percentage of estimates greater than 1.0; however, Prototype 3 also had an estimate that was significantly less than 1.0.

Table 17. Percentages of All Estimates Significantly Greater and Less than 1.0, by Prototype: Heat Cold Survey

Prototype	All Estimates	
	> 1.0	< 1.0
Prototype 1	0%	0%
Prototype 2	8%	0%
Prototype 3	8%	8%
Prototype 4	8%	0%
Total Number of Estimates [a]	12	

[a] This is the total for each Prototype

Table 18 expands the summary in Table 17 by breaking the percentages down by prompt level (i.e., Watch, Advisory, Warning). **Remember:** for the Excessive Heat Cold Regions Prototypes, a "Watch Level" involved an "Advisory" headline, the "Advisory level" involved the continuance of an "Advisory" headline, and the "Warning level" involved a "Warning" headline. In Table 18, we see that all of Prototype 2 and 4's estimates that were significantly greater than 1.0 were at the "Watch level." However, we see that Prototype 3's estimate that was significantly greater occurred at the "Advisory level."

Table 18. Percentages of All Estimates Significantly Greater and Less than 1.0, by Prototype and Prompt Level: Heat Cold Survey

Prototype	Watch		Advisory		Warning	
	> 1.0	< 1.0	> 1.0	< 1.0	> 1.0	< 1.0
Prototype 1	0%	0%	0%	0%	0%	0%
Prototype 2	25%	0%	0%	0%	0%	0%
Prototype 3	0%	25%	25%	0%	0%	0%
Prototype 4	25%	0%	0%	0%	0%	0%
Total Number of Estimates [a]	4		4		4	

[a] This is the total for each Prototype

Table 19 expands the summary in Tables 17 and 18 by breaking the percentages down by protective response variable (i.e., Action taken, Likelihood to Monitor, Likelihood to Prepare, and Likelihood to Act. These data reveal that all of the estimates that were significantly greater than 1.0 were concentrated on

increasing preparation. Further, Prototype 3's estimate that was significantly less than 1.0 was associated with the action a respondent indicated they would take given the forecast information.

Table 19. Percentages of All Estimates Significantly Greater and Less than 1.0, by Prototype and Protective Response Variable: Heat Cold Survey

Prototype	Action Taken		Likelihood of Monitoring		Likelihood of Preparing		Likelihood of Acting	
	> 1.0	< 1.0	> 1.0	< 1.0	> 1.0	< 1.0	> 1.0	< 1.0
Prototype 1	0%	0%	0%	0%	0%	0%	0%	0%
Prototype 2	0%	0%	0%	0%	33%	0%	0%	0%
Prototype 3	0%	33%	0%	0%	33%	0%	0%	0%
Prototype 4	0%	0%	0%	0%	33%	0%	0%	0%
Total Number of Estimates [a]	3		3		3		3	

[a] This is the total for each Prototype

Based on this summary and the results presented in the above sections, some overall conclusions can be drawn.

- Across all levels and prototypes for the **action taken response variable,** the current system consistently performed better or equal to the prototype language. Specifically, the odds ratio values were all below or close to equaling one in the "Watch, Advisory, and Warning levels."
- Prototype 3 offered mixed results. At the "Watch level" (i.e., advisory), those who saw Prototype 3 were significantly less likely to take a more protective action in comparison to those who saw the current system. However, in the "Advisory level" (i.e., advisory continued), Prototype 3 consistently performed well for the **likelihood to monitor, prepare, and take protective action response variables.** Specifically, it was significant for the **likelihood to prepare**.
- Prototype 4 consistently performed well at the "Watch level" (i.e., advisory) and "Warning level" for the **likelihood to monitor, prepare, and take protective action response variables.** Specifically, it was significant for the **likelihood to prepare** at the "Watch level" and *close to significance* at the "Warning level."

6.6 Summary and Conclusions for Both Excessive Heat Surveys

To offer a summary results of both excessive heat surveys (cold and warm regions), Table 20 presents the percentages of estimates for each prototype that were significantly greater or significantly less than 1.0. Based on Table 20, Prototype 2 and 4 had the same percentage of estimates greater than 1.0; however, Prototype 3 was the only prototype to have an estimate that was significantly less than 1.0.

Table 20. Percentages of All Estimates Significantly Greater and Less than 1.0, by Prototype: Both Excessive Heat Surveys

Prototype	All Estimates	
	> 1.0	< 1.0
Prototype 1	8%	0%
Prototype 2	13%	0%
Prototype 3	8%	4%
Prototype 4	13%	0%
Total Number of Estimates [a]	24	

[a] This is the total for each Prototype

Table 21 expands the summary in Table 20 by breaking the percentages down by prompt level (i.e., Watch, Advisory, Warning). **Remember:** for the Excessive Heat Warm and Cold Region Prototypes, a "Watch Level" involved an "Advisory" headline, the "Advisory level" involved the continuance of an "Advisory" headline, and the "Warning level" involve a "Warning" headline. In Table 21, we see that Prototype 2 and 4's estimates that were significantly greater than 1.0 occurred at the "Watch level" and "Warning level." However, we see that Prototype 3's estimate that was significantly less than 1.0 occurred at the "Watch level."

Table 21. Percentages of All Estimates Significantly Greater and Less than 1.0, by Prototype and Prompt Level: Both Excessive Heat Surveys

Prototype	Watch		Advisory		Warning	
	> 1.0	< 1.0	> 1.0	< 1.0	> 1.0	< 1.0
Prototype 1	13%	0%	0%	0%	13%	0%
Prototype 2	25%	0%	0%	0%	13%	0%
Prototype 3	13%	13%	13%	0%	0%	0%
Prototype 4	25%	0%	0%	0%	13%	0%
Total Number of Estimates [a]	8		8		8	

[a] This is the total for each Prototype

Table 22 expands the summary in Tables 20 and 21 by breaking the percentages down by protective response variable (i.e., Action taken, Likelihood to Monitor, Likelihood to Prepare, and Likelihood to Act. These data reveal that all of the estimates that were significantly greater than 1.0 were concentrated on increasing monitoring and preparation. Further, Prototype 3 offered mixed results: In the Cold Region

Survey, the estimate that was significantly less than 1.0 was associated with the action a respondent indicated they would take given the forecast information. However, in the Warm Region Survey, Prototype 3 produced an estimate that was significantly more than 1.0 for the action taken.

Table 22. Percentages of All Estimates Significantly Greater and Less than 1.0, by Prototype and Protective Response Variable: Both Excessive Heat Surveys

Prototype	Action Taken		Likelihood of Monitoring		Likelihood of Preparing		Likelihood of Acting	
	> 1.0	< 1.0	> 1.0	< 1.0	> 1.0	< 1.0	> 1.0	< 1.0
Prototype 1	0%	0%	33%	0%	0%	0%	0%	0%
Prototype 2	0%	0%	33%	0%	17%	0%	0%	0%
Prototype 3	17%	17%	0%	0%	17%	0%	0%	0%
Prototype 4	0%	0%	33%	0%	17%	0%	0%	0%
Total Number of Estimates [a]	6		6		6		6	

[a] This is the total for each Prototype

Based on this summary and the results presented in the two survey sections, some overall conclusions about the excessive heat hazard can be drawn.

- **Across all levels, prototypes, and regions, the current system consistently performed better or equal to the prototype language for the likelihood of taking protective action response variable**. Specifically, the odds ratio values were generally below or close to equaling one in the "Watch, Advisory, and Warning levels." The only exception was Prototype 4, at the "Watch level", in the Cold Regions Survey, which was *extremely close to significance.* However, do we want respondents taking protective action this early on?
- **There is no clear prototype winner across both excessive heat surveys.** For the Cold Regions, Prototype 4 consistently performed well at the "Watch level" and "Warning level" for the likelihood to monitor, prepare, and take protective action response variables. For the Warm Regions, Prototype 2 consistently performed well across the "Watch level" and "Warning level" for the likelihood to monitor, prepare, and take protective action response variables.
- **Prototype 3 offered mixed results.** For Cold Regions, those who saw Prototype 3 – at the "Watch level" - were significantly less likely to take a more protective action in comparison to those who saw the current system. For Warm Regions, those who saw Prototype 3 – at the "Watch level" were significantly ***more likely*** to take a more protective action compared to those who saw the current system. Beyond the significant estimates, generally Prototype 3 performs poorly in comparison to the current system and other prototypes.

7.0 High Winds

This section discusses the results from the high winds survey. Based on the wide variety of high wind warning issuance criteria across the United States, it was decided between the researcher and the NWS, that there would not be any geographic limits to sampling for the high wind survey. Therefore, all contiguous U.S. States were surveyed. To ensure equal distribution and representation of a variety of U.S. states, an East/West sampling technique was employed.

***States**: All Contiguous U.S. States*

***Respondents**: 1,079*

***Collection time frame**: 1/2/18 – 1/4/18*

7.1 Basic Demographics

Table 23 provides a summary of the demographics assessed in the high winds survey. Overall, the sample contains more females and Caucasian Americans. The sample seems to be fairly balanced across income, age, and education level. For a complete breakdown of all the demographic variables collected within the high winds sample, please see Appendix 4.

Table 23. Basic Demographics for the High Winds Survey

Category	Percentage of Sample / Sample Value	Category	Percentage of Sample / Sample Value
Age		**Race**	
18-24	10.4%	White	83.8%
25-34	19.0%	Black/African-American	7.3%
35-44	17.5%	Asian	5.1%
45-54	15.3%	Other	3.8%
55-64	20.1%	**Income**	
65+	17.6%	Less than $24,999	20.3%
Gender		$25,000 - $49,999	32.1%
Female	67.3%	$50,000 - $99,999	24.1%
Male	32.4%	$100,000 - $199,999	10.6%
Education		More than $200,000	2.9%
Less than college degree	49.0%	**Home Location**	
College degree	32.2%	Urban	23.3%
Graduate work/degree	18.6%	Suburban	50.2%
Hispanic origin		Rural	26.5%
Yes	8.6%		
No	91.4%	**Average number of adults in home**	**2.05**
		Average number of children in home	**0.52**

Figure 10 provides a summary of the states and the total number of respondents from each state that completed the high wind survey. The largest number of participants resided in California (111), and the least number lived in Delaware (2), New Hampshire (2), and Wyoming (1).

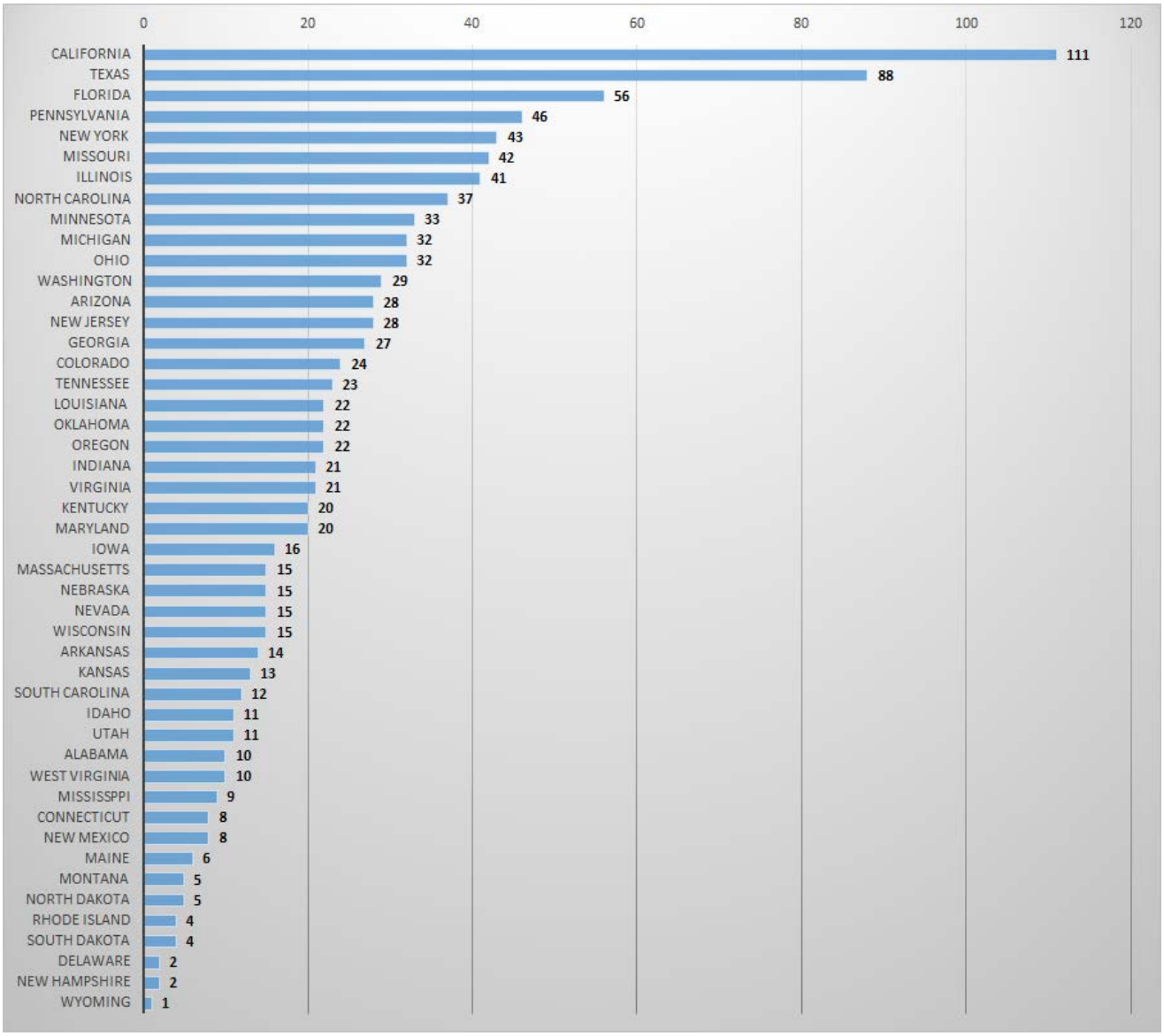

Figure 10. Number of respondents from States in the High Winds Survey

7.2 Weather Information Use

Figure 11 provides an overview of the participants' preference for receiving *daily* weather information. Participants overwhelmingly reported the use of television and a website/app for receiving their *daily* weather information. However, more individuals noted that they prefer to receive their daily weather information from a website/app.

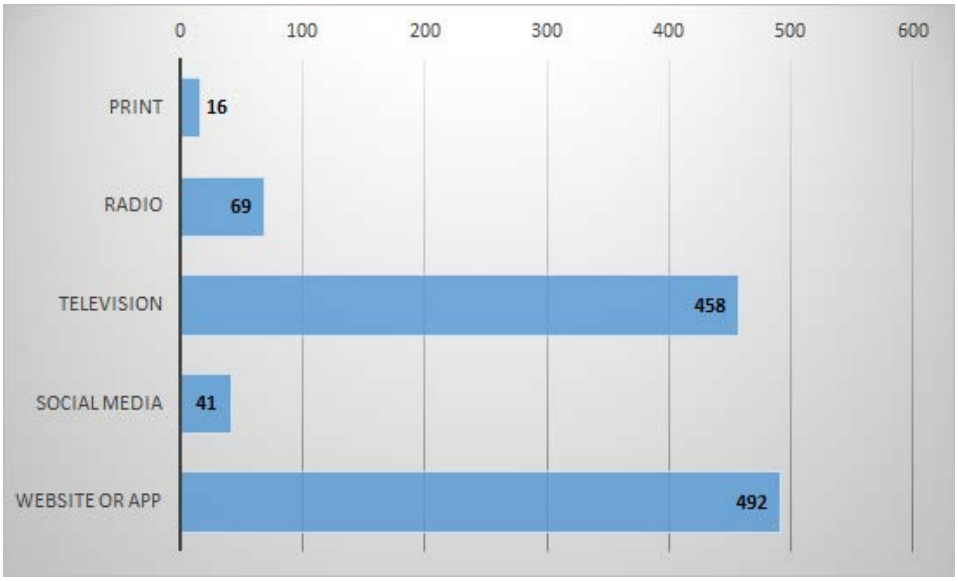

Figure 11. Participant's preference for receiving daily weather information

Figure 12 provides an overview of the participants' preference for receiving *information about excessive heat*. Similar to daily weather information, a large majority of participants reported the use of television and a website/app for receiving information about *high winds.* However, more individuals noted that they prefer to receive their *high wind information* from television sources.

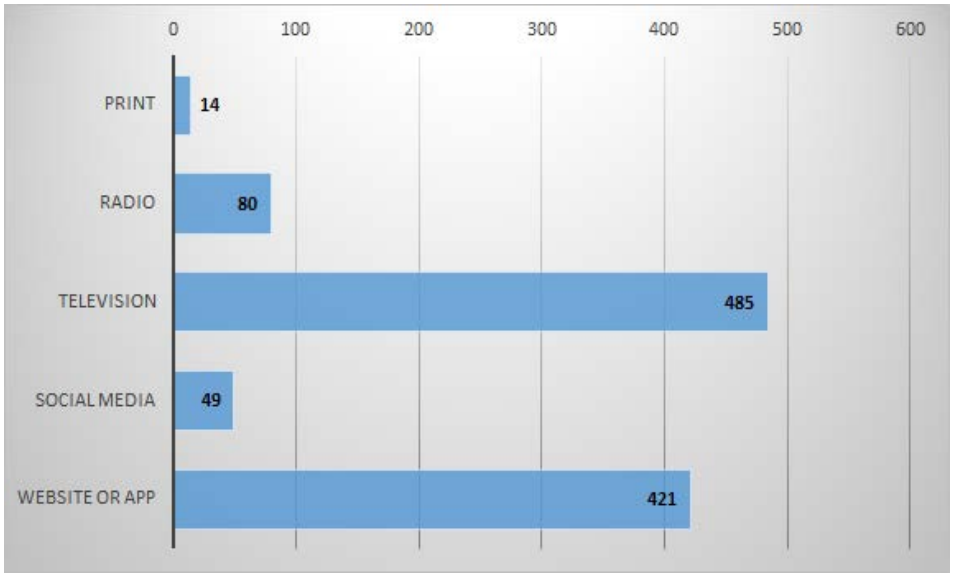

Figure 12. Participant's preference for receiving information about high winds

7.3 Current Knowledge

As discussed in Section 2.4, the current knowledge questions were developed after the deployment of the high wind survey; however, additional questions were included that provide some insight into the participants' current knowledge of the high wind products. Taken together, the following questions were used to assess knowledge of the High Wind Watch, Wind Advisory, and High Wind Warning:

- **Action taken** – Respondents were asked about the action they would take in response to the prompt provided; the actions included (1) do nothing, (2) monitor, (3) prepare, (4) take some action, or (5) take protective action. Each survey provided a unique descriptions of what each type of action meant for the particular hazard being surveyed.

- **Likelihood of monitoring** – Respondents were asked how likely they were to monitor forecast information given the scenario provided and could select from a five-point scale with one indicating "very unlikely" and five indicating "very likely."

- **Likelihood of preparing** – Respondents were asked how likely they were to prepare given the information provided and could select a five-point scale with one indicating "very unlikely" and five indicating "very likely."

- **Likelihood of taking some action** – Respondents were asked how likely they were to take some action given the information provided and could select a five-point scale with one indicating "very unlikely" and five indicating "very likely." **This variable was added based on the NWS' interest in investigating the importance of the "Wind Advisory" and the behavioral response associated with this WWA headline.**

- **Likelihood of acting** – Respondents were asked how likely they were to take a protective action given the information provided and could select from a five-point scale with one indicating "very unlikely" and five indicating "very likely."

- **Perceived risk of the forecast** – Respondents were asked about their perceived risk given the forecast information provided and could select from a ten-point scale with one indicating "no risk" and ten indicating "extreme risk."

- **Perceived confidence in the forecast** – Respondents were asked about their perceived confidence in the forecast information provided and could select from a ten-point scale with one indicating "no confidence" and ten indicating "extreme confidence."

- **Perceived urgency of the forecast** – Respondents were asked about their perceived urgency given the forecast information and could select from a ten-point scale with one indicating "no urgency" and ten indicating "extreme urgency."

- **Probability of Occurrence –** Respondents were asked to describe the probability that they would see high winds given the forecast information provided and could select from a sliding scale from one to one hundred.

Using these questions, we can examine different aspects of the participants' knowledge of the current watch, warning, advisory system. Table 24 provides a summary of the means of these variables for individuals who saw the Warning with a Downgrade Scenario and Table 25 provides a summary of the means associated with the Advisory with an Upgrade Scenario**. Overall, the respondents appear to be misunderstanding the "Wind Advisory" in both the Warning with a Downgrade and Advisory with an Upgrade conditions. Instead of an increase in forecast certainty, respondents perceived less risk, confidence, urgency, and probability when an "Advisory" headline was seen. In fact, their response to these variables was lower than their response to the "Watch" headline.** This conclusion can be drawn based on the means associated with the "Advisory level" being lower than both the "Watch level" and "Warning level." This pattern is evident across *all response variables.* Specifically, there does not appear to be much difference in the overall action taken when transitioning from the "Watch level" to "Advisory level" in the Advisory with an Upgrade condition.

Table 24. Knowledge of the Current System using Behavioral and Perception Variables for the Warning with a Downgrade Scenario

Current System – Warning with a Downgrade				
	Base	**Watch**	**Warning**	**Advisory**
Overall Action	2.76	2.85	3.29	2.73
Monitor	3.79	3.85	4.06	3.50
Prepare	3.62	3.67	3.84	3.04
Some Action	3.49	3.50	3.76	2.87
Prot. Action	3.30	3.21	3.71	2.99
Risk	6.16	6.11	6.70	5.45
Confidence	6.78	6.80	7.23	6.54
Urgency	6.36	6.29	7.03	5.56
Probability	55.40	56.85	68.06	51.30

Table 25. Knowledge of the Current System using Behavioral and Perception Variables for the Advisory with an Upgrade Scenario

Current System – Advisory with an Upgrade				
	Base	**Watch**	**Advisory**	**Warning**
Overall Action	2.69	2.71	2.76	3.32
Monitor	3.76	3.87	3.54	4.02
Prepare	3.71	3.72	3.32	3.84
Some Action	3.54	3.49	3.09	3.76
Prot. Action	3.20	3.21	2.94	3.62
Risk	6.18	6.31	5.76	7.01
Confidence	6.91	7.00	6.79	7.60
Urgency	6.44	6.44	5.80	7.08
Probability	59.04	59.63	59.15	69.31

To further examine the behavioral response associated with each WWA headline, a breakdown of the **actions taken** is shown in Tables 26 and 27. A similar trend is observed, the behavioral response seems appropriate for the "Watch" and "Warning" levels; however, the response to the "Advisory" headline seems uncharacteristic given the goals of this WWA headline: (1) We are seeing a majority of respondents monitoring the situation and (2) a very small percentage of respondents are correctly responding to this headline by preparing and/or taking some action.

Table 26. Percentage Breakdown of Actions associated with each WWA Headline for the Warning with a Downgrade Scenario

Current System – Warning with an Downgrade - Action Breakdown (%)				
	Base	**Watch**	**Warning**	**Advisory**
Nothing	17.3	14.5	10.1	10.0
Monitor	20.9	31.8	20.2	43.6
Prepare	36.4	25.5	29.4	28.2
Some Action	12.7	13.6	14.7	7.3
Prot. Action	12.7	14.5	25.7	10.9

Table 27. Percentage Breakdown of Actions associated with each WWA Headline for the Advisory with an Upgrade Scenario

Current System – Advisory with an Upgrade - Action Breakdown (%)				
	Base	**Watch**	**Advisory**	**Warning**
Nothing	14.6	10.7	9.3	7.4
Monitor	28.2	36.4	44.4	22.3
Prepare	35.2	29.0	19.6	28.4
Some Action	17.4	18.7	14.5	14.9
Prot. Action	4.7	5.1	12.1	27.0

7.4 Prototype Analyses

This section presents the results of the ordered logistic regression analyses we performed on the prototype testing. The methods are discussed in Section 4.0. We analyzed data from the first few questions described in the previous section: **Action taken, Likelihood of monitoring, Likelihood of preparing, and Likelihood of acting.** To remain consistent with the ordered logistic regression analyses employed by ERG, the **Likelihood of taking some action** was not included in this analysis and was only used to provide additional information regarding the sample's current knowledge of the WWA headlines.

The goal of the ordered logistic regression analyses was to determine whether those who saw certain prototypes were more or less likely to take protective actions compared to the current system using those four questions to measure different responses. As noted in Section 4.2, the analyses resulted in

the estimation of odds ratios that indicate the degree to which the four new prototypes performed against the current system. An odds ratio of 1.0 indicates that a prototype is just as protective as the current system, odds ratios below 1.0 indicate the prototype is less protective, and odds ratios above 1.0 indicate the prototype is more protective. By design, odds ratios cannot be below zero.

As discussed in Section 2.2, the high wind survey examined two scenarios: **Warning with a Downgrade** and **Advisory with an Upgrade.** Therefore, the next section will provide an in-depth discussion of the results for these two scenarios. We present odds ratios for each prompt within the scenario. The results are organized by the protective response variables listed above. The specific prototypes tested for the high wind survey appear in Table 28.

Table 28. Specific Prototype Language Tested for High Winds Survey

Level	Current System	Prototype 1	Prototype 2	Prototype 3	Prototype 4
Watch level	High Wind Watch	Wind Outlook	Wind Notice	Possible Wind Event	Possible High Winds
Advisory level	Wind Advisory	Wind Warning	Wind Alert	Moderate Wind Warning	Level Orange Wind Warning
Warning level	High Wind Warning	Wind Warning	Wind Warning	Severe Wind Warning	Level Red Wind Warning

7.4.1 Warning with a Downgrade Scenario

After a baseline prompt, the warning with a downgrade scenario started with a watch-level prompt, and then progressed to a warning-level prompt followed by an downgrade to an advisory. Table 29 presents the estimated odds ratios for the warning downgrade scenario; in the table, the "*" symbol depicts statistical significance. Figure 13 provides a graphical depiction of the estimates in Table 29 and using red text and the "*" again to depict statistical significance. The results of each protective response variable can be described as follows:

Action Taken

- At the "Watch level," all of the prototypes are less protective than the current system. This was especially true for Prototype 3 and 4 as those who saw these prototypes were significantly less likely to take a more protective action in comparison to those who saw the current system.
- At the "Advisory level" and "Warning level," Prototype 4 consistently performed better than the current system. Also, Prototype 1 performed better than the current system – but only at the "Warning level."

Likelihood of Monitoring

- At the "Watch level," the current system outperformed all of the prototypes in terms of monitoring. Specifically, those who saw Prototypes 1 and 3 were significantly less likely to monitor.
- At the "Advisory level," those who saw Prototypes 1 and 2 were significantly less likely to monitor. However, those who saw Prototype 4 performed better than the current system and other prototypes – although not significantly.

Likelihood of Preparing

- At the "Watch level," the current system outperformed all of the prototypes in terms of preparation. Specifically, those who saw Prototypes 1, 2, and 4 were significantly less likely to prepare – in comparison to those who saw the current system.
- At the "Advisory level," the current system outperformed Prototypes 1, 2, and 3. Specifically, those who saw Prototype 1 were significantly less likely to prepare – in comparison to those who saw the current system. Those who saw Prototype 4 performed better than the current system and other prototypes – although not significantly.
- At the "Warning level," those who saw Prototype 4 were significantly more likely to prepare.

Likelihood of Acting

- Again, at the "Watch level," the current system outperformed all of the prototypes in terms of eliciting action. However, those who saw Prototype 4 were significantly more likely to act at the "Advisory level" and "Warning level."

Table 29. Estimated Odds Ratios for Warning Downgrade Scenario: High Winds

	(1) Action Taken	(2) Likelihood of Monitoring	(3) Likelihood of Preparing	(4) Likelihood of Acting
Prompt 2: *Watch*				
Prototype 1	0.764 (-1.42)	0.716* (-1.65)	0.579*** (-2.87)	0.830 (-1.00)
Prototype 2	0.829 (-0.98)	0.782 (-1.21)	0.677** (-2.04)	0.954 (-0.25)
Prototype 3	0.708* (-1.79)	0.673* (-1.95)	0.734 (-1.63)	0.835 (-0.96)
Prototype 4	0.711* (-1.79)	0.789 (-1.16)	0.610*** (-2.62)	0.756 (-1.49)
Prompt 3: *Warning*				
Prototype 1	1.035 (0.19)	0.674* (-1.96)	0.623** (-2.56)	0.793 (-1.25)
Prototype 2	0.893 (-0.62)	0.703* (-0.84)	0.853 (-0.84)	0.984 (-0.09)
Prototype 3	1.237 (1.17)	0.963 (-0.20)	0.963 (-0.20)	1.132 (0.65)
Prototype 4	1.812*** (3.20)	1.235 (1.11)	1.235 (1.11)	1.453* (-0.29)
Prompt 4: *Advisory*				
Prototype 1	1.654*** (2.71)	1.274 (1.31)	1.288 (1.41)	1.409* (1.90)
Prototype 2	1.247 (1.20)	1.085 (0.43)	1.212 (1.07)	1.280 (1.37)
Prototype 3	1.080 (0.42)	1.175 (0.87)	1.007 (0.04)	0.973 (-0.15)
Prototype 4	1.505** (2.20)	1.671*** (2.72)	1.459** (1.53)	1.525** (2.33)

Exponentiated coefficients; *z* statistics in parentheses
* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

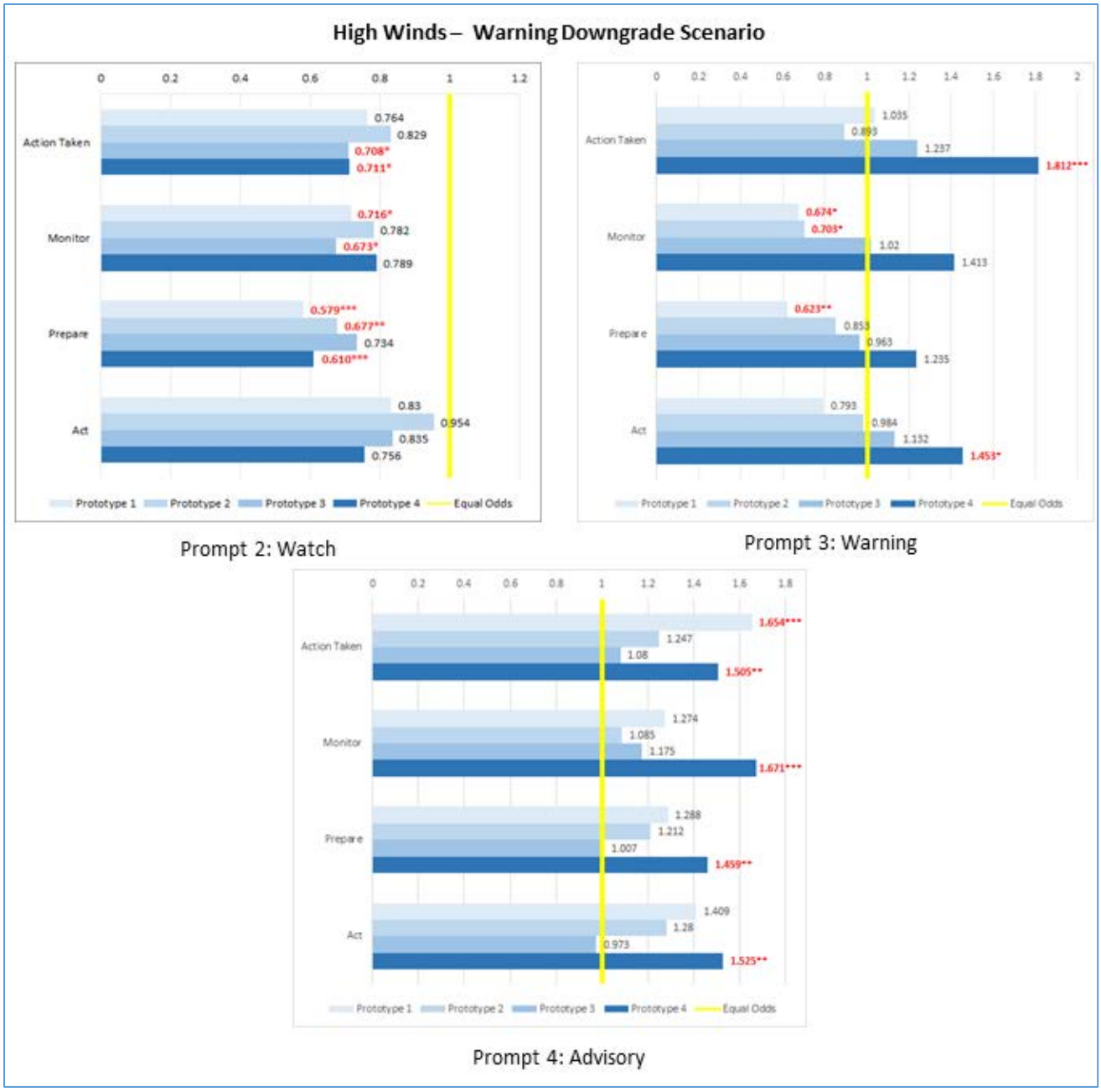

Figure 13. Graphical Depiction of Estimated Odds Ratios for Warning Downgrade Scenario: High Winds Survey

7.4.2 *Advisory with an Upgrade Scenario*

After a baseline prompt, the warning with a downgrade scenario started with a watch-level prompt, and then progressed to an advisory-level prompt followed by an upgrade to a warning. Table 30 presents the estimated odds ratios for the warning downgrade scenario; in the table, the "*" symbol depicts statistical significance. Figure 14 provides a graphical depiction of the estimates in Table 30 and using red text and the "*" again to depict statistical significance. The results of each protective response variable can be described as follows:

Action Taken

- At the "Advisory level," Prototypes 1, 2, and 4 performed better than the current system. Specifically, those who saw Prototypes 1, 2, and 4 were significantly more likely to take a more protective action in comparison to those who saw the current system.
- Prototype 4 consistently performed better than the current system at all levels.

Likelihood of Monitoring

- At the "Watch level," the current system outperformed all of the prototypes in terms of monitoring. Specifically, those who saw Prototypes 3 and 4 were significantly less likely to monitor.
- At the "Advisory level," those who saw Prototypes 1, 2, and 4 performed better than the current system. However, only those who saw Prototype 1 were significantly more likely to monitor.

Likelihood of Preparing

- At the "Watch level," the current system outperformed all of the prototypes in terms of preparation. Specifically, those who saw Prototypes 3 and 4 were significantly less likely to prepare – in comparison to those who saw the current system.
- At the "Advisory level," Prototypes 1, 2 , and 4 outperformed the current system. Specifically, those who saw Prototype 1 and 4 were significantly more likely to prepare – in comparison to those who saw the current system.

Likelihood of Acting

- Again, at the "Watch level," the current system outperformed all of the prototypes in terms of eliciting action. Specifically, those who saw Prototype 3 and 4 were significantly less likely to act than those who saw the current system. **Could this be a positive result? Do we want people taking protective action at a "Watch level" headline?**
- At the "Advisory level," those who saw Prototypes 1 and 2 were significantly more likely to act in comparison to those who saw the current system. However, the odds ratios produced by Prototype 4 were *extremely close to significance*.
- At the "Warning level," those who saw Prototype 4 were significantly more likely to act in comparison to the those who saw the current system.

Table 30. Estimated Odds Ratios for Advisory Upgrade Scenario: High Winds

	(1) Action Taken	(2) Likelihood of Monitoring	(3) Likelihood of Preparing	(4) Likelihood of Acting
Prompt 2: *Watch*				
Prototype 1	1.009	0.770	0.828	0.801
	(0.05)	(-1.28)	(-0.99)	(-1.16)
Prototype 2	1.217	0.781	0.951	0.966
	(1.06)	(-1.22)	(-0.26)	(-0.18)
Prototype 3	1.092	0.650**	0.538***	0.708*
	(0.47)	(-1.95)	(-3.21)	(-1.80)
Prototype 4	1.190	0.696*	0.674**	0.681**
	(0.94)	(-1.16)	(-2.07)	(-2.03)
Prompt 3: *Advisory*				
Prototype 1	1.566**	1.499**	1.520**	1.602**
	(2.41)	(-1.96)	(2.28)	(2.53)
Prototype 2	1.701***	1.194	1.272	1.400
	(2.86)	(0.94)	(1.33)	(1.83)
Prototype 3	0.831	0.845	0.773	0.833
	(-1.01)	(-0.90)	(-1.43)	(-0.99)
Prototype 4	1.386*	1.227	1.352*	1.350
	(1.76)	(1.09)	(1.66)	(1.64)
Prompt 4: *Warning*				
Prototype 1	1.122	0.712*	1.011	0.897
	(0.63)	(-1.68)	(0.06)	(-0.60)
Prototype 2	1.058	0.806	0.845	0.904
	(0.31)	(-1.06)	(-0.92)	(-0.55)
Prototype 3	1.348	0.974	1.008	1.106
	(1.63)	(-0.13)	(0.04)	(0.55)
Prototype 4	1.325	1.198	1.198	1.372**
	(1.54)	(0.96)	(0.96)	(1.67)

Exponentiated coefficients; *z* statistics in parentheses
* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

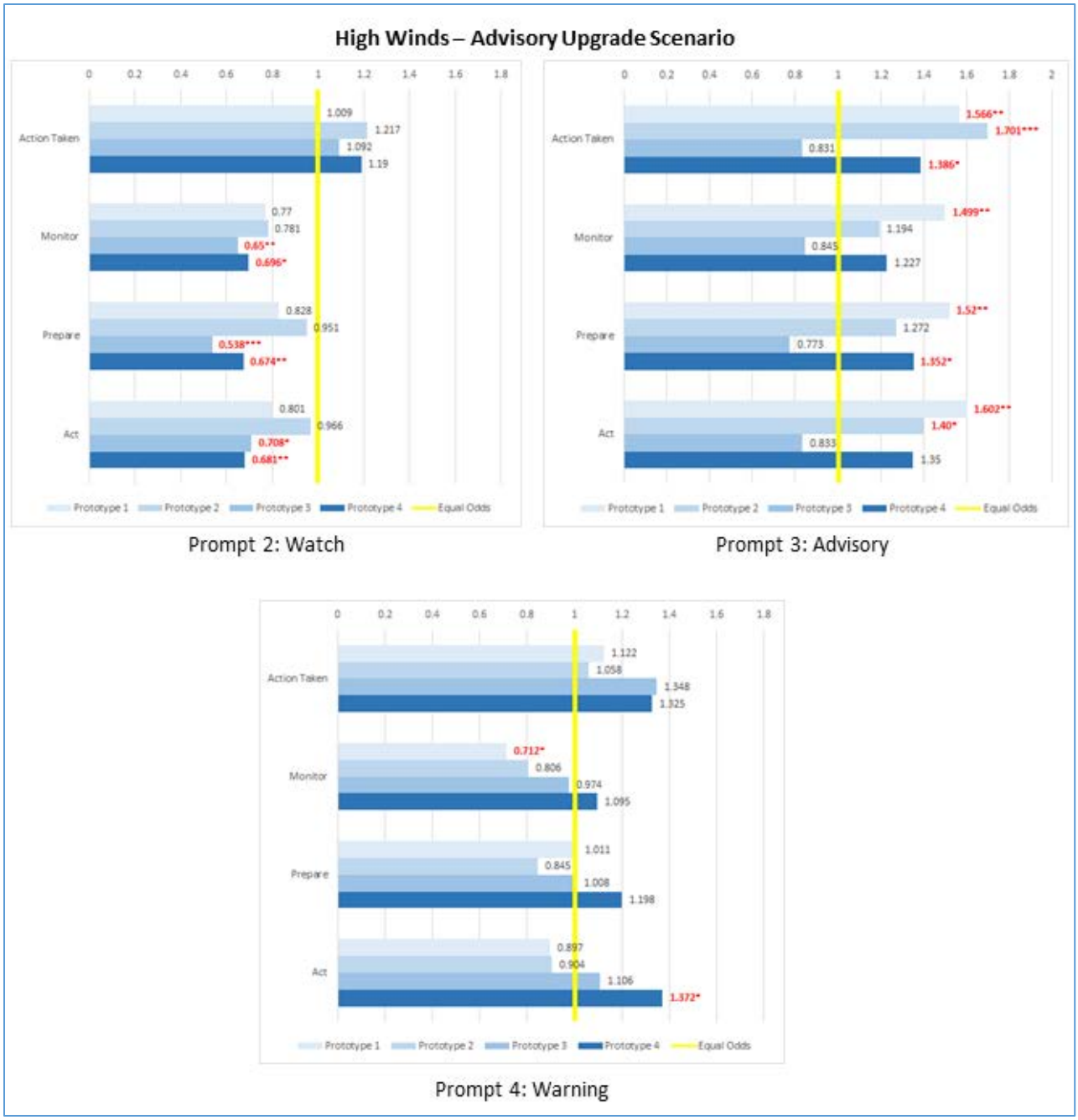

Figure 14. Graphical Depiction of Estimated Odds Ratios for Advisory Upgrade Scenario: High Winds Survey

7.5 Summary and Conclusions

To offer a summary of the high wind survey results, Table 31 presents the percentages of estimates for each prototype that were significantly greater or significantly less than 1.0. Based on Table 31, Prototype 4 had the greater percentage of estimates larger than 1.0. However, Prototypes 1, 3, and 4 had an equal percentage of estimates less than 1.0. However, we need to further examine the specifics of these estimates less than 1.0.

Table 31. Percentages of All Estimates Significantly Greater and Less than 1.0, by Prototype: High Wind Survey

Prototype	All Estimates	
	> 1.0	< 1.0
Prototype 1	21%	21%
Prototype 2	8%	8%
Prototype 3	0%	21%
Prototype 4	38%	21%
Total Number of Estimates [a]	24	

[a] This is the total for each Prototype

Table 32 expands the summary in Table 31 by breaking the percentages down by prompt level (i.e., Watch, Advisory, Warning). In Table 32, we see that Prototype 1 and 4's estimates that were significantly less than 1.0 occurred at the "Watch level." In fact, all of Prototype 4's estimates that were significantly less than 1.0 occurred at the "Watch level." The greatest point of improvement over the current system occurred at the "Advisory level," where Prototype's 1, 2, and 4 all achieved estimates that were significantly greater than 1.0. At the "Warning level," Prototype 4 is the only prototype to achieve an estimate significantly greater than 1.0 – Prototype 1 and 2 both had estimates that were significantly less than 1.0.

Table 32. Percentages of All Estimates Significantly Greater and Less than 1.0, by Prototype and Prompt Level: High Wind Survey

Prototype	Watch		Advisory		Warning	
	> 1.0	< 1.0	> 1.0	< 1.0	> 1.0	< 1.0
Prototype 1	0%	13%	63%	0%	0%	38%
Prototype 2	0%	13%	25%	0%	0%	13%
Prototype 3	0%	50%	0%	0%	0%	0%
Prototype 4	0%	63%	63%	0%	25%	0%
Total Number of Estimates [a]	8		8		8	

[a] This is the total for each Prototype

Table 33 expands the summary in Tables 31 and 32 by breaking the percentages down by protective response variable (i.e., Action taken, Likelihood to Monitor, Likelihood to Prepare, and Likelihood to Act). These data reveal that all of the estimates that were significantly greater than 1.0 were concentrated on increasing action taken and likelihood of taking protective action. On the other hand, the estimates that were significantly less than 1.0 were concentrated on decreasing the likelihood of monitoring and preparing.

Table 33. Percentages of All Estimates Significantly Greater and Less than 1.0, by Prototype and Protective Response Variable: High Wind Survey

Prototype	Action Taken		Likelihood of Monitoring		Likelihood of Preparing		Likelihood of Acting	
	> 1.0	< 1.0	> 1.0	< 1.0	> 1.0	< 1.0	> 1.0	< 1.0
Prototype 1	33%	0%	17%	50%	17%	33%	17%	0%
Prototype 2	17%	0%	0%	17%	0%	17%	17%	0%
Prototype 3	0%	17%	0%	33%	0%	17%	0%	17%
Prototype 4	50%	17%	17%	17%	33%	33%	50%	17%
Total Number of Estimates [a]	6		6		6		6	

[a] This is the total for each Prototype

Table 34, 35, and 36 further breakdown the percentages by looking at both protective response variable (i.e., Action taken, Likelihood to Monitor, Likelihood to Prepare, and Likelihood to Act) and prompt level (i.e., Watch level, Advisory level, Warning level). These tables offer additional information to better determine if individuals are taking the *most appropriate actions* at each prompt level. At the "Watch level," all of the estimates were significantly less than 1.0. At the "Advisory level," Prototypes 1 and 4 consistently perform better than the current system across all protective response variables. At the "Warning level," Prototype 4 promotes action.

Table 34. Percentages of All Estimates Significantly Greater and Less than 1.0 at the Watch level, by Prototype and Protective Response Variable: High Wind Survey

WATCH LEVEL								
Prototype	Action Taken		Likelihood of Monitoring		Likelihood of Preparing		Likelihood of Acting	
	> 1.0	< 1.0	> 1.0	< 1.0	> 1.0	< 1.0	> 1.0	< 1.0
Prototype 1	0%	0%	0%	50%	0%	50%	0%	0%
Prototype 2	0%	0%	0%	0%	0%	50%	0%	0%
Prototype 3	0%	50%	0%	100%	0%	100%	0%	50%
Prototype 4	0%	50%	0%	50%	0%	50%	0%	50%
Total Number of Estimates [a]	2		2		2		2	

[a] This is the total for each Prototype

Table 35. Percentages of All Estimates Significantly Greater and Less than 1.0 at the Advisory level, by Prototype and Protective Response Variable: High Wind Survey

ADVISORY LEVEL								
Prototype	**Action Taken**		**Likelihood of Monitoring**		**Likelihood of Preparing**		**Likelihood of Acting**	
	> 1.0	**< 1.0**	**> 1.0**	**< 1.0**	**> 1.0**	**< 1.0**	**> 1.0**	**< 1.0**
Prototype 1	100%	0%	50%	0%	50%	0%	50%	0%
Prototype 2	50%	0%	0%	0%	0%	0%	50%	0%
Prototype 3	0%	0%	0%	0%	0%	0%	0%	0%
Prototype 4	100%	0%	50%	0%	100%	0%	50%	0%
Total Number of Estimates [a]	2		2		2		2	

[a] This is the total for each Prototype

Table 36. Percentages of All Estimates Significantly Greater and Less than 1.0 at the Warning level, by Prototype and Protective Response Variable: High Wind Survey

WARNING LEVEL								
Prototype	**Action Taken**		**Likelihood of Monitoring**		**Likelihood of Preparing**		**Likelihood of Acting**	
	> 1.0	**< 1.0**	**> 1.0**	**< 1.0**	**> 1.0**	**< 1.0**	**> 1.0**	**< 1.0**
Prototype 1	0%	0%	0%	100%	0%	50%	0%	0%
Prototype 2	0%	0%	0%	50%	0%	0%	0%	0%
Prototype 3	0%	0%	0%	0%	0%	0%	0%	0%
Prototype 4	50%	0%	0%	0%	0%	0%	100%	0%
Total Number of Estimates [a]	2		2		2		2	

[a] This is the total for each Prototype

Based on this summary and the results presented in the two scenarios, some overall conclusions about the high wind hazard can be drawn.

- **The Current System "Watch level" headline (i.e., High Wind Watch) outperforms all of the Prototypes**. Specifically, the odds ratio values were generally below or close to equaling one in the "Watch, Advisory, and Warning levels" across all prototypes.
- **Prototype 1 performed consistently at the "Advisory level," but does not work well at the "Warning level."** Prototype 1 had several estimates significantly greater than 1.0 associated with the "Advisory level;" however, those estimates significantly greater than 1.0 did not translate into the "Warning level." Perhaps, the use of the "Warning" headline creates action

during the “Advisory” phase – but does not encourage further action when the headline is repeated at the “Warning level.”

- **Prototype 3 consistently underperformed in comparison to the current system and other prototypes.** Specifically, Prototype 3 only achieved estimates that were significantly less than 1.0 for all of the response variables.
- **Prototype 4 consistently performs better than the other prototypes for high wind hazards, except at the “Watch level.”** Outside of the “Watch level,” all of the odds ratios associated with Prototype 4 are above 1.0. Further, there are 9 significant estimates that were greater than 1.0.
- **Current Knowledge Conclusion:** Overall, the respondents appear to be misunderstanding the “Wind Advisory” in both the Warning with a Downgrade and Advisory with an Upgrade conditions. Instead of an increase in forecast certainty, respondents perceived less risk, confidence, urgency, and probability when an “Advisory” headline was seen. In fact, their response to these variables was lower than their response to the “Watch” headline.

8.0 Education and Outreach Potential

As discussed in Section 2.2, participants were randomly assigned to either receive additional information about the prototype or not. This variable was manipulated for two reasons: (1) to evaluate the intuitiveness of the system (i.e., those individuals who did not receive additional information) and (2) to determine the value of educational outreach. Further, this provided a more realistic sample of individuals when evaluating the current system – as some individuals understand the difference between the watch, warning, advisory terminology and others do not. However, this single manipulation cannot be used extensively to argue for *or* against the value of education and outreach, but it does provide additional information to the NWS.

Figure 15 provides an example of the additional information given to participants *before* being asked about the prototype scenarios. This information was different for each prototype and for each hazard being surveyed. **Remember:** Half of the total sample saw additional information prior to seeing the prototype scenarios.

The National Weather Service is considering a change to a warning system that involves three high wind messages: **WIND NOTICE, WIND ALERT, and WIND WARNING.** Below you will find more information and a table that describes each message in more detail.

When conditions are favorable for the occurrence of high winds, a **WIND NOTICE** may be issued for your area. As forecasters become more certain, they will issue a **WIND ALERT** for sustained wind speeds ranging from 30 to 39 miles per hour – lasting for one hour or longer. This product may then be changed to a **WIND WARNING** if sustained wind speeds are forecast to be greater than 40 miles per hour for one hour or longer, or for winds gusting to 58 miles per hour for any duration.

Message:	Message Details:
Wind Notice	The ***potential*** for sustained wind speeds greater than 40 miles per hour for one hour or longer, or winds gusting to 58 miles per hour for any duration in the next 12 to 48 hours.
Wind Alert	Sustained wind speeds are forecast to range from 30 to 39 miles per hour for one hour or longer.
Wind Warning	Sustained wind speeds are forecast to be greater than 40 miles per hour for one hour or longer, or for winds gusting to 58 miles per hour for any duration.

Please take a look at the table above, as the next several questions will prompt you to make decisions using this weather warning system. When you are finished looking over the table, please continue to the next page. ***Note:*** You will not be able to return to this page.

Figure 15. Additional Information Given to Half of Participants

Similar to the odds ratios used to describe the differences between the prototypes in the previous sections, the odds ratios can tell us whether those who saw additional information (Figure 15) before the prototype were more or less likely to be in a higher response category. Table 37 presents the

estimated odds ratios for showing additional information before seeing the prototype in the excessive heat surveys, and Table 38 offers the estimated odds ratios for the high wind survey. In the table, the "*" symbol depicts statistical significance. The results can be described as follows:

Excessive Heat:

- **Providing additional information may help respondents make better decisions at early-stages of a long-term weather event.** When individuals saw additional information *before* seeing a prototype, they were less likely to be in a higher response category during the early-stages of a hypothetical excessive heat scenario (Prompt 2 and Prompt 3). In other words, providing additional information may help respondents understand that hazardous weather will not be occurring for a few days. As a result, respondents were more likely to take more appropriate actions (i.e., Monitor or Prepare) during the early-stages of an excessive heat event. This pattern was most obvious among the Warm Regions survey; however, there was some indication in the Cold Region survey as well.

- **Providing additional information may not be as important for excessive heat events.** While there are some significant odds ratios (like those discussed in the previous section), a majority of the odds ratios are not significant. This in itself is somewhat of a result. Perhaps providing information is not as important for excessive heat events.

Table 37. Estimated Odds Ratios for Additional Information in the Excessive Heat Warm and Cold Region Surveys

	(1) Action Taken	(2) Likelihood of Monitoring	(3) Likelihood of Preparing	(4) Likelihood of Acting
Prompt 2: *Advisory*				
Warm Regions	0.731*	0.531**	0.655**	0.776
	(-1.76)	(-2.98)	(-2.10)	(-1.34)
Cold Regions	0.902	1.014	0.963	1.163
	(-0.59)	(0.07)	(-0.20)	(0.83)
Prompt 3: *Advisory Cont.*				
Warm Regions	1.175	0.893	0.950	0.985
	(0.96)	(-0.56)	(-0.27)	(-0.08)
Cold Regions	1.134	0.721*	1.028	1.104
	(0.77)	(-1.77)	(0.15)	(0.56)
Prompt 4: *Warning*				
Warm Regions	1.106	0.915	0.975	1.030
	(0.58)	(-0.42)	(-0.13)	(0.16)
Cold Regions	1.145	0.907	1.198	1.114
	(0.81)	(-0.51)	(1.00)	(0.60)

Exponentiated coefficients; *z* statistics in parentheses
* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

High Winds:

- **Providing additional information may help respondents make better decisions at the "Advisory" and "Warning" levels.** Unlike excessive heat, most of the odds ratios associated with the additional information variable for the high wind surveys are significant – especially at the

"Advisory" and "Warning" levels. What does this mean? Perhaps this hazard is not as well known as the other hazards. Therefore, providing additional information about the meteorological criteria (i.e., wind speeds) may, in fact, educate respondents and in turn encourage them to take further action. As a result, providing this additional information ahead of the prototype manipulation may be creating somewhat of an anchoring effect.

Table 38. Estimated Odds Ratios for Additional Information in the High Wind Survey

	(1) Action Taken	(2) Likelihood of Monitoring	(3) Likelihood of Preparing	(4) Likelihood of Acting
Prompt 2:				
AU: *Watch*	1.176	1.032	1.364***	1.214
	(1.38)	(0.25)	(2.59)	(1.62)
WD: *Watch*	1.371**	1.139	1.205	1.022
	(2.57)	(1.00)	(1.54)	(0.18)
Prompt 3:				
AU: *Advisory*	1.281**	1.256*	1.285**	1.231*
	(2.14)	(1.93)	(2.19)	(1.80)
WD: *Warning*	1.688***	1.248*	1.707***	1.379***
	(4.42)	(1.68)	(4.42)	(2.63)
Prompt 4:				
AU: *Warning*	1.285**	1.284*	1.511**	1.477***
	(2.19)	(1.93)	(3.50)	(3.32)
WD: *Advisory*	1.141	1.140	1.380***	1.330**
	(1.11)	(1.09)	(2.79)	(2.46)

Exponentiated coefficients; *z* statistics in parentheses
* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$
[a] AU = Advisory with an Upgrade condition; WD = Warning with a Downgrade condition.

Summary:

- **The importance of education and outreach may vary between hazards.** As we have seen from this modest analysis, the importance of providing additional information and/or education may vary across hazards. Can we dichotomize these differences based on short-term vs. long-term hazards? Perhaps the importance of education and outreach varies based on how well-known a hazard may be. Additional analyses are needed to provide definitive answers; however, this is a start.

- **Remember:** This was only a small-scale analysis, and further interest in the educational and outreach potential of various hazards would require additional inquiry.

9.0 Conclusions, Recommendations, and Next Steps

9.1 Conclusions

9.1.1 Overall Results for Current Knowledge

Conclusion #1: Respondents seem to be responding appropriately to the current excessive heat WWA headlines. This conclusion can be drawn based on the means associated with behavior (i.e., overall action, monitoring, prepare, and protective action) increasing linearly across the conditions. Further, a similar trend is observed among the perception variables (i.e., risk, confidence, urgency, and probability). This conclusion is observed in both the excessive heat cold and warm region surveys.

Conclusion #2: Respondents appear to misunderstand the "Wind Advisory" headline in the current system – for both the upgrade and downgrade scenarios. Instead of an increase in all of the perception variables, respondents perceived less risk, confidence, urgency, and probability when an "Advisory" headline was seen. In fact, their response to these variables was lower than their response to the "Watch" headline.

9.1.2 Overall Results by Prototype and Hazard

To offer a summary of the results from all surveys, Table 39 presents the percentages of estimates for each prototype that were significantly greater or significantly less than 1.0. Remember, estimates significantly greater than 1.0 indicate that the given prototype outperformed the current system and estimates significantly less than 1.0 indicate that the current system performed better.

Conclusion #3: Prototypes 1, 2, and 4 performed the best overall in comparison to the current system. However, Prototype 1 also had several estimates that were significantly less than 1.0 – this should be taken into consideration. It is important to keep in mind that these prototypes only outperformed the current system in roughly one out of five estimates (i.e., Prototype 1), one out of ten estimates (i.e., Prototype 2), and one out of every four estimates (i.e., Prototype 4). While these three prototypes outperformed the current system at times, it was not a staggering result.

Conclusion #4: Prototype 3 performed poorly in comparison to the current system. Prototype 3 only received two estimates that were significantly greater than 1.0 and six estimates that were less than 1.0. Again, this lack of performance was not overwhelming – but noteworthy.

Table 39. Percentages of All Estimates Significantly Greater and Less than 1.0, by Prototype: Excessive Heat and High Winds Surveys

Prototype	Significantly Greater Than 1.0	Significantly Less Than 1.0
Prototype 1	17%	10%
Prototype 2	10%	4%
Prototype 3	4%	13%
Prototype 4	25%	10%
Total Number of Estimates [a]	48	

[a] This is the total for each Prototype

Conclusion #5: Prototype performance varied by hazard; however, overall they agreed with the conclusions presented above. Tables 40 and 41 provide a breakdown of the percentages of all estimates significantly greater and less than 1.0 for the excessive heat and high wind hazards. The excessive heat surveys from warm and cold regions did not completely agree. Prototypes 1, 2, and 4 outperformed the current system in the Warm Regions, whereas Prototypes 2 and 4 outperformed the current system in the Cold Regions. Again, this outperformance was not an overwhelming result. For the high wind hazard, Prototype 4 outperformed the current system and the other prototypes. While it also possessed estimates that were significantly less than 1.0, these values were isolated to the "Watch level." More on this later.

Table 40. Percentages of All Estimates Significantly Greater and Less than 1.0, by Prototype: Excessive Heat, Warm and Cold Regions

Prototypes	Excessive Heat, Warm		Excessive Heat, Cold	
	Significantly Greater Than 1.0	Significantly Less Than 1.0	Significantly Greater Than 1.0	Significantly Less Than 1.0
Prototype 1	16%	0%	0%	0%
Prototype 2	16%	0%	8%	0%
Prototype 3	8%	0%	8%	8%
Prototype 4	16%	0%	8%	0%
Total Number of Estimates [a]	12	12	12	12

Table 41. Percentages of All Estimates Significantly Greater and Less than 1.0, by Prototype: High Winds

Prototypes	High Winds	
	Significantly Greater Than 1.0	Significantly Less Than 1.0
Prototype 1	21%	21%
Prototype 2	8%	8%
Prototype 3	0%	21%
Prototype 4	38%	21%
Total Number of Estimates [a]	24	24

9.1.3 Overall Results by Prompt Level

Table 42 provides a breakdown by prompt level of the estimated odds ratios that were significantly greater than 1.0 and less than 1.0. Due to the excessive heat hazard not testing the "Watch" headline, these tables were not combined.

Conclusion #6: The prototypes perform differently within each prompt level. Although Prototypes 1, 2, and 4 performed best overall, this result varies by prompt level. For example, Prototype 1 and 4 perform best at the "Advisory level" for High Winds, but Prototypes 2 and 4 perform best when issuing an "Advisory" headline within Excessive Heat. This breakdown by prompt level (i.e., Table 42) may prove beneficial if the NWS desires to create a "Frankenstein" operational prototype given the results of the generalizable survey.

Conclusion #7: The Current System "Watch" headline (i.e., High Wind Watch) outperforms all of the high wind prototypes at the "Watch level." This is evident in Table 42 under the "High Wind Estimates" portion of the table, where a high percentage of odds ratio estimates were significantly less than 1.0.

Table 42. Percentages of All Estimates Significantly Greater and Less than 1.0, by Prototype and Prompt Level: Excessive Heat and High Wind Surveys

Prototype	High Wind Estimates						Excessive Heat Estimates [b]					
	Watch		Advisory		Warning		Watch		Advisory		Warning	
	> 1.0	< 1.0	> 1.0	< 1.0	> 1.0	< 1.0	> 1.0	< 1.0	> 1.0	< 1.0	> 1.0	< 1.0
Prototype 1	0%	13%	63%	0%	0%	38%	13%	0%	0%	0%	13%	0%
Prototype 2	0%	13%	25%	0%	0%	13%	25%	0%	0%	0%	13%	0%
Prototype 3	0%	50%	0%	0%	0%	0%	13%	13%	13%	0%	0%	0%
Prototype 4	0%	63%	63%	0%	25%	0%	25%	0%	0%	0%	13%	0%
Total Number of Estimates [a]	8		8		8		8		8		8	

[a] This is the total for each Prototype

[b] The hazards were separated because the Excessive Heat Prototypes did not test "Watch" headlines.

9.1.4 Overall Results by Protective Response Variable

Table 43 provides a breakdown by response variable of the estimated odds ratios that were significantly greater than 1.0 and less than 1.0.

Conclusion #8: Prototypes 1 and 4 were both more effective at eliciting action in comparison to the current system. For both the "Action Taken" and "Likelihood of Acting" response variables, Prototypes 1 and 4 performed the best.

Conclusion #9: Prototypes 2 and 4 were both better at increasing the monitoring of weather forecast information in comparison to the current system. For the "Likelihood of Monitoring" response variable, Prototypes 2 and 4 had a greater percentage of estimates that were significantly larger than 1.0. However, both of these prototypes did have a couple of estimates that were significantly less than 1.0.

Conclusion #10: Prototype 4 was more effective at increasing preparation in comparison to the current system. For the "Likelihood of Preparing" response variable, Prototype 4 had the greatest percentage of estimates that were significantly larger than 1.0. However, this prototype also had a fairly large percentage of estimates than were significantly less than 1.0. Upon further investigation, almost all of the estimates that were significantly lower than 1.0 occurred under the "Watch" headline, where all prototypes failed to outperform the current system.

Table 43. Percentages of All Estimates Significantly Greater and Less than 1.0, by Prototype and Protective Response Variable: Excessive Heat and High Wind Surveys

	Action Taken		Likelihood of Monitoring		Likelihood of Preparing		Likelihood of Acting	
	> 1.0	< 1.0	> 1.0	< 1.0	> 1.0	< 1.0	> 1.0	< 1.0
Prototype 1	17%	0%	25%	25%	8%	17%	8%	0%
Prototype 2	8%	0%	17%	8%	8%	8%	8%	0%
Prototype 3	0%	25%	8%	17%	8%	8%	0%	8%
Prototype 4	25%	8%	25%	8%	25%	17%	17%	8%
Total Number of Estimates [a]	12		12		12		12	

[a] This is the total for each Prototype

9.1.5 *Overall Results by Protective Response Variable and Prompt Level*

Tables 44, 45, and 46 further breakdown the percentages by looking at both protective response variable (i.e., Action taken, Likelihood to Monitor, Likelihood to Prepare, and Likelihood to Act) and prompt level (i.e., Watch level, Advisory level, Warning level). These tables offer additional information to better determine if individuals are taking the *most appropriate actions* at each prompt level. These tables only reflect the high wind surveys, due to the prompt level differences that exist within the excessive heat surveys.

Conclusion #11: Prototype 4 performs well at both the "Advisory level" and "Warning level." In comparison to the other prototypes, Prototype 4 consistently performs well at both the "Advisory" and "Warning" level. Specifically, at the "Advisory level", Prototype 4 performs well across all of the protective response variables. At the "Warning level," Prototype 4 is effective at eliciting action.

Table 44. Percentages of All Estimates Significantly Greater and Less than 1.0 at the Watch level, by Prototype and Protective Response Variable: High Wind Survey

WATCH LEVEL								
Prototype	Action Taken		Likelihood of Monitoring		Likelihood of Preparing		Likelihood of Acting	
	> 1.0	< 1.0	> 1.0	< 1.0	> 1.0	< 1.0	> 1.0	< 1.0
Prototype 1	0%	0%	0%	50%	0%	50%	0%	0%
Prototype 2	0%	0%	0%	0%	0%	50%	0%	0%
Prototype 3	0%	50%	0%	100%	0%	100%	0%	50%
Prototype 4	0%	50%	0%	50%	0%	50%	0%	50%
Total Number of Estimates [a]	2		2		2		2	

[a] This is the total for each Prototype

[b] Due to the differences in the excessive heat prototypes, only the breakdown for high winds is shown.

Table 45. Percentages of All Estimates Significantly Greater and Less than 1.0 at the Advisory level, by Prototype and Protective Response Variable: High Wind Survey

ADVISORY LEVEL								
Prototype	**Action Taken**		**Likelihood of Monitoring**		**Likelihood of Preparing**		**Likelihood of Acting**	
	> 1.0	**< 1.0**	**> 1.0**	**< 1.0**	**> 1.0**	**< 1.0**	**> 1.0**	**< 1.0**
Prototype 1	100%	0%	50%	0%	50%	0%	50%	0%
Prototype 2	50%	0%	0%	0%	0%	0%	50%	0%
Prototype 3	0%	0%	0%	0%	0%	0%	0%	0%
Prototype 4	100%	0%	50%	0%	100%	0%	50%	0%
Total Number of Estimates [a]	2		2		2		2	

[a] This is the total for each Prototype

[b] Due to the differences in the excessive heat prototypes, only the breakdown for high winds is shown.

Table 46. Percentages of All Estimates Significantly Greater and Less than 1.0 at the Warning level, by Prototype and Protective Response Variable: High Wind Survey

WARNING LEVEL								
Prototype	**Action Taken**		**Likelihood of Monitoring**		**Likelihood of Preparing**		**Likelihood of Acting**	
	> 1.0	**< 1.0**	**> 1.0**	**< 1.0**	**> 1.0**	**< 1.0**	**> 1.0**	**< 1.0**
Prototype 1	0%	0%	0%	100%	0%	50%	0%	0%
Prototype 2	0%	0%	0%	50%	0%	0%	0%	0%
Prototype 3	0%	0%	0%	0%	0%	0%	0%	0%
Prototype 4	50%	0%	0%	0%	0%	0%	100%	0%
Total Number of Estimates [a]	2		2		2		2	

[a] This is the total for each Prototype

[b] Due to the differences in the excessive heat prototypes, only the breakdown for high winds is shown.

9.2 Recommendations

After examining the results and conclusions *from the companion report authored by ERG and considering the conclusions described above*, the following recommendations are offered:

- ***Fixing the "problem" words (i.e., Watch and Advisory) can be a possible solution.***

  When examining the overall results by prompt level, Prototype 2 appears to be more effective at the "Watch" level and the "Advisory" level – in comparison to the current system. The goal of

Prototype 2 was to evaluate a similar system to the current one; however, it allowed us to test alternative headlines for "Watch" and "Advisory." Considering that previous Hazard Simplification projects have noted that emergency managers and broadcast meteorologists were interested in only making minor changes, this could be an solution that considers those needs. **After further examination of the results across different prompt levels, it appears that the transition from "Alert" to "Warning" does not provoke much behavior change. Therefore, replacing "Advisory" with "Alert" may only lead to individuals performing "Warning" level behaviors at the "Advisory" level. As a result, this change may fail to improve the spectrum of understanding that exists surrounding our current weather warning system.** ***This should be strongly considered when thinking about this as a possible solution.***

- ***Develop a new message sequence that combines Prototypes 2 and 4.***

  As described in both reports, Prototypes 2 and 4 consistently performed better than the current system and other prototypes. However, when examining the overall results by prompt level, Prototype 2 appears to be more effective at the "Watch" level and the "Emergency" level and Prototype 4 consistently performs well at the "Advisory," and "Warning" levels. To maximize the results of these two prototypes, it is suggested that a new prototype combine the two. Table 47 provides one option for a possible "Operational Prototype" when combining Prototype 2 and 4. **The message sequence in the combined column would, based on the data analyses, generate the greatest preparation and protective action response. However, this is only one option for combining the two prototypes.** Additional conversations and further discussion with NWS will be conducted to determine the best approaches to consider.

Table 47. Combined Prototype 2 and 4 Based on Data Analysis Results

Prompt Level	Prototype 2	Prototype 4	Combined
Watch	X Notice	Possible X Conditions	X Notice
Advisory	X Alert	Level Orange X Warning	Level Orange X Warning
Warning	X Warning	Level Red X Warning	Level Red X Warning
Emergency	X Emergency	Level Purple X Warning	X Emergency

Additional Thoughts:

- **Headlines matter.** Prototype 1 was specifically designed to evaluate whether individuals anchor to weather information or the weather-related headlines. Because Prototype 1 performs poorly across most of the hazards, this survey effort reveals the importance of weather headlines when communicating with a general public audience.
- **Any changes to the prototypes should take into account all hazards.** As discussed in the results, the success of the prototypes varied by hazard. Therefore, strong consideration should be given

to each hazard when deciding on a final "Operational Prototype." Further, other hazards that were not considered during this survey process (i.e., Tropical hazards) should also be considered when deciding on a final "Operational Prototype." Ask questions such as: Does this prototype make sense for all hazards? Are we staying consistent across all program areas? Will the tropical hazards fit into this "Operational Prototype?"

- **The NWS should continue thinking about the meteorological attributes that will drive each headline change.** The survey discussed in this report mapped meteorological criteria that is currently used by NWS policy to issue *watches, warnings, and advisories.* Therefore, considerable effort should be given to the meteorological attributes that would drive each headline change in a new or modified weather warning system. For example, would it be focused around impacts, confidence, or even a matrix system combining both impacts and confidence? This should be strongly considered as the NWS moves forward with additional testing.

9.3 Next Steps and Lessons Learned

9.3.1 Next Steps

Given these recommendations, several next steps are proposed for consideration as the NWS continues to evaluate alternatives to the current WWA system:

Discuss the results of the generalizable survey with members of the weather community, partners, and stakeholders.

- **Hazard Simplification Workshop 2.0:** Consider conducting another workshop similar to the Hazard Simplification Workshop in 2015. Given the various options and recommendations for creating an "Operational Prototype," NWS participants, emergency managers, broadcast meteorologists, social scientists, and other relevant partners could assist in finalizing an appropriate "Operational Prototype" that could be evaluated via additional operational testing in the Hazardous Weather Testbed. However, it will be *very important* to develop a core set of goals ahead of the workshop to ensure that a "Operational Prototype" is obtained at the end of the workshop.

- **Hazard Simplification Webinar:** Since the Hazard Simplification Workshop 2.0 would only allow a select number of participants and would ultimately require travel, webinar(s) in conjunction with the workshop may be considered to obtain feedback from a larger community perspective. This activity could act as a mini "listening tour" to better understand the partner's/stakeholder's perspective on the finalized "Operational Prototype." For example, the NWS could team up with members of the NWA Societal Impacts Committee to co-host a NWA Webinar Wednesday by creating an interactive, online focus group with various members of the community. This could produce additional opportunities to obtain feedback from the weather enterprise, while collaborating with professional organizations in our community.

Utilize the Hazardous Weather Testbed (HWT) to evaluate the operational viability of a finalized "Operational Prototype."

- **Testing operational feasibility of "Operational Prototype" in the HWT:** Consider conducting another operational feasibility study in collaboration with the HWT to test the "Operational Prototype" with NWS forecasters, emergency managers, and broadcast meteorologists using past events and real-world examples. The proposed "Operational Prototype" may seem appropriate on paper, but caveats and shortcomings of the newly proposed system may only arise through further operational testing.

- **Incorporate members of the general public into the HWT process:** Although the results of the generalizable survey allow us to understand the warning language that best resonates with the public, that data only used hypothetical situations. Therefore, it is recommended that members of the general public be included in the HWT process. To my knowledge, this has never been done before. However, if it is important to evaluate the "Operational Prototype" among NWS forecasters, emergency managers, and broadcast meteorologists using past events, then this process should also be conducted with members of the public. This exercise may reveal additional details about the proposed "Operational Prototype" that did not arise when members of the public completed the generalizable survey.

- **Evaluate the feasibility of the "Operational Prototype" in relation to the other NOAA/NWS initiatives:** The use of further testing within the HWT could also provide an opportunity to evaluate the Hazard Simplification "Operational Prototype" with other NOAA/NWS initiatives (e.g., FACETS, PHI, Hazard Services). All of these different projects are progressing independently; however, collaborating with the HWT would allow for feasibility testing of the "Operational Prototype" with these other initiatives. This process was extremely insightful during the previous Hazard Simplification Testbed evaluation; therefore, it is recommended that further testing be conducted that combines all of these initiatives.

Offer remote and/or on-site internship or research opportunities for students to continue analyzing the Hazard Simplification survey data.

- The Hazard Simplification survey data collected by myself and ERG contains a plethora of variables and demographic information that was not able to be completely investigated. Therefore, NWS should invest in internship and/or research opportunities for students and early career professionals. For example, the NWS may consider advertising on the National Science Foundation (NSF) Graduate Research Internship Program (GRIP) website. This dataset would also be optimal for further investigation by a Masters or Ph.D. student. This could promote further collaborations between the NWS and the academic sectors of the weather enterprise.

Develop and implement an extensive public education campaign to inform the general public of any changes to the weather warning system.

- **Conduct focus groups, interviews, and/or surveys to evaluate the audience and test messages.** If changes are made to the weather warning system, then extensive educational

research will need to be conducted. This could involve focus groups, interviews, and/or surveys to better understand your audience and to test any messages developed. Prior to implementing any changes to the weather warning system, this research will need to be conducted and evaluated to better understand the best way to convey and communicate these changes to the general public. Only then, can a major marketing effort occur.

- **Revise K-12 curriculum to emphasize any new changes to the weather warning system.** Since individuals learn about our weather warning system in school, it will be incredibly important to update the K-12 curriculum in schools across the United States. Further, K-12 students can be used as a vehicle to discuss the changes to the weather warning system with their families. This could include sending information home with students, assignments to be completed with the entire family, as well as projects such as creating a family emergency plan.

Coordinate with all sectors of the weather enterprise and partners/stakeholders to assist with transition to new weather warning system.

- **Develop a task force or advisory group to assist with weather warning system transition:** If any changes are made to the weather warning system, the NWS may consider developing a taskforce, advisory group, or subcommittee to assist with the transition. This task force/advisory group should be charged with stimulating ideas and activities on matters that pertain to the interests and transition of the weather warning system across all sectors of the weather enterprise and partners/stakeholders. This task force/advisory group should also promote consistency across the entirety of the weather enterprise, to ensure we are all working together toward a common goal. The task force/advisory group should consist of members drawn from the academic, private, emergency manager, and government sectors of our enterprise. Specifically, the government sectors should include representatives from other governmental partners (e.g., Department of Transportation, National Parks Service, and other entities that convey weather-related warnings).

- **Collaborate with professional organizations (e.g., American Meteorological Society, National Weather Association, etc.) and develop subcommittees to assist with weather warning system transition:** If a task force or advisory group is not preferred, the NWS could consider collaborating with several relevant committees within different professional organizations. Some relevant boards/committees include: AMS Board on Enterprise Communication, AMS Committee on Effective Communication of Weather and Climate Information, NWA Societal Impacts Committee, etc. In addition to these professional organizations, NWS may consider reaching out to the Alliance for Integrative Approaches to Extreme Environmental Events – a newly formed entity that seeks to serve as an organizing mechanism among the various sectors and stakeholders in the hazards community.

9.3.2 Lessons Learned

Considering the extent of the survey implementation process and the undertaking of surveying the general public, the following section documents the successes and challenges associated with the

entirety of this process. It is our hope that this information can be used by the NWS when collecting survey data in the future.

- **External validation must be conducted when using a scenario- and prompt-based methodology:** While an effective approach for collecting data surrounding hypothetical weather situations, this methodological approach requires external validation to ensure that participants are effectively progressing through time with each new prompt. This was especially challenging when surveying long-term hazards, as participants initially struggled with making decisions days in advance of the severe weather event. If considering this methodology in the future, (1) allot additional time and funding for external validation and (2) consider conducting cognitive interviews to walk through the scenarios in a one-on-one setting. This was extremely beneficial in the present study and provided direct feedback for improving the prompts.

- **Strongly consider the number of prototypes tested/evaluated in future research endeavors:** Although evaluating five prototypes provided extensive data, it ultimately restricts the number of participants that can be purchased with the budget provided and required that individuals each view two prototypes. While the report authored by ERG considered the sequence that individuals saw the prototypes, future studies should consider only showing participants *one* prototype to prevent cross-contamination. As a result, future research endeavors should strongly consider narrowing the number of prototypes tested.

- **Evaluating current knowledge of "Watch, Warning, and Advisory" using knowledge questions *and* behavioral response:** Previous research has shown that measuring current WWA knowledge is often difficult and done inconsistently. To overcome this concern, this research project utilized both current knowledge questions *and* the behavioral response to each of the WWA headlines. While further improvement and refinement is needed to evaluate the best ways to obtain current knowledge among members of the public, this was an improvement over simply asking individuals to report factual information. Future studies should continue looking for additional ways to evaluate current knowledge. NWS should consider using the perception questions that were included in this report (i.e., perceived risk, perceived confidence, perceived urgency, and probability of occurrence). These perception variables evaluate different aspects of each headline to provide additional information on their knowledge and/or willingness to react to certain WWA headlines.

- **Establish a timeline that considers document review from all hazard areas:** To ensure that the language included in the survey was representative of each hazard and NWS policy, each hazard program area reviewed the prototypes and language associated with their hazard survey prior to deployment. This was a much needed, yet intricate and lengthy process. Therefore, future studies involving survey efforts *across* hazard program areas should consider this review process when establishing a timeline for project completion.

- **Encourage the use of collaborative editing tools when crafting the questionnaire, survey instrument language, and working across hazard areas:** The use of cloud-based, editing tools (i.e., Google Documents) proved beneficial when crafting scenario- and prompt-based language across hazard areas. However, this was not used extensively throughout this process. As a result, I would advocate for exclusively using these online editing tools when editing scenario-

and prompt-based language or survey question wording. This will offer documentation of all the changes made, and allow everyone to decide on a finalized version.

Appendix 1: Example Survey Instrument

Hazard Simplification Survey
High Wind Survey Instrument

Part I - Easy Demographics

State: Using the dropdown list, please select the state where your primary residence is located. [dropdown list of states]

How_long: Approximately how long have you lived in that state?

1- Less than 1 year
2- 1 to 3 years
3- 3 to 5 years
4- 5 to 10 years
5- More than 10 years

----------Page Break----------

adults: Including yourself, how many *adults age 18 and older* live at your primary residence? [Verbatim]

children: How many *children age 17 and younger* live at your primary residence? [Verbatim]

zipcode: What is your current zipcode? (E.g., 30602). [Verbatim]

home_type: What type of home is your primary residence?

1 - Apartment

2 - Single family home

3 - Duplex

4 - Mobile home

5 - Condo or townhouse

6 - Other (please specify) [Verbatim]

home_lot: Which of the following categories best describes the location of your primary residence?

1 - Urban location in a densely populated area

2 - Suburban location in a neighborhood that is near a densely populated area

3 - Rural location in a sparsely populated area

Hazard_proximity: If applicable, which of the following categories best describes the environment near your residence?

1 - River, stream, or small creek

2 - Lake or pond

3 - Ocean or coastal community

4 – Mountain

5 – Forest

6 - Not applicable

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Part II - General Risk and Weather Questions

Now, we have a few questions that will assess your risk perception, attitudes, and experiences surrounding high winds. Here, "high winds" refers to situations where strong wind speeds are the *primary threat,* even if weather conditions are otherwise good. Using this information, please answer the following questions to the best of your knowledge.

[W_RP_susceptibility]: Using a scale from 0 to 10, where 0 means *not likely at all* and 10 means *extremely likely*, how do you rate the overall harm from high winds to:

- You

- Your home/apartment

- Your local community

[W_RP_Severity]: Using a scale from 0 to 10, where 0 means *not serious at all* and 10 means *extremely serious*, how do you rate the overall threat from high winds to:

- You

- Your home/apartment

- Your local community

----------Page Break----------

[H_RP_Affect]: How would you describe your feelings when you hear about an impending…

Very negative feelings	Rather negative feelings	Neither negative nor positive feelings	Rather positive feelings	Very positive feelings

…day without wind?

… breezy day?

… high wind day?

Thinking about high winds, please click on a circle between the pair of words that best describes your feelings.

Stressed ..... Calm
Displeased .....Pleased
Sad .....Happy
Depressed ....Elated

----------Page Break----------

[W_exp_past]: Have you or your family members, neighbors, friends, or associates ever experienced property damage, personal injury, or loss of life from high winds? *Please select all that apply.*

1 - No

2 - Yes, for you personally

3 - Yes, for family

4 - Yes, for neighbors

5 - Yes, for close friends or associates

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[W_exp_fut]: If you were to live in your neighborhood for the rest of your life, what is the probability that you or one of your neighbors will experience property damage, personal injury, or loss of life from high winds? Please indicate the probability as a *percent*. [Verbatim]

----------Page Break----------

[W_Adaptive_behaviors]: Using a scale from 0 to 10, where 0 means *disagree* and 10 means *agree*, how do you rate your agreement or disagreement with the following statements:

0 1 2 3 4 5 6 7 8 9 10 N/A.

My car handles high winds very well.

Driving in high winds make me nervous.

I have Homeowner's Insurance or Renter's Insurance in case high winds, fallen trees, or large branches damage my home.

I prepare for the possibility of a power outage that may be caused by high winds, fallen trees, or large branches.

High winds influence me to change my schedule.

My job requires me to work outside.

I avoid being outside during high winds, even if weather conditions are otherwise good.

I regularly trim the trees and branches in my yard.

I regularly have my trees inspected for wounds, decay, or structural defects.

I live near a wooded area with large trees.

I take proper precautions when required to work outdoors in high winds.

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[W_Att_Info]: Using a scale from 0 to 10, where 0 means *disagree* and 10 means *agree*, please rate your agreement or disagreement with the following.

Understanding the risks posed by high winds is:

Strongly Disagree Strongly Agree

0 1 2 3 4 5 6 7 8 9 10

a.Wise

b.Useful

c.Valuable

d.Beneficial

----------Page Break----------

[W_GathCap]: Using a scale from 0 to 10, where 0 means *disagree* and 10 means *agree*, please rate your agreement or disagreement with the following statements.

Strongly Disagree Strongly Agree

0 1 2 3 4 5 6 7 8 9 10

a. I can't make sense of information about high winds.

b. When it comes to information about high winds, I don't know how to separate facts from fiction.

c. Most information about high winds is too technical for me to understand.

d. I can't understand information about high winds even if I make an effort.

[H_SubjNorms]: Using a scale from 0 to 10, where 0 means *disagree* and 10 means *agree*, please rate your agreement or disagreement with the following statements.

Strongly Disagree Strongly Agree

0 1 2 3 4 5 6 7 8 9 10

a. My friends expect me to know something about high winds.

b. Most people who are important to me think I should know something about high winds.

c. My family expects me to know something about high winds.

Part III – High Wind Messaging Treatments

The next two sections will prompt you to make decisions using a given set of forecast scenarios and excessive heat messages. It is important that you are realistic and honest about how you might respond to the different scenarios, as your responses may be considered when making decisions about how to issue weather warning messages in the future.

****Participants will be randomly selected to see 2 of the five proposed weather warning system prototypes. Further, they will each be randomly selected to receive either the Warning Downgrade (WarnDown) or Advisory Upgrade (AdvUp) change in forecast condition.**

****Participants will be randomly selected to see no additional information or will be provided additional information (see below).**

This section will prompt you to answer questions based on a given warning system. Please pay attention to the time period in each scenario, as each new scenario will ask you to answer similar questions at different time points.

Current Prototype:

The National Weather Service currently issues three types of messages: **WATCHES, WARNINGS, and ADVISORIES** depending on forecast certainty and threat to life and property. Below you will find more information and a table that describes the National Weather Service's current warning system for high winds in more detail.

When conditions are favorable for the occurrence of high winds, a **HIGH WIND WATCH** may be issued for your area. As forecasters become more certain, they will issue a **WIND ADVISORY** for sustained winds ranging from 30 to 39 miles per hour – lasting for one hour or longer. This product may then be changed to a **HIGH WIND WARNING** if sustained winds are forecast to be greater than 40 miles per hour for one hour or longer, or for winds gusting to 58 miles per hour for any duration.

Name of Warning	Details
High Wind Watch	The ***potential*** for sustained wind speeds greater than 40 miles per hour for one hour or longer, or winds gusting to 58 miles per hour for any duration in the next 12 to 48 hours.
Wind Advisory	Sustained wind speeds are forecast to range from 30 to 39 miles per hour for one hour or longer.
High Wind Warning	Sustained wind speeds are forecast to be greater than 40 miles per hour for one hour or longer, or for winds gusting to 58 miles per hour for any duration.

Please take a look at the table above, as the next several questions will prompt you to make decisions using this weather warning system. When you are finished looking over the table, please continue to the next page. ***Note:*** You will not be able to return to this page.

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- Wind Messaging Treatments_Curr_WarnDown:

- **W_Curr_WD_Base:** Forecast Scenario: Imagine you are home on a Tuesday in March. You learn that the National Weather Service is forecasting the potential for high winds on Wednesday with sustained winds greater than 40 miles per hour for one hour or longer, or winds gusting to 58 miles per hour for any duration.
  - *W_Curr_WD_Base_1* – Based on the forecast scenario, which of the following most accurately describes what you would do on Tuesday?
    - **Nothing:** I would continue my current activities.
    - **Monitor:** I would monitor weather information sources such as TV news, websites, NOAA weather radio, etc.
    - **Prepare:** I would start preparing by bringing in loose items, securing outdoor furniture, etc.
    - **Take some action:** I would cancel, move, or postpone outdoor activities; I would allow more time for driving.
    - **Take protective action***:* I would go indoors and stay away from windows, even if weather conditions are otherwise good; I would limit driving with high profile vehicles.
  - *W_Curr_WD_Base_2* – Using a scale from 1 to 5, where 1 means *very unlikely* and 5 means *very likely*, how likely are you to do the following based on the forecast scenario above? (Monitor, Prepare, Take Protective Action).
  - *W_Curr_WD_Base_3* – Based on the forecast scenario above, please rate the following using a scale from 0 to 10, where 0 means no (risk/confidence/urgency) and 10 means extreme (risk/confidence/urgency).
  - *W_Curr_WD_Base_4* – Based on the forecast scenario above, what is the probability that high winds will actually occur?
- **W_Curr_WD_Watch:** Forecast Scenario: Suppose it is still Tuesday and the National Weather Service has issued a **HIGH WIND WATCH** for Wednesday with the potential for sustained winds greater than 40 miles per hour for one hour or longer, or winds gusting to 58 miles per hour for any duration.
  - *W_Curr_WD_Watch_1* – Based on the forecast scenario, which of the following most accurately describes what you would do on Tuesday?
  - *W_Curr_WD_Watch_2* – Using a scale from 1 to 5, where 1 means *very unlikely* and 5 means *very likely*, how likely are you to do the following based on the forecast scenario above? (Monitor, Prepare, Take Protective Action).
  - *W_Curr_WD_Watch_3* – Based on the forecast scenario above, please rate the following using a scale from 0 to 10, where 0 means no (risk/confidence/urgency) and 10 means extreme (risk/confidence/urgency).
  - *W_Curr_WD_Watch_4* – Based on the forecast scenario above, what is the probability that high winds will actually occur?
- **W_Curr_WD_Warn:** Forecast Scenario: Now, it is Wednesday morning and the National Weather Service has issued a **HIGH WIND WARNING** through Wednesday evening for sustained winds greater than 40 miles per hour lasting one hour or longer, or winds gusting to 58 miles per hour for any duration.
  - *W_Curr_WD_Warn_1* – Based on the forecast scenario, which of the following most accurately describes what you would do on Wednesday morning?
  - *W_Curr_WD_Warn_2* – Using a scale from 1 to 5, where 1 means *very unlikely* and 5 means *very likely*, how likely are you to do the following based on the forecast scenario above? (Monitor, Prepare, Take Protective Action).

        - *W_Curr_WD_Warn_3* – Based on the forecast scenario above, please rate the following using a scale from 0 to 10, where 0 means no (risk/confidence/urgency) and 10 means extreme (risk/confidence/urgency).
        - *W_Curr_WD_Warn_4* – Based on the forecast scenario above, what is the probability that high winds will actually occur?
    - **W_Curr_WD_Adv:** Forecast Scenario: Now, imagine that it is Wednesday afternoon, and you receive the following information: "The National Weather Service has changed their forecast to a **WIND ADVISORY** through Wednesday evening, now expecting sustained winds ranging from 30 to 39 miles per hour lasting for one hour or longer."
        - *W_Curr_WD_Adv_1* – Based on the forecast scenario, which of the following most accurately describes what you would do on Wednesday afternoon?
        - *W_Curr_WD_Adv_2* – Using a scale from 1 to 5, where 1 means *very unlikely* and 5 means *very likely*, how likely are you to do the following based on the forecast scenario above? (Monitor, Prepare, Take Protective Action).
        - *W_Curr_WD_Adv_2* – Based on the forecast scenario above, please rate the following using a scale from 0 to 10, where 0 means no (risk/confidence/urgency) and 10 means extreme (risk/confidence/urgency).
        - *W_Curr_WD_Adv_3* – Based on the forecast scenario above, what is the probability that high winds will actually occur?

- Wind Messaging Treatments_Current_AdvUp:
    - **W_Curr_AU_Base:** Forecast Scenario: Imagine you are home on a Tuesday in March. You learn that the National Weather Service is forecasting the potential for high winds on Wednesday with sustained winds greater than 40 miles per hour for one hour or longer, or winds gusting to 58 miles per hour for any duration.
        - *W_Curr_AU_Base_1* – Based on the forecast scenario, which of the following most accurately describes what you would do on Tuesday?
        - *W_Curr_AU_Base_2* – Using a scale from 1 to 5, where 1 means *very unlikely* and 5 means *very likely*, how likely are you to do the following based on the forecast scenario above? (Monitor, Prepare, Take Protective Action).
        - *W_Curr_AU_Base_3* – Based on the forecast scenario above, please rate the following using a scale from 0 to 10, where 0 means no (risk/confidence/urgency) and 10 means extreme (risk/confidence/urgency).
        - *W_Curr_AU_Base_4* – Based on the forecast scenario above, what is the probability that high winds will actually occur?
    - **W_Curr_AU_Watch:** Forecast Scenario: Suppose it is still Tuesday and the National Weather Service has issued a **HIGH WIND WATCH** for Wednesday with the potential for sustained winds greater than 40 miles per hour for one hour or longer, or winds gusting to 58 miles per hour for any duration.
        - *W_Curr_AU_Watch_1* – Based on the forecast scenario, which of the following most accurately describes what you would do on Tuesday?
        - *W_Curr_AU_Watch_2* – Using a scale from 1 to 5, where 1 means *very unlikely* and 5 means *very likely*, how likely are you to do the following based on the forecast scenario above? (Monitor, Prepare, Take Protective Action).
        - *W_Curr_AU_Watch_3* – Based on the forecast scenario above, please rate the following using a scale from 0 to 10, where 0 means no (risk/confidence/urgency) and 10 means extreme (risk/confidence/urgency).

        - *W_Curr_AU_Watch_4* – Based on the forecast scenario above, what is the probability that high winds will actually occur?
    - **W_Curr_AU_Adv:** Forecast Scenario: Now, it is Wednesday morning and the National Weather Service has issued a **WIND ADVISORY** through Wednesday evening for sustained winds ranging from 30 to 39 miles per hour lasting for one hour or longer.
        - *W_Curr_AU_Adv_1* – Based on the forecast scenario, which of the following most accurately describes what you would do on Wednesday morning?
        - *W_Curr_AU_Adv_2* – Using a scale from 1 to 5, where 1 means *very unlikely* and 5 means *very likely*, how likely are you to do the following based on the forecast scenario above? (Monitor, Prepare, Take Protective Action).
        - *W_Curr_AU_Adv_3* – Based on the forecast scenario above, please rate the following using a scale from 0 to 10, where 0 means no (risk/confidence/urgency) and 10 means extreme (risk/confidence/urgency).
        - *W_Curr_AU_Adv_4* – Based on the forecast scenario above, what is the probability that excessive heat will actually occur?
    - **W_Curr_AU_Warn:** Forecast Scenario: Now, imagine that it is Wednesday afternoon, and you receive the following information: "The National Weather Service has changed their forecast to a **HIGH WIND WARNING** through Wednesday evening, now expecting sustained winds greater than 40 miles per hour for one hour or longer, or winds gusting to 58 miles per hour for any duration."
        - *W_Curr_AU_Warn_1* – Based on the forecast scenario, which of the following most accurately describes what you would do on Wednesday afternoon?
        - *W_Curr_AU_Warn_2* – Using a scale from 1 to 5, where 1 means *very unlikely* and 5 means *very likely*, how likely are you to do the following based on the forecast scenario above? (Monitor, Prepare, Take Protective Action).
        - *W_Curr_AU_Warn_3* – Based on the forecast scenario above, please rate the following using a scale from 0 to 10, where 0 means no (risk/confidence/urgency) and 10 means extreme (risk/confidence/urgency).
        - *W_Curr_AU_Warn_4* – Based on the forecast scenario above, what is the probability that high winds will actually occur?

Prototype 1:

The National Weather Service is considering a change to a warning system that involves only two high wind messages: **WIND OUTLOOK and WIND WARNING.** Below you will find more information and a table that describes these messages in more detail.

When conditions are favorable for the occurrence of high winds, a **WIND OUTLOOK** may be issued for your area. As forecasters become more certain, they will issue a **WIND WARNING.** Please read the forecast details for wind speed specifics, as sustained winds and/or wind gusts are forecast to meet or exceed 30 miles per hour.

Name of Warning	Details
Wind Outlook	The ***potential*** for sustained wind speeds and/or wind gusts to meet or exceed 30 miles per hour in the next 12 to 48 hours.
Wind Warning	Sustained wind speeds and/or wind gusts are forecast to meet or exceed 30 miles per hour. Please read the forecast, as wind speeds and timing can vary.

Please take a look at the table above, as the next several questions will prompt you to make decisions using this weather warning system. When you are finished looking over the table, please continue to the next page. ***Note:*** You will not be able to return to this page.

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- Wind Messaging Treatments_P1_WarnDown:
    - **W_P1_WD_Base:** Forecast Scenario: Imagine you are home on a Tuesday in March. You learn that the National Weather Service is forecasting the potential for high winds on Wednesday with sustained winds greater than 40 miles per hour for one hour or longer, or winds gusting to 58 miles per hour for any duration.
        - *W_P1_WD_Base_1* – Based on the forecast scenario, which of the following most accurately describes what you would do on Tuesday?
            - **Nothing:** I would continue my current activities.
            - **Monitor:** I would monitor weather information sources such as TV news, websites, NOAA weather radio, etc.
            - **Prepare:** I would start preparing by bringing in loose items, securing outdoor furniture, etc.

- **Take some action:** I would cancel, move, or postpone outdoor activities; I would allow more time for driving.
- **Take protective action***:* I would go indoors and stay away from windows, even if weather conditions are otherwise good; I would limit driving with high profile vehicles.

- *W_P1_WD_Base_2* – Using a scale from 1 to 5, where 1 means *very unlikely* and 5 means *very likely*, how likely are you to do the following based on the forecast scenario above? (Monitor, Prepare, Take Protective Action).
- *W_P1_WD_Base_3* – Based on the forecast scenario above, please rate the following using a scale from 0 to 10, where 0 means no (risk/confidence/urgency) and 10 means extreme (risk/confidence/urgency).
- *W_P1_WD_Base_4* – Based on the forecast scenario above, what is the probability that high winds will actually occur?

o **W_P1_WD_Watch:** Forecast Scenario: Suppose it is still Tuesday and the National Weather Service has issued a **WIND OUTLOOK** for Wednesday with the potential for sustained winds greater than 40 miles per hour for one hour or longer, or winds gusting to 58 miles per hour for any duration.
- *W_P1_WD_Watch_1* – Based on the forecast scenario, which of the following most accurately describes what you would do on Tuesday?
- *W_P1_WD_Watch_2* – Using a scale from 1 to 5, where 1 means *very unlikely* and 5 means *very likely*, how likely are you to do the following based on the forecast scenario above? (Monitor, Prepare, Take Protective Action).
- *W_P1_WD_Watch_3* – Based on the forecast scenario above, please rate the following using a scale from 0 to 10, where 0 means no (risk/confidence/urgency) and 10 means extreme (risk/confidence/urgency).
- *W_P1_WD_Watch_4* – Based on the forecast scenario above, what is the probability that high winds will actually occur?

o **W_P1_WD_Warn:** Forecast Scenario: Now, it is Wednesday morning and the National Weather Service has issued a **WIND WARNING** through Wednesday evening for sustained winds greater than 40 miles per hour lasting one hour or longer, or winds gusting to 58 miles per hour for any duration.
- *W_P1_WD_Warn_1* – Based on the forecast scenario, which of the following most accurately describes what you would do on Wednesday morning?
- *W_P1_WD_Warn_2* – Using a scale from 1 to 5, where 1 means *very unlikely* and 5 means *very likely*, how likely are you to do the following based on the forecast scenario above? (Monitor, Prepare, Take Protective Action).
- *W_P1_WD_Warn_3* – Based on the forecast scenario above, please rate the following using a scale from 0 to 10, where 0 means no (risk/confidence/urgency) and 10 means extreme (risk/confidence/urgency).
- *W_P1_WD_Warn_4* – Based on the forecast scenario above, what is the probability that high winds will actually occur?

o **W_P1_WD_Adv:** Forecast Scenario: Now, imagine that it is Wednesday afternoon, and you receive the following information: "The National Weather Service has changed their forecast to a **WIND WARNING** through Wednesday evening, now expecting sustained winds ranging from 30 to 39 miles per hour lasting for one hour or longer."
- *W_P1_WD_Adv_1* – Based on the forecast scenario, which of the following most accurately describes what you would do on Wednesday afternoon?

- *W_P1_WD_Adv_2* – Using a scale from 1 to 5, where 1 means *very unlikely* and 5 means *very likely*, how likely are you to do the following based on the forecast scenario above? (Monitor, Prepare, Take Protective Action).
- *W_P1_WD_Adv_2* – Based on the forecast scenario above, please rate the following using a scale from 0 to 10, where 0 means no (risk/confidence/urgency) and 10 means extreme (risk/confidence/urgency).
- *W_P1_WD_Adv_3* – Based on the forecast scenario above, what is the probability that high winds will actually occur?

- Wind Messaging Treatments_P1_AdvUp:
  - **W_P1_AU_Base:** Forecast Scenario: Imagine you are home on a Tuesday in March. You learn that the National Weather Service is forecasting the potential for high winds on Wednesday with sustained winds greater than 40 miles per hour for one hour or longer, or winds gusting to 58 miles per hour for any duration.
    - *W_P1_AU_Base_1* – Based on the forecast scenario, which of the following most accurately describes what you would do on Tuesday?
    - *W_P1_AU_Base_2* – Using a scale from 1 to 5, where 1 means *very unlikely* and 5 means *very likely*, how likely are you to do the following based on the forecast scenario above? (Monitor, Prepare, Take Protective Action).
    - *W_P1_AU_Base_3* – Based on the forecast scenario above, please rate the following using a scale from 0 to 10, where 0 means no (risk/confidence/urgency) and 10 means extreme (risk/confidence/urgency).
    - *W_P1_AU_Base_4* – Based on the forecast scenario above, what is the probability that high winds will actually occur?
  - **W_P1_AU_Watch:** Forecast Scenario: Suppose it is still Tuesday and the National Weather Service has issued a **WIND OUTLOOK** for Wednesday with the potential for sustained winds greater than 40 miles per hour for one hour or longer, or winds gusting to 58 miles per hour for any duration.
    - *W_P1_AU_Watch_1* – Based on the forecast scenario, which of the following most accurately describes what you would do on Tuesday?
    - *W_P1_AU_Watch_2* – Using a scale from 1 to 5, where 1 means *very unlikely* and 5 means *very likely*, how likely are you to do the following based on the forecast scenario above? (Monitor, Prepare, Take Protective Action).
    - *W_P1_AU_Watch_3* – Based on the forecast scenario above, please rate the following using a scale from 0 to 10, where 0 means no (risk/confidence/urgency) and 10 means extreme (risk/confidence/urgency).
    - *W_P1_AU_Watch_4* – Based on the forecast scenario above, what is the probability that high winds will actually occur?
  - **W_P1_AU_Adv:** Forecast Scenario: Now, it is Wednesday morning and the National Weather Service has issued a **WIND WARNING** through Wednesday evening for sustained winds ranging from 30 to 39 miles per hour lasting for one hour or longer.
    - *W_P1_AU_Adv_1* – Based on the forecast scenario, which of the following most accurately describes what you would do on Wednesday morning?
    - *W_P1_AU_Adv_2* – Using a scale from 1 to 5, where 1 means *very unlikely* and 5 means *very likely*, how likely are you to do the following based on the forecast scenario above? (Monitor, Prepare, Take Protective Action).

- *W_P1_AU_Adv_3* – Based on the forecast scenario above, please rate the following using a scale from 0 to 10, where 0 means no (risk/confidence/urgency) and 10 means extreme (risk/confidence/urgency).
- *W_P1_AU_Adv_4* – Based on the forecast scenario above, what is the probability that excessive heat will actually occur?

o **W_P1_AU_Warn:** Forecast Scenario: Now, imagine that it is Wednesday afternoon, and you receive the following information: "The National Weather Service has changed their forecast to a **WIND WARNING** through Wednesday evening, now expecting sustained winds greater than 40 miles per hour for one hour or longer, or winds gusting to 58 miles per hour for any duration."

- *W_P1_AU_Warn_1* – Based on the forecast scenario, which of the following most accurately describes what you would do on Wednesday afternoon?
- *W_P1_AU_Warn_2* – Using a scale from 1 to 5, where 1 means *very unlikely* and 5 means *very likely*, how likely are you to do the following based on the forecast scenario above? (Monitor, Prepare, Take Protective Action).
- *W_P1_AU_Warn_3* – Based on the forecast scenario above, please rate the following using a scale from 0 to 10, where 0 means no (risk/confidence/urgency) and 10 means extreme (risk/confidence/urgency).
- *W_P1_AU_Warn_4* – Based on the forecast scenario above, what is the probability that high winds will actually occur?

Prototype 2:

The National Weather Service is considering a change to a warning system that involves three high wind messages: **WIND NOTICE, WIND ALERT, and WIND WARNING.** Below you will find more information and a table that describes each message in more detail.

When conditions are favorable for the occurrence of high winds, a **WIND NOTICE** may be issued for your area. As forecasters become more certain, they will issue a **WIND ALERT** for sustained winds ranging from 30 to 39 miles per hour – lasting for one hour or longer. This product may then be changed to a **WIND WARNING** if sustained winds are forecast to be greater than 40 miles per hour for one hour or longer, or for winds gusting to 58 miles per hour for any duration.

Name of Warning	Details
Wind Notice	The ***potential*** for sustained wind speeds greater than 40 miles per hour for one hour or longer, or winds gusting to 58 miles per hour for any duration in the next 12 to 48 hours.
Wind Alert	Sustained wind speeds are forecast to range from 30 to 39 miles per hour for one hour or longer.
Wind Warning	Sustained wind speeds are forecast to be greater than 40 miles per hour for one hour or longer, or for winds gusting to 58 miles per hour for any duration.

Please take a look at the table above, as the next several questions will prompt you to make decisions using this weather warning system. When you are finished looking over the table, please continue to the next page. ***Note:*** You will not be able to return to this page.

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- Wind Messaging Treatments_P2_WarnDown:
    - **W_P2_WD_Base:** Forecast Scenario: Imagine you are home on a Tuesday in March. You learn that the National Weather Service is forecasting the potential for high winds on Wednesday with sustained winds greater than 40 miles per hour for one hour or longer, or winds gusting to 58 miles per hour for any duration.

- *W_P2_WD_Base_1* – Based on the forecast scenario, which of the following most accurately describes what you would do on Tuesday?
    - **Nothing:** I would continue my current activities.
    - **Monitor:** I would monitor weather information sources such as TV news, websites, NOAA weather radio, etc.
    - **Prepare:** I would start preparing by bringing in loose items, securing outdoor furniture, etc.
    - **Take some action:** I would cancel, move, or postpone outdoor activities; I would allow more time for driving.
    - **Take protective action***:* I would go indoors and stay away from windows, even if weather conditions are otherwise good; I would limit driving with high profile vehicles.
- *W_P2_WD_Base_2* – Using a scale from 1 to 5, where 1 means *very unlikely* and 5 means *very likely*, how likely are you to do the following based on the forecast scenario above? (Monitor, Prepare, Take Protective Action).
- *W_P2_WD_Base_3* – Based on the forecast scenario above, please rate the following using a scale from 0 to 10, where 0 means no (risk/confidence/urgency) and 10 means extreme (risk/confidence/urgency).
- *W_P2_WD_Base_4* – Based on the forecast scenario above, what is the probability that high winds will actually occur?

o **W_P2_WD_Watch:** Forecast Scenario: Suppose it is still Tuesday and the National Weather Service has issued a **WIND NOTICE** for Wednesday with the potential for sustained winds greater than 40 miles per hour for one hour or longer, or winds gusting to 58 miles per hour for any duration.

- *W_P2_WD_Watch_1* – Based on the forecast scenario, which of the following most accurately describes what you would do on Tuesday?
- *W_P2_WD_Watch_2* – Using a scale from 1 to 5, where 1 means *very unlikely* and 5 means *very likely*, how likely are you to do the following based on the forecast scenario above? (Monitor, Prepare, Take Protective Action).
- *W_P2_WD_Watch_3* – Based on the forecast scenario above, please rate the following using a scale from 0 to 10, where 0 means no (risk/confidence/urgency) and 10 means extreme (risk/confidence/urgency).
- *W_P2_WD_Watch_4* – Based on the forecast scenario above, what is the probability that high winds will actually occur?

o **W_P2_WD_Warn:** Forecast Scenario: Now, it is Wednesday morning and the National Weather Service has issued a **WIND WARNING** through Wednesday evening for sustained winds greater than 40 miles per hour lasting one hour or longer, or winds gusting to 58 miles per hour for any duration.

- *W_P2_WD_Warn_1* – Based on the forecast scenario, which of the following most accurately describes what you would do on Wednesday morning?
- *W_P2_WD_Warn_2* – Using a scale from 1 to 5, where 1 means *very unlikely* and 5 means *very likely*, how likely are you to do the following based on the forecast scenario above? (Monitor, Prepare, Take Protective Action).
- *W_P2_WD_Warn_3* – Based on the forecast scenario above, please rate the following using a scale from 0 to 10, where 0 means no (risk/confidence/urgency) and 10 means extreme (risk/confidence/urgency).
- *W_P2_WD_Warn_4* – Based on the forecast scenario above, what is the probability that high winds will actually occur?

- **W_P2_WD_Adv:** Forecast Scenario: Now, imagine that it is Wednesday afternoon, and you receive the following information: "The National Weather Service has changed their forecast to a **WIND ALERT** through Wednesday evening, now expecting sustained winds ranging from 30 to 39 miles per hour lasting for one hour or longer."
  - *W_P2_WD_Adv_1* – Based on the forecast scenario, which of the following most accurately describes what you would do on Wednesday afternoon?
  - *W_P2_WD_Adv_2* – Using a scale from 1 to 5, where 1 means *very unlikely* and 5 means *very likely*, how likely are you to do the following based on the forecast scenario above? (Monitor, Prepare, Take Protective Action).
  - *W_P2_WD_Adv_2* – Based on the forecast scenario above, please rate the following using a scale from 0 to 10, where 0 means no (risk/confidence/urgency) and 10 means extreme (risk/confidence/urgency).
  - *W_P2_WD_Adv_3* – Based on the forecast scenario above, what is the probability that high winds will actually occur?

- Wind Messaging Treatments_P2_AdvUp:
  - **W_P2_AU_Base:** Forecast Scenario: Imagine you are home on a Tuesday in March. You learn that the National Weather Service is forecasting the potential for high winds on Wednesday with sustained winds greater than 40 miles per hour for one hour or longer, or winds gusting to 58 miles per hour for any duration.
    - *W_P2_AU_Base_1* – Based on the forecast scenario, which of the following most accurately describes what you would do on Tuesday?
    - *W_P2_AU_Base_2* – Using a scale from 1 to 5, where 1 means *very unlikely* and 5 means *very likely*, how likely are you to do the following based on the forecast scenario above? (Monitor, Prepare, Take Protective Action).
    - *W_P2_AU_Base_3* – Based on the forecast scenario above, please rate the following using a scale from 0 to 10, where 0 means no (risk/confidence/urgency) and 10 means extreme (risk/confidence/urgency).
    - *W_P2_AU_Base_4* – Based on the forecast scenario above, what is the probability that high winds will actually occur?
  - **W_P2_AU_Watch:** Forecast Scenario: Suppose it is still Tuesday and the National Weather Service has issued a **WIND NOTICE** for Wednesday with the potential for sustained winds greater than 40 miles per hour for one hour or longer, or winds gusting to 58 miles per hour for any duration.
    - *W_P2_AU_Watch_1* – Based on the forecast scenario, which of the following most accurately describes what you would do on Tuesday?
    - *W_P2_AU_Watch_2* – Using a scale from 1 to 5, where 1 means *very unlikely* and 5 means *very likely*, how likely are you to do the following based on the forecast scenario above? (Monitor, Prepare, Take Protective Action).
    - *W_P2_AU_Watch_3* – Based on the forecast scenario above, please rate the following using a scale from 0 to 10, where 0 means no (risk/confidence/urgency) and 10 means extreme (risk/confidence/urgency).
    - *W_P2_AU_Watch_4* – Based on the forecast scenario above, what is the probability that high winds will actually occur?
  - **W_P2_AU_Adv:** Forecast Scenario: Now, it is Wednesday morning and the National Weather Service has issued a **WIND ALERT** through Wednesday evening for sustained winds ranging from 30 to 39 miles per hour lasting for one hour or longer.

- *W_P2_AU_Adv_1* – Based on the forecast scenario, which of the following most accurately describes what you would do on Wednesday morning?
- *W_P2_AU_Adv_2* – Using a scale from 1 to 5, where 1 means *very unlikely* and 5 means *very likely*, how likely are you to do the following based on the forecast scenario above? (Monitor, Prepare, Take Protective Action).
- *W_P2_AU_Adv_3* – Based on the forecast scenario above, please rate the following using a scale from 0 to 10, where 0 means no (risk/confidence/urgency) and 10 means extreme (risk/confidence/urgency).
- *W_P2_AU_Adv_4* – Based on the forecast scenario above, what is the probability that excessive heat will actually occur?

o **W_P2_AU_Warn:** Forecast Scenario: Now, imagine that it is Wednesday afternoon, and you receive the following information: "The National Weather Service has changed their forecast to a **WIND WARNING** through Wednesday evening, now expecting sustained winds greater than 40 miles per hour for one hour or longer, or winds gusting to 58 miles per hour for any duration."

- *W_P2_AU_Warn_1* – Based on the forecast scenario, which of the following most accurately describes what you would do on Wednesday afternoon?
- *W_P2_AU_Warn_2* – Using a scale from 1 to 5, where 1 means *very unlikely* and 5 means *very likely*, how likely are you to do the following based on the forecast scenario above? (Monitor, Prepare, Take Protective Action).
- *W_P2_AU_Warn_3* – Based on the forecast scenario above, please rate the following using a scale from 0 to 10, where 0 means no (risk/confidence/urgency) and 10 means extreme (risk/confidence/urgency).
- *W_P2_AU_Warn_4* – Based on the forecast scenario above, what is the probability that high winds will actually occur?

Prototype 3:

The National Weather Service is considering a change to a warning system that involves three high wind messages: **POSSIBLE WIND EVENT, MODERATE WIND WARNING, and SEVERE WIND WARNING.** Below you will find more information and a table that describes each message in more detail.

When conditions are favorable for the occurrence of high winds, a **POSSIBLE WIND EVENT** may be issued for your area. As forecasters become more certain, they will issue a **MODERATE WIND WARNING** for sustained winds ranging from 30 to 39 miles per hour – lasting for one hour or longer. This product may then be changed to a **SEVERE WIND WARNING** if sustained winds are forecast to be greater than 40 miles per hour for one hour or longer, or for winds gusting to 58 miles per hour for any duration.

Name of Warning	Details
Possible Wind Event	The ***potential*** for sustained wind speeds greater than 40 miles per hour for one hour or longer, or winds gusting to 58 miles per hour for any duration in the next 12 to 48 hours.
Moderate Wind Warning	Sustained wind speeds are forecast to range from 30 to 39 miles per hour for one hour or longer.
Severe Wind Warning	Sustained wind speeds are forecast to be greater than 40 miles per hour for one hour or longer, or for winds gusting to 58 miles per hour for any duration.

Please take a look at the table above, as the next several questions will prompt you to make decisions using this weather warning system. When you are finished looking over the table, please continue to the next page. ***Note:*** You will not be able to return to this page.

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- Wind Messaging Treatments_P3_WarnDown:
    - **W_P3_WD_Base:** Forecast Scenario: Imagine you are home on a Tuesday in March. You learn that the National Weather Service is forecasting the potential for high winds on Wednesday with sustained winds greater than 40 miles per hour for one hour or longer, or winds gusting to 58 miles per hour for any duration.

- *W_P3_WD_Base_1* – Based on the forecast scenario, which of the following most accurately describes what you would do on Tuesday?
    - **Nothing:** I would continue my current activities.
    - **Monitor:** I would monitor weather information sources such as TV news, websites, NOAA weather radio, etc.
    - **Prepare:** I would start preparing by bringing in loose items, securing outdoor furniture, etc.
    - **Take some action:** I would cancel, move, or postpone outdoor activities; I would allow more time for driving.
    - **Take protective action***:* I would go indoors and stay away from windows, even if weather conditions are otherwise good; I would limit driving with high profile vehicles.
- *W_P3_WD_Base_2* – Using a scale from 1 to 5, where 1 means *very unlikely* and 5 means *very likely*, how likely are you to do the following based on the forecast scenario above? (Monitor, Prepare, Take Protective Action).
- *W_P3_WD_Base_3* – Based on the forecast scenario above, please rate the following using a scale from 0 to 10, where 0 means no (risk/confidence/urgency) and 10 means extreme (risk/confidence/urgency).
- *W_P3_WD_Base_4* – Based on the forecast scenario above, what is the probability that high winds will actually occur?

o **W_P3_WD_Watch:** Forecast Scenario: Suppose it is still Tuesday and the National Weather Service has issued a **POSSIBLE WIND EVENT** for Wednesday with the potential for sustained winds greater than 40 miles per hour for one hour or longer, or winds gusting to 58 miles per hour for any duration.

- *W_P3_WD_Watch_1* – Based on the forecast scenario, which of the following most accurately describes what you would do on Tuesday?
- *W_P3_WD_Watch_2* – Using a scale from 1 to 5, where 1 means *very unlikely* and 5 means *very likely*, how likely are you to do the following based on the forecast scenario above? (Monitor, Prepare, Take Protective Action).
- *W_P3_WD_Watch_3* – Based on the forecast scenario above, please rate the following using a scale from 0 to 10, where 0 means no (risk/confidence/urgency) and 10 means extreme (risk/confidence/urgency).
- *W_P3_WD_Watch_4* – Based on the forecast scenario above, what is the probability that high winds will actually occur?

o **W_P3_WD_Warn:** Forecast Scenario: Now, it is Wednesday morning and the National Weather Service has issued a **SEVERE WIND WARNING** through Wednesday evening for sustained winds greater than 40 miles per hour lasting one hour or longer, or winds gusting to 58 miles per hour for any duration.

- *W_P3_WD_Warn_1* – Based on the forecast scenario, which of the following most accurately describes what you would do on Wednesday morning?
- *W_P3_WD_Warn_2* – Using a scale from 1 to 5, where 1 means *very unlikely* and 5 means *very likely*, how likely are you to do the following based on the forecast scenario above? (Monitor, Prepare, Take Protective Action).
- *W_P3_WD_Warn_3* – Based on the forecast scenario above, please rate the following using a scale from 0 to 10, where 0 means no (risk/confidence/urgency) and 10 means extreme (risk/confidence/urgency).
- *W_P3_WD_Warn_4* – Based on the forecast scenario above, what is the probability that high winds will actually occur?

- **W_P3_WD_Adv:** Forecast Scenario: Now, imagine that it is Wednesday afternoon, and you receive the following information: "The National Weather Service has changed their forecast to a **MODERATE WIND WARNING** through Wednesday evening, now expecting sustained winds ranging from 30 to 39 miles per hour lasting for one hour or longer."
  - *W_P3_WD_Adv_1* – Based on the forecast scenario, which of the following most accurately describes what you would do on Wednesday afternoon?
  - *W_P3_WD_Adv_2* – Using a scale from 1 to 5, where 1 means *very unlikely* and 5 means *very likely*, how likely are you to do the following based on the forecast scenario above? (Monitor, Prepare, Take Protective Action).
  - *W_P3_WD_Adv_2* – Based on the forecast scenario above, please rate the following using a scale from 0 to 10, where 0 means no (risk/confidence/urgency) and 10 means extreme (risk/confidence/urgency).
  - *W_P3_WD_Adv_3* – Based on the forecast scenario above, what is the probability that high winds will actually occur?

- Wind Messaging Treatments_P3_AdvUp:
  - **W_P3_AU_Base:** Forecast Scenario: Imagine you are home on a Tuesday in March. You learn that the National Weather Service is forecasting the potential for high winds on Wednesday with sustained winds greater than 40 miles per hour for one hour or longer, or winds gusting to 58 miles per hour for any duration.
    - *W_P3_AU_Base_1* – Based on the forecast scenario, which of the following most accurately describes what you would do on Tuesday?
    - *W_P3_AU_Base_2* – Using a scale from 1 to 5, where 1 means *very unlikely* and 5 means *very likely*, how likely are you to do the following based on the forecast scenario above? (Monitor, Prepare, Take Protective Action).
    - *W_P3_AU_Base_3* – Based on the forecast scenario above, please rate the following using a scale from 0 to 10, where 0 means no (risk/confidence/urgency) and 10 means extreme (risk/confidence/urgency).
    - *W_P3_AU_Base_4* – Based on the forecast scenario above, what is the probability that high winds will actually occur?
  - **W_P3_AU_Watch:** Forecast Scenario: Suppose it is still Tuesday and the National Weather Service has issued a **POSSIBLE WIND EVENT** for Wednesday with the potential for sustained winds greater than 40 miles per hour for one hour or longer, or winds gusting to 58 miles per hour for any duration.
    - *W_P3_AU_Watch_1* – Based on the forecast scenario, which of the following most accurately describes what you would do on Tuesday?
    - *W_P3_AU_Watch_2* – Using a scale from 1 to 5, where 1 means *very unlikely* and 5 means *very likely*, how likely are you to do the following based on the forecast scenario above? (Monitor, Prepare, Take Protective Action).
    - *W_P3_AU_Watch_3* – Based on the forecast scenario above, please rate the following using a scale from 0 to 10, where 0 means no (risk/confidence/urgency) and 10 means extreme (risk/confidence/urgency).
    - *W_P3_AU_Watch_4* – Based on the forecast scenario above, what is the probability that high winds will actually occur?
  - **W_P3_AU_Adv:** Forecast Scenario: Now, it is Wednesday morning and the National Weather Service has issued a **MODERATE WIND WARNING** through Wednesday evening for sustained winds ranging from 30 to 39 miles per hour lasting for one hour or longer.

- *W_P3_AU_Adv_1* – Based on the forecast scenario, which of the following most accurately describes what you would do on Wednesday morning?
- *W_P3_AU_Adv_2* – Using a scale from 1 to 5, where 1 means *very unlikely* and 5 means *very likely*, how likely are you to do the following based on the forecast scenario above? (Monitor, Prepare, Take Protective Action).
- *W_P3_AU_Adv_3* – Based on the forecast scenario above, please rate the following using a scale from 0 to 10, where 0 means no (risk/confidence/urgency) and 10 means extreme (risk/confidence/urgency).
- *W_P3_AU_Adv_4* – Based on the forecast scenario above, what is the probability that excessive heat will actually occur?

o **W_P3_AU_Warn:** Forecast Scenario: Now, imagine that it is Wednesday afternoon, and you receive the following information: "The National Weather Service has changed their forecast to a **SEVERE WIND WARNING** through Wednesday evening, now expecting sustained winds greater than 40 miles per hour for one hour or longer, or winds gusting to 58 miles per hour for any duration."

- *W_P3_AU_Warn_1* – Based on the forecast scenario, which of the following most accurately describes what you would do on Wednesday afternoon?
- *W_P3_AU_Warn_2* – Using a scale from 1 to 5, where 1 means *very unlikely* and 5 means *very likely*, how likely are you to do the following based on the forecast scenario above? (Monitor, Prepare, Take Protective Action).
- *W_P3_AU_Warn_3* – Based on the forecast scenario above, please rate the following using a scale from 0 to 10, where 0 means no (risk/confidence/urgency) and 10 means extreme (risk/confidence/urgency).
- *W_P3_AU_Warn_4* – Based on the forecast scenario above, what is the probability that high winds will actually occur?

Prototype 4:

The National Weather Service is considering a change to a warning system that involves three high wind messages: **POSSIBLE HIGH WINDS, LEVEL ORANGE WIND WARNING, and LEVEL RED WIND WARNING.** Below you will find more information and a table that describes each message in more detail.

When conditions are favorable for the occurrence of high winds, a **POSSIBLE HIGH WINDS** may be issued for your area. As forecasters become more certain, they will issue a **LEVEL ORANGE WIND WARNING** for sustained winds ranging from 30 to 39 miles per hour – lasting for one hour or longer. This product may then be changed to a **LEVEL RED WIND WARNING** if sustained winds are forecast to be greater than 40 miles per hour for one hour or longer, or for winds gusting to 58 miles per hour for any duration.

Name of Warning	Details
Possible High Winds	The ***potential*** for sustained wind speeds greater than 40 miles per hour for one hour or longer, or winds gusting to 58 miles per hour for any duration in the next 12 to 48 hours.
Level Orange Wind Warning	Sustained wind speeds are forecast to range from 30 to 39 miles per hour for one hour or longer.
Level Red Wind Warning	Sustained wind speeds are forecast to be greater than 40 miles per hour for one hour or longer, or for winds gusting to 58 miles per hour for any duration.

Please take a look at the table above, as the next several questions will prompt you to make decisions using this weather warning system. When you are finished looking over the table, please continue to the next page. ***Note:*** You will not be able to return to this page.

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- Wind Messaging Treatments_P4_WarnDown:
    - **W_P4_WD_Base:** Forecast Scenario: Imagine you are home on a Tuesday in March. You learn that the National Weather Service is forecasting the potential for high winds on Wednesday with sustained winds greater than 40 miles per hour for one hour or longer, or winds gusting to 58 miles per hour for any duration.

- *W_P4_WD_Base_1* – Based on the forecast scenario, which of the following most accurately describes what you would do on Tuesday?
    - **Nothing:** I would continue my current activities.
    - **Monitor:** I would monitor weather information sources such as TV news, websites, NOAA weather radio, etc.
    - **Prepare:** I would start preparing by bringing in loose items, securing outdoor furniture, etc.
    - **Take some action:** I would cancel, move, or postpone outdoor activities; I would allow more time for driving.
    - **Take protective action***:* I would go indoors and stay away from windows, even if weather conditions are otherwise good; I would limit driving with high profile vehicles.
- *W_P4_WD_Base_2* – Using a scale from 1 to 5, where 1 means *very unlikely* and 5 means *very likely*, how likely are you to do the following based on the forecast scenario above? (Monitor, Prepare, Take Protective Action).
- *W_P4_WD_Base_3* – Based on the forecast scenario above, please rate the following using a scale from 0 to 10, where 0 means no (risk/confidence/urgency) and 10 means extreme (risk/confidence/urgency).
- *W_P4_WD_Base_4* – Based on the forecast scenario above, what is the probability that high winds will actually occur?

o **W_P4_WD_Watch:** Forecast Scenario: Suppose it is still Tuesday and the National Weather Service has issued a **POSSIBLE HIGH WINDS** for Wednesday with the potential for sustained winds greater than 40 miles per hour for one hour or longer, or winds gusting to 58 miles per hour for any duration.
- *W_P4_WD_Watch_1* – Based on the forecast scenario, which of the following most accurately describes what you would do on Tuesday?
- *W_P4_WD_Watch_2* – Using a scale from 1 to 5, where 1 means *very unlikely* and 5 means *very likely*, how likely are you to do the following based on the forecast scenario above? (Monitor, Prepare, Take Protective Action).
- *W_P4_WD_Watch_3* – Based on the forecast scenario above, please rate the following using a scale from 0 to 10, where 0 means no (risk/confidence/urgency) and 10 means extreme (risk/confidence/urgency).
- *W_P4_WD_Watch_4* – Based on the forecast scenario above, what is the probability that high winds will actually occur?

o **W_P4_WD_Warn:** Forecast Scenario: Now, it is Wednesday morning and the National Weather Service has issued a **LEVEL RED WIND WARNING** through Wednesday evening for sustained winds greater than 40 miles per hour lasting one hour or longer, or winds gusting to 58 miles per hour for any duration.
- *W_P4_WD_Warn_1* – Based on the forecast scenario, which of the following most accurately describes what you would do on Wednesday morning?
- *W_P4_WD_Warn_2* – Using a scale from 1 to 5, where 1 means *very unlikely* and 5 means *very likely*, how likely are you to do the following based on the forecast scenario above? (Monitor, Prepare, Take Protective Action).
- *W_P4_WD_Warn_3* – Based on the forecast scenario above, please rate the following using a scale from 0 to 10, where 0 means no (risk/confidence/urgency) and 10 means extreme (risk/confidence/urgency).
- *W_P4_WD_Warn_4* – Based on the forecast scenario above, what is the probability that high winds will actually occur?

- **W_P4_WD_Adv:** Forecast Scenario: Now, imagine that it is Wednesday afternoon, and you receive the following information: "The National Weather Service has changed their forecast to a **LEVEL ORANGE WIND WARNING** through Wednesday evening, now expecting sustained winds ranging from 30 to 39 miles per hour lasting for one hour or longer."
  - *W_P4_WD_Adv_1* – Based on the forecast scenario, which of the following most accurately describes what you would do on Wednesday afternoon?
  - *W_P4_WD_Adv_2* – Using a scale from 1 to 5, where 1 means *very unlikely* and 5 means *very likely*, how likely are you to do the following based on the forecast scenario above? (Monitor, Prepare, Take Protective Action).
  - *W_P4_WD_Adv_2* – Based on the forecast scenario above, please rate the following using a scale from 0 to 10, where 0 means no (risk/confidence/urgency) and 10 means extreme (risk/confidence/urgency).
  - *W_P4_WD_Adv_3* – Based on the forecast scenario above, what is the probability that high winds will actually occur?

- Wind Messaging Treatments_P4_AdvUp:
  - **W_P4_AU_Base:** Forecast Scenario: Imagine you are home on a Tuesday in March. You learn that the National Weather Service is forecasting the potential for high winds on Wednesday with sustained winds greater than 40 miles per hour for one hour or longer, or winds gusting to 58 miles per hour for any duration.
    - *W_P4_AU_Base_1* – Based on the forecast scenario, which of the following most accurately describes what you would do on Tuesday?
    - *W_P4_AU_Base_2* – Using a scale from 1 to 5, where 1 means *very unlikely* and 5 means *very likely*, how likely are you to do the following based on the forecast scenario above? (Monitor, Prepare, Take Protective Action).
    - *W_P4_AU_Base_3* – Based on the forecast scenario above, please rate the following using a scale from 0 to 10, where 0 means no (risk/confidence/urgency) and 10 means extreme (risk/confidence/urgency).
    - *W_P4_AU_Base_4* – Based on the forecast scenario above, what is the probability that high winds will actually occur?
  - **W_P4_AU_Watch:** Forecast Scenario: Suppose it is still Tuesday and the National Weather Service has issued a **POSSIBLE HIGH WINDS** for Wednesday with the potential for sustained winds greater than 40 miles per hour for one hour or longer, or winds gusting to 58 miles per hour for any duration.
    - *W_P4_AU_Watch_1* – Based on the forecast scenario, which of the following most accurately describes what you would do on Tuesday?
    - *W_P4_AU_Watch_2* – Using a scale from 1 to 5, where 1 means *very unlikely* and 5 means *very likely*, how likely are you to do the following based on the forecast scenario above? (Monitor, Prepare, Take Protective Action).
    - *W_P4_AU_Watch_3* – Based on the forecast scenario above, please rate the following using a scale from 0 to 10, where 0 means no (risk/confidence/urgency) and 10 means extreme (risk/confidence/urgency).
    - *W_P4_AU_Watch_4* – Based on the forecast scenario above, what is the probability that high winds will actually occur?
  - **W_P4_AU_Adv:** Forecast Scenario: Now, it is Wednesday morning and the National Weather Service has issued a **LEVEL ORANGE WIND WARNING** through Wednesday

evening for sustained winds ranging from 30 to 39 miles per hour lasting for one hour or longer.

- *W_P4_AU_Adv_1* – Based on the forecast scenario, which of the following most accurately describes what you would do on Wednesday morning?
- *W_P4_AU_Adv_2* – Using a scale from 1 to 5, where 1 means *very unlikely* and 5 means *very likely*, how likely are you to do the following based on the forecast scenario above? (Monitor, Prepare, Take Protective Action).
- *W_P4_AU_Adv_3* – Based on the forecast scenario above, please rate the following using a scale from 0 to 10, where 0 means no (risk/confidence/urgency) and 10 means extreme (risk/confidence/urgency).
- *W_P4_AU_Adv_4* – Based on the forecast scenario above, what is the probability that excessive heat will actually occur?

o **W_P4_AU_Warn:** Forecast Scenario: Now, imagine that it is Wednesday afternoon, and you receive the following information: "The National Weather Service has changed their forecast to a **LEVEL RED WIND WARNING** through Wednesday evening, now expecting sustained winds greater than 40 miles per hour for one hour or longer, or winds gusting to 58 miles per hour for any duration."

- *W_P4_AU_Warn_1* – Based on the forecast scenario, which of the following most accurately describes what you would do on Wednesday afternoon?
- *W_P4_AU_Warn_2* – Using a scale from 1 to 5, where 1 means *very unlikely* and 5 means *very likely*, how likely are you to do the following based on the forecast scenario above? (Monitor, Prepare, Take Protective Action).
- *W_P4_AU_Warn_3* – Based on the forecast scenario above, please rate the following using a scale from 0 to 10, where 0 means no (risk/confidence/urgency) and 10 means extreme (risk/confidence/urgency).
- *W_P4_AU_Warn_4* – Based on the forecast scenario above, what is the probability that high winds will actually occur?

Part IV - Sources

Adapted from a Pew News Media Survey

[News_Level] How closely do you follow …

	Very closely	Somewhat closely	Not very closely	Not at all closely	No Answer
a.) Your local weather					
b.) The weather where your friends or family live					
b.) National Weather					

[NEWS_DEVICE] Thinking about the weather, how often do you get weather information… [RANDOMIZE a-b]

	Often	Sometimes	Hardly Ever	Never	No Answer

a.) On a desktop or laptop computer

b.) On a mobile device (such as a smartphone or tablet)

If [NEWS_Device] a = often, sometimes, hardly ever and [NEWS_Device] b = often, sometimes, hardly ever then ask:

[NewsDigPref] Do you prefer to get your weather information

a.) on a desktop or laptop

b.) on a mobile device (such as a smartphone or tablet)

[NEWS_PLATFORM] And how often do you… [randomize options]

	Often	Sometimes	Hardly Ever	Never	No Answer
a.) Read weather in print?					
b.) Listen to weather on the radio?					
c.) Watch local television weather?					
d.) Watch national evening network television weather?					
e.) Watch cable television weather (such as The Weather Channel, WeatherNation, or AccuWeather)?					
f.) Get weather from a social networking site (such as Facebook or Twitter)?					
g.) Get weather from a website or application?					

[Randomize order of PLATFROM_DAILY/WIND]

[PLATFORM_Daily] Which of the following would you say you prefer for getting *daily* weather information? (choose one)

Reading weather in a print newspaper

Listening to weather on the radio

Watching weather on television

Getting weather from a social networking site (such as Facebook or Twitter)

Getting weather from a website or app

[PLATFORM_Wind] Which of the following would you say you prefer for getting *high wind* information? (choose one)

Reading weather in a print newspaper

Listening to weather on the radio

Watching weather on television

Getting weather from a social networking site (such as Facebook or Twitter)

Getting weather from a website or app

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[H_conf_info] Thinking about the past 12 months, how much conflicting or contradictory information ***about high winds*** have you heard from each of the following sources?

- Online news (such as New York Times website, CNN.com)
- Social media (such as Facebook, Youtube, Twitter, or blogs)
- Weather websites (such as weather.com, weather.gov, accuweather.com, wunderground.com)
- Local Television Weather
- Cable Television Weather (such as The Weather Channel, WeatherNation, or AccuWeather)
- Print newspapers or magazines
- Family, friends, or co-workers
- Weather Phone Apps
- Other sources

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[H_conf_actions] Thinking about the past 12 months, how much conflicting or contradictory information ***about what actions to take during high winds*** have you heard from each of the following sources?

- Online news (such as New York Times website, CNN.com)
- Social media (such as Facebook, Youtube, Twitter, or blogs)
- Weather websites (such as weather.com, weather.gov, accuweather.com, wunderground.com)
- Local Television Weather
- Cable Television Weather (such as The Weather Channel, WeatherNation, or AccuWeather)
- Print newspapers or magazines
- Family, friends, or co-workers
- Weather Phone Apps
- Other sources

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Part V – Demographics

age: What is your age?

Under 18 years

18 to 24 years

25 to 34 years

35 to 44 years

45 to 54 years

55 to 64 years

Age 65 or older

edu: What is the highest level of education you have completed?

1 – Elementary, junior high or some high school

2 - High school graduate/GED

3 - Some college/vocational school

4 - College graduate

5 - Some graduate work

6 - Master's degree

7 - Doctorate (of any type)

8 - Other degree [Verbatim]

gend: Are you male or female?

1 - Female

2 – Male

3 – Prefer Not to Answer

4 – Other [Verbatim]

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hisp: Are you, yourself, of Hispanic or Latinx origin or descent, such as Mexican, Puerto Rican, Cuban, South American, Central American, or other Spanish background?

0 - No, I am not of Hispanic or Latino origin or descent.

1 - Yes, I am of Hispanic or Latino origin or descent.

race: Which of the following best describes your race?

1 - White

2 - Black or African American

3 - American Indian or Alaska Native

4 - Asian

5 - Native Hawaiian or Pacific Islander

6 – Other (please explain) [Verbatim]

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Income: Thinking specifically about the past 12 months, what was your annual household income from all sources?

1 - Less than $24,999

2 - $25,000 – $49,999

3 - $50,000 – $99,999

4 - $100,000 – $199,999

5 - $200,000 or more

Appendix 2: Excessive Heat – Warm Regions Demographic Information

Demographic Information:

Variable	*N*	%
Gender:		
Female	208	76.2
Male	63	23.1
Annual Household Income:		
Less than $24,999	71	25.8
$25,000 - $49,999	96	34.9
$50,000 – $99,999	77	28.0
$100,000 - $199,999	26	9.5
$200,000+	5	1.8
Race:		
Caucasian American	224	81.5
Black or African American	33	12.0
American Indian or Alaska Native	3	1.1
Asian	14	5.1
Native Hawaiian or Pacific Islander	0	0
Other (or not reported)	1	0.4
Hispanic Origin:		
Yes	24	8.7
No	251	91.3
Educational Background:		
Elementary, junior high, or some high school.	12	2.5
High School Graduate/GED	63	26
Some College/vocational school	80	32.9
College graduate	74	26.7
Some graduate work	17	1.4
Master's Degree	21	7.6
Doctorate (of any type) or Professional Degree	4	2.9
Other Degree	3	1.1
Age Breakdown:		
18-24 years old	22	8.0
25-34 years old	46	16.7
35-44 years old	46	16.7
45-54 years old	38	13.8
55-64 years old	63	22.9
65+ years old	60	21.8
Primary Residence:		
Apartment	44	16.0
Single family home	180	65.5
Duplex	4	1.5

Mobile home	35	12.7
Condo or townhouse	12	4.4
Other	0	0.0
Location of Primary Residence:		
Urban location	65	23.7
Suburban location	133	48.5
Rural location	76	27.7
Environment Near Residence:		
River, stream, or creek	59	21.5
Lake or pond	52	18.9
Ocean or coastal community	30	10.9
Mountain	32	11.6
Desert	16	5.8
Not Applicable (or not reported)	86	31.3
Number of Adults (18+) in Household:		
One	70x1	25.4
Two	153x2	55.6
Three	39x3	14.2
Four	9x4	3.3
Five	3x5	1.1
Eleven	1	0.4
Number of Children (<17) in Household:		
Zero	180	65.5
One	40	14.5
Two	28	10.2
Three	22	8.0
Four	3	1.1
Five	1	0.4
Seven	1	0.4
Past Experiences with Heat:		
No	221	80.4
Yes, for you personally	31	11.3
Yes, for family	19	6.9
Yes, for neighbors	13	4.7
Yes, for close friends/associates	13	4.7
***Note**:* The past experiences with heat question allowed participants to select more than one option.		

Weather Information Habits:

Variable	*N*	%
How closely do you follow your local weather?		
Not at all closely	4	1.5
Not very closely	16	5.9
Somewhat closely	83	30.6
Very closely	166	62.0
How closely do you follow the weather of friends/fam?		
Not at all closely	25	9.4
Not very closely	49	18.4
Somewhat closely	107	40.2
Very closely	85	32.0
How closely do you follow national weather?		
Not at all closely	18	6.7
Not very closely	64	23.7
Somewhat closely	98	36.3
Very closely	90	33.3
How often do you get weather info from a computer?		
Never	22	8.1
Hardly Ever	24	8.9
Sometimes	99	36.5
Often	126	45.8
How often do you get weather info from a mobile device?		
Never	38	15.2
Hardly Ever	20	8.0
Sometimes	60	24.0
Often	132	52.8
Which do you prefer? Computer or mobile device?		
Computer	125	55.3
Mobile Device	101	44.7
How often do you read weather in print?		
Never	75	28.7
Hardly Ever	64	24.5
Sometimes	63	24.1
Often	59	22.6
How often do you listen to weather on the radio?		
Never	45	17.0
Hardly Ever	59	22.3
Sometimes	89	33.6
Often	72	27.2

How often do you watch local television weather?		
Never	23	8.5
Hardly Ever	21	7.7
Sometimes	58	21.3
Often	170	62.5
How often do you watch national evening weather?		
Never	37	13.9
Hardly Ever	36	13.5
Sometimes	82	30.7
Often	112	41.9
How often do you watch cable television weather?		
Never	38	14.3
Hardly Ever	44	16.5
Sometimes	87	32.7
Often	97	36.5
How often do you get weather from social media?		
Never	93	35.8
Hardly Ever	45	17.3
Sometimes	70	26.9
Often	52	20.0
How often do you get weather from a website or app?		
Never	32	11.9
Hardly Ever	30	11.2
Sometimes	74	27.6
Often	132	49.3
Which do you prefer for getting daily weather info?		
Print	4	1.5
Radio	11	4.0
Television	143	52.4
Social Media	11	4.0
Website or app	104	38.1
Which do you prefer for getting excessive heat info?		
Print	5	1.9
Radio	12	4.5
Television	147	55.5
Social Media	15	5.7
Website or app	86	32.5

Theoretical Risk Variables:

Variable	*Mean*	*Standard Deviation*
Perceived Susceptibility:		
You	6.87	2.79
Your home/apartment	5.89	2.88
Your local community	6.50	2.65
Perceived Severity:		
You	6.84	2.82
Your home/apartment	5.88	2.93
Your local community	6.39	2.75
Affect:		
70-80 degree day?	3.94	1.00
80-90 degree day?	2.51	1.23
Multiple days above 95 degrees?	1.83	1.30
Possibility of Experiencing Heat Impacts in Future:	42.96%	27.53
Adaptive Behaviors:		
I use A/C during excessive heat.	8.97	1.97
I don't use A/C during excessive heat.	2.80	2.76
I am aware of resources offered by my community for staying cool	6.61	3.08
I don't feel safe leaving my house to stay cool during excessive heat.	5.05	3.26
My job requires me to work outside.	3.24	3.22
I take proper precautions when required to work outdoors in excessive heat.	8.40	1.91
I avoid being outside during excessive heat	8.32	2.42
I usually stay inside during excessive heat.	8.55	2.18
I make an effort to stay hydrated.	9.06	1.43
Excessive heat influences me to change my schedule.	6.64	2.94
Gathering Capacity:		
I can't make sense of information about excessive heat.	3.11	2.65
When it comes to information about excessive heat, I can't separate facts from fiction.	3.73	2.92
Most information about excessive heat is too technical for me to understand.	3.34	2.78
I can't understand information about excessive heat even if I make an effort.	3.04	2.74
Subjective Norms:		
My friends expect me to know something about excessive heat.	6.14	2.91

Most people who are important to me think I should know something about excessive heat.	6.45	2.86
My family expects me to know something about excessive heat.	6.68	2.81

Appendix 3: Excessive Heat – Cold Regions Demographic Information

Demographic Information:

Variable	*N*	%
Gender:		
Female	192	68.8
Male	83	30.1
Annual Household Income:		
Less than $24,999	80	29.0
$25,000 - $49,999	94	34.1
$50,000 – $99,999	81	29.3
$100,000 - $199,999	19	6.9
$200,000+	2	0.7
Race:		
Caucasian American	240	86.6
Black or African American	26	9.4
American Indian or Alaska Native	0	0
Asian	9	3.2
Native Hawaiian or Pacific Islander	0	0
Other (or not reported)	4	1.4
Hispanic Origin:		
Yes	18	6.5
No	259	93.5
Educational Background:		
Elementary, junior high, or some high school.	7	2.5
High School Graduate/GED	72	26
Some College/vocational school	91	32.9
College graduate	74	26.7
Some graduate work	4	1.4
Master's Degree	21	7.6
Doctorate (of any type) or Professional Degree	8	2.9
Age Breakdown:		
18-24 years old	20	7.2
25-34 years old	47	17.0
35-44 years old	33	11.9
45-54 years old	41	14.8
55-64 years old	61	22.0
65+ years old	75	27.1
Primary Residence:		
Apartment	53	19.1
Single family home	189	68.2
Duplex	10	3.6
Mobile home	10	3.6

Condo or townhouse	10	3.6
Other	5	1.8
Location of Primary Residence:		
Urban location	73	26.4
Suburban location	129	46.7
Rural location	74	26.8
Environment Near Residence:		
River, stream, or creek	77	27.6
Lake or pond	35	12.5
Ocean or coastal community	18	6.5
Mountain	30	10.8
Desert	2	0.7
Not Applicable (or not reported)	117	41.9
Number of Adults (18+) in Household:		
One	80	28.7
Two	135	48.4
Three	44	15.8
Four	12	4.3
Five	4	1.4
Six	1	0.4
Number of Children (<17) in Household:		
Zero	209	75.5
One	39	14.1
Two	20	7.2
Three	7	2.5
Four	2	0.7
Past Experiences with Heat:		
No	232	83.2
Yes, for you personally	30	10.8
Yes, for family	14	5.0
Yes, for neighbors	11	3.9
Yes, for close friends/associates	12	4.3
***Note**:* The past experiences with heat question allowed participants to select more than one option.		

Weather Information Habits:

Variable	*N*	%
How closely do you follow your local weather?		
Not at all closely	5	1.8
Not very closely	18	6.6
Somewhat closely	89	32.5
Very closely	162	59.1
How closely do you follow the weather of friends/fam?		
Not at all closely	28	10.5
Not very closely	59	22.1
Somewhat closely	101	37.8
Very closely	79	29.6
How closely do you follow national weather?		
Not at all closely	25	9.1
Not very closely	65	23.7
Somewhat closely	118	43.1
Very closely	66	24.1
How often do you get weather info from a computer?		
Never	24	8.9
Hardly Ever	35	13.0
Sometimes	91	33.8
Often	119	44.2
How often do you get weather info from a mobile device?		
Never	71	28.3
Hardly Ever	13	5.2
Sometimes	58	23.1
Often	109	43.4
Which do you prefer? Computer or mobile device?		
Computer	96	48.5
Mobile Device	102	51.5
How often do you read weather in print?		
Never	89	34.1
Hardly Ever	60	23.0
Sometimes	53	20.3
Often	59	22.6
How often do you listen to weather on the radio?		
Never	57	21.5
Hardly Ever	58	21.9
Sometimes	86	32.5
Often	64	24.2

How often do you watch local television weather?		
Never	20	7.5
Hardly Ever	28	10.5
Sometimes	61	22.8
Often	158	59.2
How often do you watch national evening weather?		
Never	41	15.4
Hardly Ever	47	17.6
Sometimes	73	27.3
Often	106	39.7
How often do you watch cable television weather?		
Never	48	18.5
Hardly Ever	41	15.8
Sometimes	78	30.0
Often	93	35.8
How often do you get weather from social media?		
Never	113	43.3
Hardly Ever	49	18.8
Sometimes	53	20.3
Often	46	17.6
How often do you get weather from a website or app?		
Never	40	15.2
Hardly Ever	24	9.1
Sometimes	62	23.5
Often	138	52.3
Which do you prefer for getting daily weather info?		
Print	8	2.9
Radio	17	6.2
Television	138	50.2
Social Media	9	3.3
Website or app	103	37.5
Which do you prefer for getting excessive heat info?		
Print	8	3.0
Radio	19	7.0
Television	144	53.1
Social Media	11	4.1
Website or app	89	32.8

Theoretical Risk Variables:

Variable	*Mean*	*Standard Deviation*
Perceived Susceptibility:		
You	6.45	2.891
Your home/apartment	5.57	2.976
Your local community	6.14	2.870
Perceived Severity:		
You	6.14	2.986
Your home/apartment	5.28	2.966
Your local community	5.58	2.870
Affect:		
60-70 degree day?	4.34	0.910
80-90 degree day?	3.12	1.115
Multiple days above 95 degrees?	2.12	1.236
Possibility of Experiencing Heat Impacts in Future:	34.43%	26.169
Adaptive Behaviors:		
I use A/C during excessive heat.	8.73	2.20
I don't use A/C during excessive heat.	3.16	2.99
I am aware of resources offered by my community for staying cool	6.17	3.19
I don't feel safe leaving my house to stay cool during excessive heat.	4.65	3.18
My job requires me to work outside.	2.97	3.06
I take proper precautions when required to work outdoors in excessive heat.	8.27	2.09
I avoid being outside during excessive heat	8.02	2.38
I usually stay inside during excessive heat.	8.26	2.21
I make an effort to stay hydrated.	8.85	1.73
Excessive heat influences me to change my schedule.	7.01	2.81
Gathering Capacity:		
I can't make sense of information about excessive heat.	3.06	2.65
When it comes to information about excessive heat, I can't separate facts from fiction.	3.65	2.83
Most information about excessive heat is too technical for me to understand.	3.32	2.86
I can't understand information about excessive heat even if I make an effort.	2.91	2.71
Subjective Norms:		
My friends expect me to know something about excessive heat.	5.81	3.04

Most people who are important to me think I should know something about excessive heat.	6.31	2.96
My family expects me to know something about excessive heat.	6.21	3.08

Appendix 4: High Wind Demographic Information

***Demographic Information*:**

Variable	*N*	%
Gender:		
Female	735	67.3
Male	349	32.4
Annual Household Income:		
Less than $24,999	219	20.3
$25,000 - $49,999	346	32.1
$50,000 – $99,999	368	24.1
$100,000 - $199,999	114	10.6
$200,000+	31	2.9
Race:		
Caucasian American	898	83.8
Black or African American	78	7.3
American Indian or Alaska Native	9	0.8
Asian	55	5.1
Native Hawaiian or Pacific Islander	2	0.2
Other (or not reported)	30	2.8
Hispanic Origin:		
Yes	92	8.6
No	984	91.4
Educational Background:		
Elementary, junior high, or some high school.	15	1.4
High School Graduate/GED	190	17.7
Some College/vocational school	321	29.9
College graduate	346	32.2
Some graduate work	33	3.1
Master's Degree	138	12.8
Doctorate (of any type) or Professional Degree	29	2.7
Other Degree	3	0.3
Age Breakdown:		
18-24 years old	112	10.4
25-34 years old	205	19.0
35-44 years old	189	17.5
45-54 years old	165	15.3
55-64 years old	217	20.1
65+ years old	190	17.6
Primary Residence:		
Apartment	200	18.5
Single family home	727	67.4
Duplex	28	2.6

Mobile home	42	3.9
Condo or townhouse	72	6.7
Other	10	0.9
Location of Primary Residence:		
Urban location	249	23.3
Suburban location	536	50.2
Rural location	283	26.5
Environment Near Residence:		
River, stream, or creek	193	17.9
Lake or pond	151	14.0
Ocean or coastal community	77	7.1
Mountain	95	8.8
Forest/Wooded Area	207	19.2
Not Applicable (or not reported)	356	33.0
Number of Adults (18+) in Household:		
One	295	27.4
Two	530	49.2
Three	166	15.4
Four	68	6.3
Five	13	1.2
Six	4	0.4
Seven	1	0.1
Number of Children (≤17) in Household:		
Zero	749	69.6
One	165	15.3
Two	104	9.7
Three	43	4.0
Four	8	0.7
Five	4	0.4
Six	1	0.1
Nine	1	0.1
Past Experiences with Wind:		
No	475	44.0
Yes, for you personally	295	27.3
Yes, for family	250	23.2
Yes, for neighbors	289	26.8
Yes, for close friends/associates	184	17.1
***Note**:* The past experiences with wind question allowed participants to select more than one option.		

***Weather Information Habits*:**

Variable	*N*	%
How closely do you follow your local weather?		
Not at all closely	21	1.9
Not very closely	71	6.6
Somewhat closely	394	36.6
Very closely	591	54.9
How closely do you follow the weather of friends/fam?		
Not at all closely	92	8.7
Not very closely	233	22.0
Somewhat closely	486	45.9
Very closely	247	23.3
How closely do you follow national weather?		
Not at all closely	95	8.9
Not very closely	296	27.6
Somewhat closely	454	42.3
Very closely	228	21.2
How often do you get weather info from a computer?		
Never	76	7.1
Hardly Ever	164	15.3
Sometimes	388	36.3
Often	441	41.3
How often do you get weather info from a mobile device?		
Never	150	14.5
Hardly Ever	78	7.6
Sometimes	259	25.1
Often	546	52.9
Which do you prefer? Computer or mobile device?		
Computer	321	36.4
Mobile Device	561	63.6
How often do you read weather in print?		
Never	363	34.7
Hardly Ever	273	26.1
Sometimes	260	24.9
Often	150	14.3
How often do you listen to weather on the radio?		
Never	192	18.1
Hardly Ever	272	25.7
Sometimes	380	35.9
Often	214	20.2

How often do you watch local television weather?		
Never	98	9.2
Hardly Ever	131	12.3
Sometimes	283	26.6
Often	550	51.8
How often do you watch national evening weather?		
Never	184	17.5
Hardly Ever	199	18.9
Sometimes	317	30.1
Often	353	33.5
How often do you watch cable television weather?		
Never	186	17.6
Hardly Ever	231	21.9
Sometimes	325	30.7
Often	315	29.8
How often do you get weather from social media?		
Never	381	36.7
Hardly Ever	193	18.6
Sometimes	272	26.2
Often	191	18.4
How often do you get weather from a website or app?		
Never	106	10.1
Hardly Ever	102	9.7
Sometimes	320	30.4
Often	523	49.8
Which do you prefer for getting daily weather info?		
Print	16	1.5
Radio	69	6.4
Television	458	42.6
Social Media	41	3.8
Website or app	492	45.7
Which do you prefer for getting high wind info?		
Print	14	1.3
Radio	80	7.6
Television	485	46.2
Social Media	49	4.7
Website or app	421	40.1

Theoretical Risk Variables:

Variable	*Mean*	*Standard Deviation*
Perceived Susceptibility:		
You	4.92	2.74
Your home/apartment	5.73	2.67
Your local community	6.10	2.59
Perceived Severity:		
You	4.97	2.72
Your home/apartment	5.62	2.64
Your local community	5.95	2.64
Affect:		
Day without wind?	3.81	0.95
Breezy day?	3.66	0.85
High wind day?	2.28	1.02
Possibility of Experiencing Wind Impacts in Future:	48.58%	27.46
Adaptive Behaviors:		
My car handles high winds very well.	6.19	2.30
Driving in high winds makes me nervous.	7.09	2.52
I have Homeowner's Insurance or Renter's Insurance in case high winds damage my home.	7.24	3.19
I prepare for power outages.	6.56	2.76
My job requires me to work outside.	2.94	2.92
I take proper precautions when required to work outdoors in high winds	6.61	2.62
I avoid being outside during high winds.	6.02	3.08
I regularly trim the trees in my backyard.	4.23	3.02
I regularly have my trees checked for wounds, decay, or structural damage.	5.40	2.90
High winds influence me to change my schedule.	6.80	2.68
I live near a wooded area with trees.	5.43	3.31
Gathering Capacity:		
I can't make sense of information about high winds.	3.39	2.47
When it comes to information about high winds, I can't separate facts from fiction.	3.75	2.61
Most information about high winds is too technical for me to understand.	3.54	2.55
I can't understand information about high winds even if I make an effort.	3.13	2.47

Subjective Norms:		
My friends expect me to know something about excessive heat.	4.93	2.91
Most people who are important to me think I should know something about high winds.	5.28	2.85
My family expects me to know something about high winds.	5.43	2.87

Appendix 5: Excessive Heat Prototype Summaries

The following tables provide means for the variables collected for each prompt. This information can provide more behavioral and perceptual information associated with all of the prototypes. For example, these means can be compared to the Current System data found in each hazard specific chapter. While this information is not associated with statistical testing, it can provide a rough estimate of how individuals understand the headlines within each prototype.

Prototype 1:

P1				
Warm Climate				
	Base	**Watch**	**Advisory**	**Warning**
Overall Action	2.68	2.77	3.08	3.49
Monitor	3.92	4.07	4.16	4.37
Prepare	3.76	3.82	3.93	4.05
Prot. Action	3.76	3.75	3.99	4.26
Risk	7.23	7.40	7.82	8.14
Confidence	7.73	7.88	8.21	8.55
Urgency	7.45	7.72	7.97	8.31
Probability	73.15	75.54	77.96	80.96
Cold Climate				
	Base	**Watch**	**Advisory**	**Warning**
Overall Action	2.63	2.66	3.06	3.45
Monitor	3.91	3.86	3.98	4.16
Prepare	3.62	3.58	3.79	3.90
Prot. Action	3.63	3.49	3.80	4.06
Risk	6.90	6.80	7.17	7.56
Confidence	7.29	7.35	7.97	8.10
Urgency	6.81	6.53	7.27	7.50
Probability	66.53	66.49	70.94	76.74

Prototype 2:

P2				
Warm Climate				
	Base	**Watch**	**Advisory**	**Warning**
Overall Action	3.08	3.19	3.26	3.74
Monitor	4.13	4.21	4.27	4.43
Prepare	4.16	4.12	4.20	4.37
Prot. Action	4.10	4.10	4.17	4.34
Risk	7.65	7.76	8.09	8.28
Confidence	7.99	8.33	8.64	8.71
Urgency	7.64	7.84	8.21	8.48
Probability	75.81	77.34	81.36	83.22
Cold Climate				
	Base	**Watch**	**Advisory**	**Warning**
Overall Action	2.26	2.44	2.87	3.21
Monitor	4.06	4.08	4.06	4.18
Prepare	3.70	3.73	3.87	3.87
Prot. Action	3.50	3.51	3.72	3.96
Risk	6.81	7.00	7.29	7.46
Confidence	7.66	7.69	7.91	8.06
Urgency	6.77	6.83	7.35	7.71
Probability	69.51	72.17	77.71	78.98

Prototype 3:

P3				
Warm Climate				
	Base	**Watch**	**Advisory**	**Warning**
Overall Action	2.60	2.90	3.01	3.26
Monitor	3.79	3.84	3.94	4.06
Prepare	3.59	3.67	3.74	3.91
Prot. Action	3.64	3.75	3.77	4.01
Risk	6.79	7.12	7.39	7.57
Confidence	7.48	7.73	7.89	8.14
Urgency	6.83	7.10	7.28	7.68
Probability	72.43	75.74	78.15	81.07
Cold Climate				
	Base	**Watch**	**Advisory**	**Warning**
Overall Action	2.57	2.50	2.89	3.54
Monitor	3.97	3.98	4.20	4.27
Prepare	3.60	3.64	3.98	4.06
Prot. Action	3.64	3.60	3.98	4.14
Risk	6.74	6.71	7.29	7.68
Confidence	7.23	7.18	7.77	8.13
Urgency	6.44	6.73	7.31	7.84
Probability	70.54	71.68	78.83	80.96

Prototype 4:

P4				
Warm Climate				
	Base	**Watch**	**Advisory**	**Warning**
Overall Action	2.89	2.84	3.07	3.56
Monitor	3.92	4.02	4.06	4.27
Prepare	3.87	3.86	3.94	4.09
Prot. Action	3.92	3.89	4.02	4.31
Risk	7.28	7.45	7.61	8.08
Confidence	7.72	7.76	8.14	8.42
Urgency	7.36	7.47	7.72	8.31
Probability	75.31	76.63	79.66	83.24
Cold Climate				
	Base	**Watch**	**Advisory**	**Warning**
Overall Action	2.50	2.66	2.99	3.39
Monitor	3.81	3.97	4.00	4.17
Prepare	3.64	3.69	3.79	4.04
Prot. Action	3.53	3.67	3.72	4.08
Risk	6.55	6.57	6.84	7.41
Confidence	7.09	7.36	7.77	8.20
Urgency	6.39	6.79	7.11	7.63
Probability	66.25	69.52	74.08	79.96

Appendix 6: High Wind Prototype Summaries

The following tables provide means for the variables collected for each prompt. This information can provide more behavioral and perceptual information associated with all of the prototypes. For example, these means can be compared to the Current System data found in each hazard specific chapter. While this information is not associated with statistical testing, it can provide a rough estimate of how individuals understand the headlines within each prototype.

Prototype 1:

P1				
Warning with a Downgrade:				
	Base	**Watch**	**Warning**	**Advisory**
Overall Action	2.87	2.79	3.37	3.08
Monitor	3.79	3.71	3.93	3.61
Prepare	3.61	3.43	3.65	3.21
Some Action	3.47	3.30	3.61	3.15
Prot. Action	3.21	3.11	3.56	3.16
Risk	6.02	5.91	6.69	5.82
Confidence	6.96	6.77	7.55	7.05
Urgency	6.34	6.22	7.08	6.15
Probability	60.76	59.67	70.88	63.90
Advisory with an Upgrade:				
	Base	**Watch**	**Advisory**	**Warning**
Overall Action	2.70	2.72	2.97	3.50
Monitor	3.87	3.85	3.74	3.98
Prepare	3.53	3.47	3.37	3.70
Some Action	3.31	3.25	3.15	3.43
Prot. Action	3.04	3.01	3.08	3.43
Risk	5.93	6.32	5.85	6.45
Confidence	6.94	7.28	6.97	7.10
Urgency	6.25	6.52	6.11	6.55
Probability	58.95	56.35	63.51	66.13

Prototype 2:

P2				
Warning with a Downgrade:				
	Base	**Watch**	**Warning**	**Advisory**
Overall Action	2.77	2.78	3.20	2.87
Monitor	3.95	3.89	4.05	3.64
Prepare	3.72	3.58	3.84	3.26
Some Action	3.58	3.45	3.67	3.11
Prot. Action	3.19	3.11	3.66	3.09
Risk	6.22	6.12	6.95	5.89
Confidence	6.82	6.90	7.49	6.95
Urgency	6.45	6.32	7.13	5.99
Probability	59.68	58.88	70.04	61.70
Advisory with an Upgrade:				
	Base	**Watch**	**Advisory**	**Warning**
Overall Action	2.72	2.82	3.04	3.35
Monitor	3.80	3.80	3.61	3.96
Prepare	3.56	3.58	3.35	3.71
Some Action	3.44	3.42	3.14	3.61
Prot. Action	3.13	3.19	3.06	3.53
Risk	6.06	6.29	5.90	6.73
Confidence	6.99	7.03	6.85	7.28
Urgency	6.47	6.65	6.26	7.16
Probability	60.65	61.67	63.32	68.98

Prototype 3:

P3				
Warning with a Downgrade:				
	Base	**Watch**	**Warning**	**Advisory**
Overall Action	2.92	2.81	3.48	2.87
Monitor	3.99	3.87	4.22	3.69
Prepare	3.77	3.65	3.99	3.20
Some Action	3.61	3.42	3.90	3.18
Prot. Action	3.11	3.28	3.88	3.10
Risk	6.24	6.12	7.10	5.78
Confidence	6.98	6.79	7.65	6.63
Urgency	6.57	6.31	7.50	5.98
Probability	60.46	57.53	71.08	59.32
Advisory with an Upgrade:				
	Base	**Watch**	**Advisory**	**Warning**
Overall Action	2.70	2.75	2.66	3.51
Monitor	3.80	3.72	3.44	4.02
Prepare	3.65	3.37	3.10	3.79
Some Action	3.45	3.17	2.85	3.69
Prot. Action	3.11	3.01	2.75	3.60
Risk	6.16	5.95	5.34	6.87
Confidence	6.90	6.72	6.51	7.44
Urgency	6.30	6.08	5.40	7.13
Probability	59.25	55.40	55.92	70.04

Prototype 4:

P4				
Warning with a Downgrade:				
	Base	**Watch**	**Warning**	**Advisory**
Overall Action	2.62	2.66	3.53	2.95
Monitor	3.75	3.74	4.16	3.69
Prepare	3.60	3.48	3.94	3.29
Some Action	3.41	3.32	3.78	3.18
Prot. Action	3.10	3.01	3.77	3.14
Risk	5.81	5.78	7.02	5.79
Confidence	6.69	6.57	7.58	6.93
Urgency	6.05	5.89	7.30	6.01
Probability	57.33	56.61	73.35	62.48
Advisory with an Upgrade:				
	Base	**Watch**	**Advisory**	**Warning**
Overall Action	2.80	2.89	3.03	3.61
Monitor	3.82	3.81	3.71	4.07
Prepare	3.55	3.50	3.42	3.85
Some Action	3.40	3.29	3.20	3.78
Prot. Action	3.17	3.10	3.14	3.76
Risk	5.88	5.92	5.91	7.03
Confidence	6.69	6.67	6.77	7.52
Urgency	6.20	6.08	6.06	7.23
Probability	58.20	57.15	63.07	72.01

Appendix 7: Excessive Heat (Cold Regions) – Ordinal Logistic Regression Models

Excessive Heat - Cold, Advisory Upgrade, Prompt 2 - Advisory

	(1) v2_1	(2) v2_2_1	(3) v2_2_2	(4) v2_2_3
main				
v1_1	6.387***			
	(16.95)			
proto1	0.701	0.941	1.233	0.748
	(-1.32)	(-0.22)	(0.75)	(-1.05)
proto2	0.664	1.234	1.649*	0.997
	(-1.51)	(0.72)	(1.73)	(-0.01)
proto3	0.519**	0.976	1.385	1.008
	(-2.44)	(-0.09)	(1.14)	(0.03)
proto4	0.863	1.402	1.739*	1.566
	(-0.56)	(1.19)	(1.94)	(1.63)
RP_SusSev	1.008	1.005	1.002	1.003
	(1.14)	(0.76)	(0.34)	(0.43)
RP_Aff1	0.964	0.992	1.050	1.066
	(-0.81)	(-0.17)	(1.01)	(1.38)
RP_Aff2	1.003	0.992	0.985	0.983
	(0.12)	(-0.31)	(-0.58)	(-0.66)
AdptBeh	1.009*	1.007	1.009	1.009
	(1.67)	(1.14)	(1.51)	(1.54)
exppast1	0.957	0.851	0.917	1.077
	(-0.18)	(-0.59)	(-0.33)	(0.30)
AttInfo	0.994	1.016	1.024*	1.010
	(-0.48)	(1.09)	(1.67)	(0.69)
GathCap1	0.984	0.987	0.998	1.010
	(-1.47)	(-1.13)	(-0.16)	(0.88)
SubjNorm1	1.004	1.008	1.014	1.017
	(0.34)	(0.66)	(1.10)	(1.42)
age	0.892*	0.944	0.935	0.991
	(-1.90)	(-0.92)	(-1.05)	(-0.14)
Childinhome	1.153	0.773	0.949	1.156
	(0.66)	(-1.09)	(-0.22)	(0.63)
female	0.893	1.332	0.966	0.975
	(-0.58)	(1.42)	(-0.17)	(-0.13)
college	1.224	0.796	0.972	0.824
	(1.12)	(-1.17)	(-0.15)	(-1.03)
white	1.126	1.127	1.401	0.817
	(0.44)	(0.40)	(1.23)	(-0.76)
Info	0.902	1.014	0.963	1.163
	(-0.59)	(0.07)	(-0.20)	(0.83)
v1_2_1		8.577***		

		(16.65)		
v1_2_2			10.01***	
			(18.18)	
v1_2_3				7.340***
				(17.84)
/				
cut1	4.944*	37.71***	216.4***	90.89***
	(1.87)	(3.91)	(5.85)	(4.99)
cut2	67.02***	171.9***	1330.4***	459.0***
	(4.82)	(5.50)	(7.69)	(6.67)
cut3	588.6***	2476.6***	21944.3***	6210.3***
	(7.07)	(8.05)	(10.11)	(9.11)
cut4	1828.6***	28270.8***	264226.5***	37274.6***
	(8.14)	(10.04)	(11.93)	(10.63)
N	542	540	540	538
pseudo R^2	0.315	0.354	0.394	0.349
Chi-Squared	523.0	520.4	634.8	568.5

Exponentiated coefficients; *z* statistics in parentheses
* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Excessive Heat - Cold, Advisory Upgrade, Prompt 3 – Advisory Cont.

	(1) v3_1	(2) v3_2_1	(3) v3_2_2	(4) v3_2_3
main				
v1_1	2.598***			
	(12.12)			
proto1	1.139	0.933	1.289	1.029
	(0.52)	(-0.25)	(0.95)	(0.11)
proto2	1.050	0.772	1.421	1.032
	(0.19)	(-0.92)	(1.28)	(0.12)
proto3	0.743	1.253	1.626*	1.223
	(-1.17)	(0.78)	(1.75)	(0.74)
proto4	1.044	1.040	1.256	0.926
	(0.17)	(0.14)	(0.85)	(-0.29)
RP_SusSev	1.006	1.006	1.008	1.010
	(0.97)	(0.79)	(1.13)	(1.55)
RP_Aff1	0.928*	0.992	1.044	1.062
	(-1.72)	(-0.17)	(0.93)	(1.37)
RP_Aff2	0.975	0.970	0.981	0.978
	(-1.11)	(-1.22)	(-0.77)	(-0.92)
AdptBeh	1.013***	0.999	1.007	1.006
	(2.69)	(-0.13)	(1.23)	(1.11)
exppast1	0.684*	0.722	0.677	0.900
	(-1.66)	(-1.17)	(-1.54)	(-0.43)
AttInfo	1.026**	1.035***	1.053***	1.027**
	(2.11)	(2.59)	(3.91)	(1.96)
GathCap1	0.979**	0.987	0.987	0.981*
	(-2.11)	(-1.13)	(-1.19)	(-1.71)
SubjNorm1	1.005	1.030**	1.033***	1.018
	(0.43)	(2.37)	(2.68)	(1.49)
age	0.889**	0.947	0.914	0.885**
	(-2.07)	(-0.88)	(-1.47)	(-1.97)
Childinhome	1.014	0.849	1.062	0.907
	(0.07)	(-0.71)	(0.27)	(-0.44)
female	1.180	0.767	0.976	0.972
	(0.92)	(-1.30)	(-0.12)	(-0.15)
college	1.725***	0.873	0.921	1.048
	(3.14)	(-0.70)	(-0.45)	(0.26)
white	1.490	0.716	0.989	0.910
	(1.59)	(-1.15)	(-0.04)	(-0.35)
Info	1.134	0.721*	1.028	1.104
	(0.77)	(-1.77)	(0.15)	(0.56)
v1_2_1		5.139***		
		(14.59)		
v1_2_2			3.977***	
			(14.46)	

v1_2_3				4.048***
				(15.29)
/				
cut1	2.329	3.562	30.83***	10.34***
	(1.06)	(1.44)	(4.02)	(2.75)
cut2	10.46***	14.31***	104.8***	33.94***
	(2.92)	(3.03)	(5.47)	(4.15)
cut3	55.34***	161.5***	906.4***	295.7***
	(4.95)	(5.65)	(7.77)	(6.53)
cut4	198.3***	1092.4***	5386.9***	1815.9***
	(6.42)	(7.58)	(9.48)	(8.37)
N	543	542	539	536
pseudo R^2	0.165	0.279	0.258	0.249
Chi-Squared	284.3	395.0	391.8	383.0

Exponentiated coefficients; *z* statistics in parentheses
* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Excessive Heat - Cold, Advisory Upgrade, Prompt 4 - Warning

	(1) v4_1	(2) v4_2_1	(3) v4_2_2	(4) v4_2_3
main				
v1_1	1.872***			
	(8.52)			
proto1	0.841	1.031	1.082	1.128
	(-0.69)	(0.11)	(0.29)	(0.45)
proto2	0.667	0.908	0.972	0.864
	(-1.57)	(-0.34)	(-0.10)	(-0.54)
proto3	0.871	1.058	1.282	0.911
	(-0.53)	(0.19)	(0.91)	(-0.33)
proto4	0.801	1.257	1.529	1.174
	(-0.87)	(0.77)	(1.53)	(0.58)
RP_SusSev	1.011*	1.019**	1.023***	1.023***
	(1.66)	(2.56)	(3.30)	(3.16)
RP_Aff1	0.926*	0.958	0.992	1.036
	(-1.79)	(-0.89)	(-0.18)	(0.79)
RP_Aff2	0.975	0.954*	0.999	0.951**
	(-1.11)	(-1.82)	(-0.06)	(-2.02)
AdptBeh	1.004	0.998	1.007	1.004
	(0.89)	(-0.32)	(1.24)	(0.72)
exppast1	0.698	0.898	0.739	0.843
	(-1.55)	(-0.38)	(-1.16)	(-0.66)
AttInfo	1.027**	1.033**	1.041***	1.056***
	(2.17)	(2.39)	(3.12)	(4.09)
GathCap1	0.981*	0.968***	0.970***	0.958***
	(-1.81)	(-2.78)	(-2.73)	(-3.68)
SubjNorm1	1.022*	1.026**	1.024**	1.046***
	(1.94)	(2.03)	(1.97)	(3.57)
age	0.946	0.893*	0.936	0.933
	(-0.95)	(-1.76)	(-1.10)	(-1.11)
Childinhome	0.926	0.540***	0.946	0.799
	(-0.37)	(-2.60)	(-0.24)	(-0.98)
female	1.091	1.080	1.121	1.198
	(0.48)	(0.38)	(0.59)	(0.93)
college	1.409**	0.864	0.949	0.709*
	(1.97)	(-0.74)	(-0.28)	(-1.83)
white	1.145	1.152	0.967	0.987
	(0.54)	(0.49)	(-0.12)	(-0.05)
Info	1.145	0.907	1.198	1.114
	(0.81)	(-0.51)	(1.00)	(0.60)
v1_2_1		3.688***		
		(12.64)		
v1_2_2			2.837***	
			(12.01)	

v1_2_3				2.272***
				(10.43)
/				
cut1	0.800	1.754	12.72***	4.617*
	(-0.28)	(0.63)	(2.99)	(1.79)
cut2	2.271	5.711*	27.49***	12.63***
	(1.03)	(1.95)	(3.89)	(2.98)
cut3	7.144**	36.29***	152.7***	61.64***
	(2.47)	(3.95)	(5.80)	(4.77)
cut4	15.02***	184.1***	633.7***	253.8***
	(3.38)	(5.65)	(7.28)	(6.31)
N	542	541	540	538
pseudo R^2	0.098	0.233	0.197	0.174
Chi-Squared	162.4	309.8	288.9	245.3

Exponentiated coefficients; *z* statistics in parentheses
* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Appendix 8: Excessive Heat (Warm Regions) – Ordinal Logistic Regression Models

Excessive Heat - Warm, Advisory Upgrade, Prompt 2 - Advisory

	(1) v2_1	(2) v2_2_1	(3) v2_2_2	(4) v2_2_3
main				
v1_1	6.476***			
	(18.19)			
proto1	1.344	2.262**	1.195	1.122
	(1.10)	(2.54)	(0.58)	(0.40)
proto2	1.403	2.324***	1.076	1.373
	(1.26)	(2.67)	(0.24)	(1.10)
proto3	1.730**	1.541	1.230	1.141
	(2.04)	(1.40)	(0.69)	(0.46)
proto4	1.080	2.382***	1.104	1.061
	(0.29)	(2.72)	(0.33)	(0.21)
RP_SusSev	1.008	1.004	1.007	1.000
	(1.28)	(0.51)	(0.85)	(-0.02)
RP_Aff1	0.978	1.029	1.034	1.117**
	(-0.55)	(0.59)	(0.75)	(2.53)
RP_Aff2	0.947**	0.961	0.963	0.964
	(-2.14)	(-1.38)	(-1.42)	(-1.43)
AdptBeh	1.003	0.999	1.002	1.014**
	(0.64)	(-0.11)	(0.32)	(2.53)
exppast1	1.094	0.719	1.126	0.833
	(0.38)	(-1.13)	(0.45)	(-0.70)
AttInfo	1.001	1.065***	1.029	1.043**
	(0.08)	(3.41)	(1.57)	(2.53)
GathCap1	1.002	0.958***	0.986	0.966***
	(0.15)	(-3.08)	(-1.06)	(-2.67)
SubjNorm1	1.011	1.034**	1.027*	1.014
	(0.95)	(2.24)	(1.94)	(1.05)
age	0.983	0.940	1.062	0.845**
	(-0.29)	(-0.80)	(0.82)	(-2.44)
Childinhome	0.815	0.791	0.784	0.649**
	(-1.03)	(-0.99)	(-1.09)	(-2.03)
female	0.591**	1.859***	1.419	1.254
	(-2.52)	(2.65)	(1.57)	(1.05)
college	0.774	0.653**	0.761	0.882
	(-1.45)	(-2.03)	(-1.36)	(-0.67)
white	0.797	0.550**	0.566**	0.759
	(-0.94)	(-2.03)	(-2.06)	(-1.02)
Info	0.731*	0.531***	0.655**	0.776
	(-1.76)	(-2.98)	(-2.10)	(-1.34)
v1_2_1		14.19***		

		(16.98)		
v1_2_2			13.71***	
			(17.97)	
v1_2_3				7.486***
				(17.11)
/				
cut1	5.719*	97.13***	148.8***	53.34***
	(1.96)	(4.55)	(4.95)	(4.23)
cut2	56.62***	1210.8***	1750.4***	247.0***
	(4.41)	(6.82)	(7.26)	(5.86)
cut3	518.0***	34279.2***	24483.7***	3135.8***
	(6.68)	(9.39)	(9.37)	(8.19)
cut4	2376.6***	546743.0***	425294.5***	38851.2***
	(8.15)	(11.23)	(11.32)	(10.16)
N	537	536	536	534
pseudo R^2	0.338	0.471	0.451	0.372
Chi-Squared	578.1	670.0	685.1	564.2

Exponentiated coefficients; *z* statistics in parentheses
* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Excessive Heat - Warm, Advisory Upgrade, Prompt 3 – Advisory Cont.

	(1) v3_1	(2) v3_2_1	(3) v3_2_2	(4) v3_2_3
main				
v1_1	2.794***			
	(13.93)			
proto1	0.980	1.550	0.763	1.159
	(-0.08)	(1.39)	(-0.91)	(0.50)
proto2	0.807	1.395	0.709	1.128
	(-0.82)	(1.08)	(-1.15)	(0.41)
proto3	0.878	1.127	0.758	0.825
	(-0.50)	(0.40)	(-0.93)	(-0.67)
proto4	0.676	1.254	0.663	0.931
	(-1.54)	(0.75)	(-1.41)	(-0.25)
RP_SusSev	1.005	0.991	1.016**	1.000
	(0.82)	(-1.14)	(2.00)	(-0.02)
RP_Aff1	0.944	1.054	1.069	1.040
	(-1.54)	(1.17)	(1.50)	(0.92)
RP_Aff2	0.961*	0.945**	0.919***	0.936***
	(-1.76)	(-2.06)	(-3.30)	(-2.59)
AdptBeh	1.008*	0.997	1.011*	1.017***
	(1.72)	(-0.49)	(1.84)	(3.03)
exppast1	0.839	0.926	1.414	0.930
	(-0.77)	(-0.27)	(1.34)	(-0.28)
AttInfo	1.053***	1.104***	1.062***	1.085***
	(3.29)	(5.49)	(3.43)	(4.93)
GathCap1	0.993	0.975*	0.981	0.975**
	(-0.59)	(-1.90)	(-1.45)	(-1.99)
SubjNorm1	0.982	1.027*	1.000	1.007
	(-1.62)	(1.86)	(0.03)	(0.54)
age	1.044	0.999	1.028	0.917
	(0.74)	(-0.01)	(0.39)	(-1.26)
Childinhome	0.931	1.144	1.078	1.080
	(-0.38)	(0.59)	(0.34)	(0.37)
female	0.618**	1.834***	1.373	1.232
	(-2.42)	(2.68)	(1.47)	(0.98)
college	0.893	1.054	1.089	1.255
	(-0.67)	(0.26)	(0.44)	(1.19)
white	0.907	0.818	1.244	0.835
	(-0.43)	(-0.73)	(0.87)	(-0.69)
Info	1.175	0.893	0.950	0.985
	(0.96)	(-0.56)	(-0.27)	(-0.08)
v1_2_1		7.583***		
		(15.62)		
v1_2_2			6.362***	
			(15.95)	

v1_2_3				4.423***
				(14.87)
/				
cut1	3.127	145.6***	131.1***	57.07***
	(1.40)	(5.10)	(5.13)	(4.41)
cut2	15.24***	923.6***	884.3***	194.7***
	(3.30)	(6.84)	(7.05)	(5.75)
cut3	71.15***	12740.1***	7317.7***	1745.5***
	(5.11)	(8.94)	(8.93)	(7.84)
cut4	201.6***	159120.4***	81618.0***	11847.9***
	(6.29)	(10.79)	(10.74)	(9.47)
N	537	533	533	532
pseudo R^2	0.174	0.385	0.351	0.292
Chi-Squared	296.4	519.5	506.8	418.4

Exponentiated coefficients; *z* statistics in parentheses
* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Excessive Heat - Warm, Advisory Upgrade, Prompt 4 - Warning

	(1) v4_1	(2) v4_2_1	(3) v4_2_2	(4) v4_2_3
main				
v1_1	2.016***			
	(10.33)			
proto1	1.086	2.013**	1.124	1.268
	(0.32)	(2.15)	(0.41)	(0.80)
proto2	1.234	2.140**	1.453	1.126
	(0.79)	(2.35)	(1.30)	(0.41)
proto3	0.758	1.272	1.202	0.832
	(-1.09)	(0.78)	(0.65)	(-0.64)
proto4	1.008	2.268**	1.348	1.161
	(0.03)	(2.53)	(1.06)	(0.52)
RP_SusSev	0.992	0.988	1.005	0.997
	(-1.17)	(-1.36)	(0.71)	(-0.44)
RP_Aff1	0.908**	1.011	1.048	1.059
	(-2.54)	(0.23)	(1.10)	(1.33)
RP_Aff2	0.986	0.943**	0.952**	0.959*
	(-0.62)	(-2.01)	(-2.01)	(-1.65)
AdptBeh	1.014***	0.992	1.009	1.014**
	(2.99)	(-1.05)	(1.53)	(2.38)
exppast1	0.728	0.838	1.227	0.775
	(-1.35)	(-0.58)	(0.81)	(-0.96)
AttInfo	1.065***	1.135***	1.081***	1.076***
	(3.92)	(6.86)	(4.42)	(4.51)
GathCap1	0.988	0.969**	0.971**	0.953***
	(-1.07)	(-2.18)	(-2.25)	(-3.70)
SubjNorm1	0.975**	1.064***	1.012	1.040***
	(-2.27)	(3.74)	(0.88)	(2.85)
age	1.036	1.038	0.955	1.008
	(0.59)	(0.48)	(-0.67)	(0.12)
Childinhome	0.963	1.019	0.965	1.013
	(-0.20)	(0.08)	(-0.17)	(0.06)
female	0.786	1.989***	1.562**	1.874***
	(-1.19)	(2.91)	(2.12)	(2.90)
college	1.145	0.835	0.812	0.998
	(0.79)	(-0.84)	(-1.10)	(-0.01)
white	1.134	0.804	0.974	0.785
	(0.54)	(-0.77)	(-0.10)	(-0.93)
Info	1.106	0.915	0.975	1.030
	(0.58)	(-0.42)	(-0.13)	(0.16)
v1_2_1		5.689***		
		(13.81)		
v1_2_2			3.688***	
			(13.23)	

v1_2_3				2.245***
				(9.79)
/				
cut1	1.812	141.7***	49.49***	9.377**
	(0.74)	(4.90)	(4.30)	(2.49)
cut2	6.083**	733.7***	161.4***	27.14***
	(2.23)	(6.43)	(5.60)	(3.71)
cut3	19.97***	8103.4***	1070.3***	161.3***
	(3.66)	(8.28)	(7.48)	(5.58)
cut4	45.58***	67219.2***	7606.5***	668.6***
	(4.65)	(9.84)	(9.22)	(6.98)
N	534	535	534	533
pseudo R^2	0.115	0.372	0.262	0.184
Chi-Squared	186.4	459.2	357.1	230.9

Exponentiated coefficients; *z* statistics in parentheses
* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Appendix 8: High Winds (Advisory with an Upgrade) – Ordinal Logistic Regression Models

High Winds, Advisory Upgrade, Prompt 2 - Watch

	(1) v2_1	(2) v2_2_1	(3) v2_2_2	(4) v2_2_4
main				
v1_1	4.851***			
	(21.09)			
proto1	1.009	0.770	0.828	0.801
	(0.05)	(-1.28)	(-0.99)	(-1.16)
proto2	1.217	0.781	0.951	0.966
	(1.06)	(-1.22)	(-0.26)	(-0.18)
proto3	1.092	0.650**	0.538***	0.708*
	(0.47)	(-2.12)	(-3.21)	(-1.80)
proto4	1.190	0.696*	0.674**	0.681**
	(0.94)	(-1.76)	(-2.07)	(-2.03)
RP_SusSev	0.993	1.011**	1.000	1.000
	(-1.55)	(2.02)	(0.06)	(0.10)
RP_Aff1	0.990	1.012	0.996	1.045
	(-0.26)	(0.28)	(-0.11)	(1.12)
RP_Aff2	1.008	1.021	1.017	1.010
	(0.44)	(1.09)	(0.94)	(0.57)
AdptBeh	1.004	1.001	1.004	1.003
	(1.00)	(0.34)	(1.19)	(0.74)
exppast1	0.682***	0.946	0.930	0.986
	(-2.92)	(-0.39)	(-0.55)	(-0.11)
AttInfo	0.997	1.025**	1.019*	1.018*
	(-0.31)	(2.31)	(1.86)	(1.73)
GathCap1	1.004	0.997	1.007	1.028***
	(0.57)	(-0.32)	(0.91)	(3.33)
SubjNorm1	1.025***	1.006	1.033***	1.032***
	(2.92)	(0.60)	(3.57)	(3.46)
age	1.013	1.016	1.008	1.020
	(0.32)	(0.37)	(0.19)	(0.48)
childinhome	1.000	1.162	1.138	1.038
	(0.00)	(1.02)	(0.93)	(0.27)
female	1.048	1.052	1.335**	1.015
	(0.36)	(0.36)	(2.18)	(0.12)
college	0.845	0.790*	0.927	0.820
	(-1.41)	(-1.81)	(-0.62)	(-1.60)
white	0.829	0.850	1.081	0.588***
	(-1.08)	(-0.89)	(0.46)	(-3.06)
Info	1.176	1.032	1.364***	1.214
	(1.38)	(0.25)	(2.59)	(1.62)
v1_2_1		9.472***		

		(24.36)		
v1_2_2			5.197***	
			(22.46)	
v1_2_4				5.520***
				(23.63)
/				
cut1	3.534**	59.09***	39.00***	45.81***
	(2.15)	(6.30)	(6.08)	(6.21)
cut2	69.82***	429.9***	174.5***	268.5***
	(7.04)	(9.34)	(8.53)	(9.00)
cut3	396.7***	7074.3***	1896.5***	2457.1***
	(9.73)	(13.07)	(12.01)	(12.13)
cut4	2679.4***	92902.1***	16724.7***	17832.3***
	(12.42)	(15.95)	(14.79)	(14.53)
N	1042	1055	1050	1046
pseudo R^2	0.203	0.355	0.272	0.304
Chi-Squared	620.7	1056.8	852.3	1012.7

Exponentiated coefficients; *z* statistics in parentheses
* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

High Winds, Advisory Upgrade, Prompt 3 - Advisory

	(1) v3_1	(2) v3_2_1	(3) v3_2_2	(4) v3_2_4
main				
v1_1	2.694***			
	(15.83)			
proto1	1.566**	1.499**	1.520**	1.602**
	(2.41)	(2.12)	(2.28)	(2.53)
proto2	1.701***	1.194	1.272	1.400*
	(2.86)	(0.94)	(1.33)	(1.83)
proto3	0.831	0.845	0.773	0.833
	(-1.01)	(-0.90)	(-1.43)	(-0.99)
proto4	1.386*	1.227	1.352*	1.350
	(1.77)	(1.09)	(1.66)	(1.64)
RP_SusSev	0.997	1.012**	1.003	1.004
	(-0.67)	(2.48)	(0.74)	(0.84)
RP_Aff1	1.040	1.044	1.032	1.022
	(1.06)	(1.13)	(0.86)	(0.57)
RP_Aff2	0.989	1.026	1.033*	1.010
	(-0.67)	(1.47)	(1.91)	(0.57)
AdptBeh	1.006	1.002	0.999	1.001
	(1.62)	(0.47)	(-0.33)	(0.42)
exppast1	0.776**	0.974	0.826	0.889
	(-1.97)	(-0.20)	(-1.51)	(-0.91)
AttInfo	1.017*	1.025**	1.021**	1.012
	(1.70)	(2.57)	(2.22)	(1.25)
GathCap1	1.014*	1.000	1.016**	1.022***
	(1.83)	(-0.04)	(2.04)	(2.74)
SubjNorm1	1.008	1.007	1.032***	1.041***
	(0.92)	(0.81)	(3.68)	(4.57)
age	0.944	0.948	0.954	0.878***
	(-1.47)	(-1.33)	(-1.24)	(-3.33)
childinhome	1.156	1.027	1.164	1.109
	(1.09)	(0.20)	(1.14)	(0.77)
female	1.306**	1.566***	1.536***	1.471***
	(2.10)	(3.45)	(3.40)	(3.02)
college	0.767**	0.948	1.047	0.772**
	(-2.24)	(-0.45)	(0.39)	(-2.16)
white	0.989	0.892	0.814	0.698**
	(-0.06)	(-0.69)	(-1.27)	(-2.17)
Info	1.281**	1.256*	1.285**	1.231*
	(2.14)	(1.93)	(2.19)	(1.80)
v1_2_1		4.065***		
		(19.67)		
v1_2_2			2.808***	
			(17.35)	

v1_2_4				2.811***
				(18.05)
/				
cut1	3.405**	52.55***	26.22***	11.82***
	(2.12)	(6.81)	(5.80)	(4.40)
cut2	54.09***	264.4***	91.70***	48.50***
	(6.78)	(9.54)	(8.01)	(6.88)
cut3	198.9***	1544.6***	523.0***	279.2***
	(8.87)	(12.23)	(10.82)	(9.75)
cut4	874.9***	8570.0***	2452.5***	1006.5***
	(11.13)	(14.54)	(13.07)	(11.66)
N	1042	1054	1053	1046
pseudo R^2	0.118	0.209	0.155	0.185
Chi-Squared	362.8	660.8	505.5	615.8

Exponentiated coefficients; *z* statistics in parentheses
* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

High Winds, Advisory Upgrade, Prompt 4 - Warning

	(1) v4_1	(2) v4_2_1	(3) v4_2_2	(4) v4_2_4
main				
v1_1	2.476***			
	(14.73)			
proto1	1.122	0.712*	1.011	0.897
	(0.63)	(-1.68)	(0.06)	(-0.60)
proto2	1.058	0.806	0.845	0.904
	(0.31)	(-1.06)	(-0.92)	(-0.55)
proto3	1.348	0.974	1.008	1.106
	(1.63)	(-0.13)	(0.04)	(0.55)
proto4	1.325	1.095	1.198	1.372*
	(1.54)	(0.43)	(0.96)	(1.67)
RP_SusSev	1.004	1.017***	1.013***	1.009*
	(0.96)	(3.14)	(2.70)	(1.80)
RP_Aff1	0.971	1.045	0.975	0.986
	(-0.82)	(1.05)	(-0.66)	(-0.37)
RP_Aff2	0.963**	1.015	0.997	0.974
	(-2.20)	(0.76)	(-0.19)	(-1.50)
AdptBeh	1.000	0.992*	0.996	0.997
	(0.13)	(-1.94)	(-1.03)	(-0.90)
exppast1	0.834	0.886	0.890	1.009
	(-1.43)	(-0.86)	(-0.90)	(0.07)
AttInfo	1.028***	1.054***	1.051***	1.064***
	(2.88)	(4.94)	(5.08)	(6.17)
GathCap1	1.000	0.982**	1.002	1.001
	(-0.00)	(-1.98)	(0.19)	(0.09)
SubjNorm1	1.015*	0.994	1.017*	1.029***
	(1.76)	(-0.58)	(1.82)	(3.21)
age	0.915**	0.943	0.971	0.939
	(-2.24)	(-1.34)	(-0.73)	(-1.57)
childinhome	0.981	1.204	1.222	1.170
	(-0.14)	(1.23)	(1.47)	(1.14)
female	1.277*	1.187	1.274*	1.184
	(1.95)	(1.21)	(1.88)	(1.33)
college	0.810*	1.038	1.214	0.980
	(-1.81)	(0.28)	(1.61)	(-0.16)
white	0.786	0.941	0.917	0.686**
	(-1.43)	(-0.33)	(-0.52)	(-2.22)
Info	1.285**	1.284*	1.511***	1.477***
	(2.19)	(1.93)	(3.50)	(3.32)
v1_2_1		5.700***		
		(21.04)		
v1_2_2			2.642***	
			(16.15)	

v1_2_4				2.586***
				(16.37)
/				
cut1	0.798	43.45***	12.79***	7.560***
	(-0.40)	(5.87)	(4.38)	(3.48)
cut2	5.310***	176.0***	34.02***	23.88***
	(2.91)	(8.02)	(6.07)	(5.47)
cut3	20.91***	1247.7***	131.9***	114.9***
	(5.26)	(10.78)	(8.27)	(8.07)
cut4	59.94***	10166.1***	694.9***	518.8***
	(7.03)	(13.39)	(10.78)	(10.36)
N	1043	1051	1053	1049
pseudo R^2	0.099	0.284	0.151	0.164
Chi-Squared	316.4	791.5	460.6	520.6

Exponentiated coefficients; *z* statistics in parentheses
* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Appendix 9: High Winds (Warning with a Downgrade) – Ordinal Logistic Regression Models

High Winds, Warning Downgrade, Prompt 2 - Watch

	(1) v2_1	(2) v2_2_1	(3) v2_2_2	(4) v2_2_4
main				
v1_1	5.548***			
	(21.70)			
proto1	0.764	0.716*	0.579***	0.830
	(-1.42)	(-1.65)	(-2.87)	(-1.00)
proto2	0.829	0.782	0.677**	0.954
	(-0.98)	(-1.21)	(-2.04)	(-0.25)
proto3	0.708*	0.673*	0.734	0.835
	(-1.79)	(-1.95)	(-1.63)	(-0.96)
proto4	0.711*	0.789	0.610***	0.756
	(-1.79)	(-1.16)	(-2.62)	(-1.49)
RP_SusSev	0.999	1.007	1.005	0.999
	(-0.11)	(1.24)	(1.08)	(-0.19)
RP_Aff1	0.982	0.994	1.047	1.056
	(-0.47)	(-0.15)	(1.20)	(1.42)
RP_Aff2	0.975	1.003	0.976	0.997
	(-1.41)	(0.15)	(-1.39)	(-0.18)
AdptBeh	1.003	1.001	0.999	1.000
	(0.72)	(0.22)	(-0.23)	(0.08)
exppast1	1.009	0.990	0.922	0.952
	(0.07)	(-0.07)	(-0.63)	(-0.38)
AttInfo	1.032***	1.039***	1.026**	1.015
	(3.06)	(3.51)	(2.51)	(1.51)
GathCap1	0.996	0.986	1.004	1.003
	(-0.52)	(-1.64)	(0.49)	(0.37)
SubjNorm1	1.015*	1.020**	1.011	1.013
	(1.67)	(2.04)	(1.26)	(1.45)
age	0.948	1.086*	1.010	0.997
	(-1.30)	(1.92)	(0.25)	(-0.07)
childinhome	0.883	0.976	0.837	0.860
	(-0.88)	(-0.16)	(-1.27)	(-1.06)
female	0.865	0.940	0.941	0.826
	(-1.09)	(-0.44)	(-0.47)	(-1.47)
college	1.067	0.973	1.136	0.938
	(0.53)	(-0.21)	(1.06)	(-0.53)
white	0.522***	0.650**	0.720*	0.677**
	(-3.66)	(-2.31)	(-1.90)	(-2.27)
Info	1.371**	1.139	1.205	1.022
	(2.57)	(1.00)	(1.54)	(0.18)
v1_2_1		8.869***		

		(23.38)		
v1_2_2			5.099***	
			(22.10)	
v1_2_4				5.714***
				(23.89)
/				
cut1	4.200**	43.63***	12.51***	19.41***
	(2.45)	(5.90)	(4.39)	(5.09)
cut2	101.8***	437.2***	82.80***	121.8***
	(7.64)	(9.45)	(7.64)	(8.16)
cut3	726.2***	6629.6***	679.0***	1000.8***
	(10.62)	(13.10)	(10.93)	(11.40)
cut4	3565.6***	75694.5***	5416.8***	7606.6***
	(12.78)	(15.82)	(13.81)	(14.08)
N	1019	1034	1034	1032
pseudo R^2	0.232	0.348	0.257	0.291
Chi-Squared	691.7	1014.8	796.5	954.6

Exponentiated coefficients; *z* statistics in parentheses
* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

High Winds, Warning Downgrade, Prompt 3 - Warning

	(1) v3_1	(2) v3_2_1	(3) v3_2_2	(4) v3_2_4
main				
v1_1	2.437***			
	(14.44)			
proto1	1.035	0.674*	0.623**	0.793
	(0.19)	(-1.96)	(-2.56)	(-1.25)
proto2	0.893	0.703*	0.853	0.984
	(-0.62)	(-1.70)	(-0.84)	(-0.09)
proto3	1.237	1.020	0.963	1.132
	(1.17)	(0.10)	(-0.20)	(0.65)
proto4	1.812***	1.413	1.235	1.453*
	(3.20)	(1.64)	(1.11)	(1.95)
RP_SusSev	1.002	1.004	1.006	1.015***
	(0.33)	(0.77)	(1.26)	(2.87)
RP_Aff1	0.927**	1.057	1.017	1.003
	(-2.12)	(1.31)	(0.44)	(0.09)
RP_Aff2	0.955***	0.963**	0.976	0.945***
	(-2.67)	(-1.98)	(-1.40)	(-3.17)
AdptBeh	1.004	0.998	0.997	0.998
	(1.31)	(-0.45)	(-0.69)	(-0.44)
exppast1	0.997	0.888	0.983	1.025
	(-0.02)	(-0.85)	(-0.13)	(0.19)
AttInfo	1.042***	1.067***	1.047***	1.074***
	(4.08)	(6.13)	(4.58)	(7.13)
GathCap1	0.987*	0.975***	0.995	0.988
	(-1.81)	(-2.94)	(-0.59)	(-1.51)
SubjNorm1	1.000	1.004	1.001	1.005
	(-0.04)	(0.36)	(0.12)	(0.57)
age	0.886***	0.985	0.924*	0.900**
	(-3.06)	(-0.35)	(-1.94)	(-2.55)
childinhome	0.998	0.986	1.164	0.798
	(-0.02)	(-0.09)	(1.09)	(-1.59)
female	1.116	1.126	0.896	1.085
	(0.86)	(0.84)	(-0.83)	(0.62)
college	1.307**	1.150	1.141	1.076
	(2.28)	(1.06)	(1.10)	(0.60)
white	0.811	0.752	1.054	0.700**
	(-1.24)	(-1.51)	(0.32)	(-2.02)
Info	1.688***	1.248*	1.707***	1.379***
	(4.42)	(1.68)	(4.42)	(2.63)
v1_2_1		5.157***		
		(19.59)		
v1_2_2			2.962***	
			(17.13)	

v1_2_4				2.993***
				(18.12)
/				
cut1	0.646	16.55***	6.806***	5.781***
	(-0.77)	(4.41)	(3.39)	(3.05)
cut2	4.712***	90.77***	17.36***	20.22***
	(2.72)	(7.14)	(5.07)	(5.24)
cut3	21.55***	653.1***	77.46***	101.8***
	(5.34)	(10.01)	(7.61)	(7.93)
cut4	67.29***	5902.8***	509.0***	622.9***
	(7.26)	(12.85)	(10.57)	(10.72)
N	1018	1035	1036	1033
pseudo R^2	0.104	0.279	0.163	0.196
Chi-Squared	322.9	744.2	472.8	592.8

Exponentiated coefficients; *z* statistics in parentheses
* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

High Winds, Warning Downgrade, Prompt 4 - Advisory

	(1) v4_1	(2) v4_2_1	(3) v4_2_2	(4) v4_2_4
main				
v1_1	1.919***			
	(11.02)			
proto1	1.654***	1.274	1.288	1.409*
	(2.71)	(1.31)	(1.41)	(1.90)
proto2	1.247	1.085	1.212	1.280
	(1.20)	(0.43)	(1.07)	(1.37)
proto3	1.080	1.175	1.007	0.973
	(0.42)	(0.87)	(0.04)	(-0.15)
proto4	1.505**	1.671***	1.459**	1.525**
	(2.20)	(2.72)	(2.09)	(2.33)
RP_SusSev	1.008*	1.007	1.009*	1.013***
	(1.66)	(1.45)	(1.85)	(2.84)
RP_Aff1	1.045	0.979	0.962	1.022
	(1.22)	(-0.57)	(-1.06)	(0.59)
RP_Aff2	0.982	0.991	1.014	1.000
	(-1.08)	(-0.50)	(0.82)	(0.01)
AdptBeh	0.999	0.995	1.000	1.000
	(-0.21)	(-1.48)	(0.05)	(0.09)
exppast1	0.833	1.154	1.095	1.153
	(-1.44)	(1.12)	(0.74)	(1.15)
AttInfo	1.024**	1.028***	1.028***	1.032***
	(2.37)	(2.73)	(2.88)	(3.33)
GathCap1	1.006	1.016**	1.021***	1.023***
	(0.78)	(2.12)	(2.82)	(3.05)
SubjNorm1	0.997	1.019**	1.017*	1.014
	(-0.29)	(2.08)	(1.92)	(1.60)
age	0.945	0.927*	0.884***	0.872***
	(-1.44)	(-1.87)	(-3.20)	(-3.49)
childinhome	0.892	0.831	0.849	0.733**
	(-0.83)	(-1.32)	(-1.23)	(-2.31)
female	1.300**	1.303**	0.983	1.198
	(2.01)	(2.03)	(-0.14)	(1.43)
college	0.929	1.051	1.056	0.880
	(-0.62)	(0.41)	(0.48)	(-1.11)
white	0.756	1.009	0.933	0.756*
	(-1.64)	(0.05)	(-0.43)	(-1.73)
Info	1.141	1.140	1.380***	1.330**
	(1.11)	(1.09)	(2.79)	(2.46)
v1_2_1		4.377***		
		(19.63)		
v1_2_2			2.371***	
			(14.84)	

v1_2_4				2.487***
				(16.44)
/				
cut1	1.027	19.15***	9.881***	13.25***
	(0.05)	(5.06)	(4.23)	(4.65)
cut2	19.80***	118.9***	29.95***	49.90***
	(5.20)	(8.17)	(6.26)	(7.01)
cut3	60.07***	712.2***	136.9***	240.7***
	(7.06)	(10.94)	(8.88)	(9.62)
cut4	169.8***	4528.9***	586.6***	1099.3***
	(8.76)	(13.53)	(11.23)	(11.93)
N	1018	1035	1033	1032
pseudo R^2	0.062	0.213	0.113	0.151
Chi-Squared	180.4	658.3	368.1	494.3

Exponentiated coefficients; *z* statistics in parentheses
* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$