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## THE USE OF COMMUNITY ASSESSMENT FOR PUBLIC HEALTH EMERGENCY RESPONSE TO EVALUATE NWS WARNINGS

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### NATIONAL WEATHER SERVICE'S COLD WEATHER WARNINGS

The National Weather Service (NWS) is the federal agency responsible for issuing official government severe weather warnings based on meteorological forecasts. During the 2012 winter season, NWS piloted a new *extreme cold warning* to replace *wind chill warning* in eight Weather Forecast offices in South Dakota, North Dakota, Minnesota, and Arkansas. This new product was developed to augment NWS cold-weather advisories. In working with the NWS Bismarck, North Dakota, area specifically, it was noted that there was no cold-warning product available for NWS to issue during life-threatening cold temperatures with little or no wind. The existing wind chill warning is typically issued if wind conditions are > 3 mph and temperatures are  $-35^{\circ}$  or  $-40^{\circ}$ F. The extreme cold warning, issued for both wind and nonwind conditions, although not used for public warning in the past, has been effectively used in the NWS-Alaska Region to warn the aviation industry against frozen fuels and hydraulic lines. The new extreme cold warning for the NWS-Bismarck Weather Forecast Office was defined as either temperature or wind chill  $-30^{\circ}$ F for an extended period of time over a large geographical area. For the experimentation of any new warning product, a period of public feedback is required prior to the product being officially adopted, and NWS evaluates the effectiveness of the warning product.

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## EVALUATING THE EXTREME COLD WARNING USING CASPER

To assist the NWS-Bismarck Weather Forecast Office in obtaining public feedback on the new extreme cold warning piloted during 18 Jan–15 April 2012, the Centers for Disease Control and Prevention (CDC) and North Dakota Department of Health (NDDoH) conducted a population-based household survey. The goal of the survey was to determine whether residents heard and understood the new warning, and if protective behaviors were prompted by the warning during the 2012 winter.

CDC has developed the Community Assessment for Public Health Emergency Response (CASPER), which is a rapid, population-based, epidemiologic tool to assess community knowledge and needs. CASPER provides a survey method to select and interview households that are representative of the whole population using a cluster sampling methodology that can be described in the following steps: 1) define a geographic area of interest as the sampling frame; 2) within this sampling frame, select a sample of 30 clusters (areas delineated by census, usually census blocks) with “probability proportional to size”; and 3) systematically sample seven households for face-to-face interviews within each cluster.

The advantages of a CASPER methodology are that the results are generalizable and data collection is timely. The questionnaire used for the survey is usually very short—around two pages—and specifically developed for each individual CASPER. Questions are based on the goal of the survey and are typically closed-ended (e.g., yes/no, multiple choice). The goal of CASPER is to survey 210 household interviews (30 clusters × 7 households), and is typically completed in two days, with the preliminary analysis completed within 1–2 days after data collection.

To obtain public feedback on the extreme cold warning, we conducted a CASPER in Burleigh County, North Dakota, one of the locations where the extreme cold warnings were issued as an experiment during the 2012 winter. Using the CASPER cluster sampling methodology, a representative sample of 210 households in Burleigh County was selected to be interviewed. In the first stage of sampling, 30 clusters were selected with a probability proportional to the number of households in each cluster. In the second stage, the interview teams systematically sampled seven households for interview within each cluster. We conducted weighted analysis to take into account the complex sampling methodology and reported the projected number and percentage of households in Burleigh County with a particular response. The objectives of this survey were to 1) assess whether residents understood the new and existing cold weather warnings; 2) determine behaviors prompted by the warnings; and 3) identify whether NWS is meeting the preferred advance warning time among the residents of Burleigh County, North Dakota.

On 10–11 April 2012, 12 interview teams of NDDoH, CDC, and NWS staff approached 483 households, completing 188 of the 210 target interviews (completion rate = 89.5%). The majority of households were aware of cold-weather warnings and took action, regardless of the name of the warning (*wind chill* or *extreme cold*) (Table 1). The majority of the

households were knowledgeable about severe cold weather; they reported concerns about the possible threats and took many forms of protective action (Table 1).

Television was the main information source for severe winter weather for the majority (81%) of households; interestingly, only 6% used the Internet as their main source for weather information. The most desirable warning times were 1–2 days prior to the event, followed by 6–24 h prior, consistent with NWS’s established target to warn the public a day or two in advance of severe winter weather. Finally, the majority of households were “very satisfied” or “satisfied” with the NWS’s warnings and forecasts in terms of four performance indicators: accuracy, timeliness, reliability, and language used.

## SUMMARY

Using CASPER, we were able to obtain feedback from Burleigh county residents on a new NWS product piloted in their geographic location. CASPERs can be used to augment public feedback provided via the Web-based survey methodology typically used by NWS to gather feedback. Web-based surveys are useful since they are inexpensive to administer and generate information quickly; however, they require the participant to have an Internet connection and typically attract “weather enthusiasts” who visit NWS web pages regularly. Therefore, Web-based survey responses may not be representative of the general public, whereas CASPERs produce generalizable results and data collection can be done quickly.

This is one of the first times NWS has partnered with public health to assess extreme-weather warnings. Collaborations for similar studies could be done in the future to assess other existing or new warnings, particularly with NWS’s growing interest to add public health messaging to their warnings to improve the public response and hopefully prevent weather-related morbidity and mortality.

**Table 1**

Key findings from CASPER in Burleigh County, North Dakota

	Projected HH	Weighted % (95% CI)
<b>Winter weather warnings and actions following hearing warnings</b>		
Heard EC Warning	29,763	86.6 (80.7–92.5)
Took action after warning *	23,483	78.9 (71.1–86.7)
Heard WC Warning	34,371	100.0 (100.0–100.0)
Took action after warning *	29,105	84.7 (78.8–90.6)
<b>Concerns and action taken during extreme cold event</b>		
<b>Concerns after hearing EC Warning</b>		
Loss of power	24,415	71.0 (63.8–78.3)
Health issues	20,923	60.9 (52.7–69.1)
Automobile not starting	20,886	60.8 (49.9–71.6)
School/business closing	17,360	50.5 (39.0–62.0)
<b>Action taken in extreme cold event</b>		
Wore extra clothing	31,487	91.6 (86.4–96.8)
Ensured vehicles were in good working order	30,100	87.6 (80.7–94.5)
Stayed indoors	29,713	86.4 (79.9–93.0)
<b>Main source of information for severe winter weather</b>		
Television	27,839	81.0 (73.8–88.1)
Internet	2,036	5.9 (1.8–10.1)
NOAA weather radio	1,717	5.0 (0.6–9.4)
Commercial radio station	1,627	4.7 (1.4–8.0)
<b>Preferred warning time before extreme cold event</b>		
Less than 6 h	2,634	7.7 (3.7–11.6)
6 to <24 h	13,765	40.0 (28.6–51.5)
1 to 2 days	15,433	44.9 (34.6–55.2)
3 or more days	2,062	6.0 (1.7–10.3)

HH = Household; EC = Extreme Cold; WC = Wind Chill

\* Of those who heard warning